PARKIN

YORK REGIONAL POLICE
HELICOPTER HANGAR
CONTRACT NO. T-24-33

Project No.	2402
Date:	September 09, 2024
Issued:	For Bid

PART 1 - THE CONSULTANTS

1.1 ARCHITECTURAL CONSULTANT

.1 Parkin Architects Limited
1 Valleybrook Drive, Suite 500
Toronto, Ontario M3B 2S7

Telephone: (416) 467-8000

1.2 STRUCTURAL CONSULTANT

.1 DK Watson Consulting
464 Willard Ave.
Toronto, ON M6S 3R6
Telephone: (416) 399-7173

1.3 MECHANICAL, ELECTRICAL CONSULTANT

.1 Quasar Consulting Group
250 Rowntree Dairy Road
Woodbridge, Ontario L4L 9J7
Telephone: (905) 507-0800

1.4 HARDWARE CONSULTANTS

.1 Allegion Canada
1076 Lakeshore Road East
Mississauga, ON L5E 1E4
Telephone: (800) 900-4734

1.5 CIVIL CONSULTANT

.1 Counterpoint Engineering Inc.
8395 Jane Street, Suite 100,
Vaughan ON, L4K 5Y2
Telephone: (905) 326-1404

1.6 LANDSCAPE CONSULTANT

.1 Ron Koudys Landscape Architects Inc. (RKLA)
368 Oxford St E,
London, ON N6A 1V7
Tel: (519) 667-3322

1.7 COST CONSULTANT

.1 Altus Group
33 Yonge St #500,
Toronto, ON M5E 1G4
Telephone: (416) 641-9500

1.8 ENERGY CONSULTANT

.1 Pratus Group Inc.
213 Sterling Rd Unit 108,
Toronto, ON M6R 2B2
Telephone: (416) 947-6918

1.9 CODE CONSULTANT

.1 LMDG
Suite 100 290 North Queen Street
Toronto, ON M9C 5L2
Telephone: (416) 646-0162

1.10 AVIATION CONSULTANT

.1 RGHeliservices Consulting Inc.
174 Skylark Ave,
Parksville, BC V9P1M3
Telephone: (604) 626-6834

END OF DOCUMENT

Updated through ADD#15

The Project Manual is bound in three separate volumes as follows:

Volume 1:	Project Specifications, Division 00 to Division 19
Volume 2:	Project Specifications, Division 20 to Division 29
Volume 3:	Project Specifications, Division 30 to Division 49

VOLUME 1

FACILITY CONSTRUCTION SUBGROUP

VOLUME 2

FACILITY SERVICES SUBGROUP

Division 27 Communications

Division 28 Electronic Safety and Security

Division 29

Not Used

VOLUME 3

SITE AND INFRASTRUCTURE SUBGROUP

END OF DOCUMENT

DOCUMENT/SECTION NAME **CONSULTANT**

CONSULTANTS

CONSULTANT NAME	DISCIPLINE	ABBREVIATION
Parkin Architects Ltd.	ARCHITECTURAL	ARCH
DK Watson Consulting	STRUCTURAL	STR
Quasar Consulting Group	MECHANICAL	MECH
Quasar Consulting Group	ELECTRICAL	ELEC
Counterpoint Engineering Inc.	CIVIL	CIV
Ron Koudys Landscape Architects Inc. (RKLA)	LANDSCAPE	LAND
Allegion Canada Inc.	HARDWARE	HARD

LEGEND

** - Specifications prepared by Consultants other than Parkin Architects Limited have been prefixed with an asterisk. These specifications are not included under, nor governed by, Parkin Architects Limited's seal*

END OF DOCUMENT

PART 1 - GENERAL

1.1 ARCHITECTURAL, STRUCTURAL, MECHANICAL, ELECTRICAL, CIVIL, LANDSCAPE AND DRAWINGS

.1 All Drawings forming part of the Contract Documents are those listed on Drawing No. 2402-A-000 dated “September 09, 2024” with the following statement in the revision column:

.1 “Issued for Bid, 2024-09-09”.

LEGEND

** - Drawings prepared by consultants other than Parkin Architects Limited have been prefixed by asterisks and are not included under, nor governed by, Parkin Architects Limited's seal.*

*** - Drawings to be issued at a later date.*

END OF DOCUMENT

PART 1 - GENERAL

1.1 DATES

.1 The Schedules are dated September 09, 2024.

PART 2 - SCHEDULES (BOUND WITH SPECIFICATIONS)

2.1 ROOM FINISH SCHEDULE

.1 Room finishes are to be applied as noted on the Drawings

2.2 DOOR SCHEDULE, DOOR TYPES AND DETAILS

.1 Refer to Drawing A-800

2.3 HARDWARE SCHEDULES**

.1 Hardware Groups: 11 Pages.
.2 Door Hardware Index: 1 Page.

2.4 ACCESSORIES SCHEDULES

.1 Refer to Drawing A-800

LEGEND

** - Documents provided by the Owner and are not included under, nor governed by, the Consultants' seal.*

*** - Schedules prepared by consultants other than Parkin Architects Limited have been prefixed by an asterisk and are not included under, nor governed by, Parkin Architects Limited's seal.*

END OF DOCUMENT

SEE ADD#4
Q#88

York Regional Police Helicopter Hangar

ADD	**BLUE**
~~**DELETE**~~	~~**RED**~~

Hardware Group No. 01

For use on Door #(s):
D-101

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 5 X 4.5 NRP	652	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	ELEC PANIC HARDWARE	LX-RX-QEL-98-NL-OP-4'-110MD-CON 24 VDC	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	PRIMUS CORE	BY OWNER	626	SCH
1	EA	45 DEGREE OFFSET PULL	8145EZHD 12" STD	630	IVE
1	EA	SURF. AUTO OPERATOR	9542 MS AS REQ (120/240 VAC)	ANCLR	LCN
1	EA	SWITCH	8310-806K (ADO ON/OFF/HOLD)		LCN
2	EA	ACTUATOR, TOUCH	8310-852T	630	LCN
2	EA	ESCUTCHEON	8310-876	630	LCN
1	EA	MOUNTING PLATE	9540-18	ANCLR	LCN
1	EA	KICK PLATE	8400 200 X LDW	630	IVE
1	EA	WALL STOP	WS406/407CVX	626	IVE
1	EA	WIRE HARNESS	CON-WIDTH		SCH
1	EA	WIRE HARNESS	CON-6W		SCH
1	EA	CARD READER	BY DIV 28		UNK
1	EA	DOOR CONTACT	679-05 __TO SUIT DOOR MATL	BLK	SCE
1	EA	POWER SUPPLY	PS902 900-4RL 120/240 VAC	LGR	SCE

York Regional Police Helicopter Hangar

Hardware Group No. 02

For use on Door #(s):
D-103 D-111 D-112 D-113

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 5 X 4.5	652	IVE
1	EA	OFFICE/ENTRY LOCK	L9050T 06B L583-363	626	SCH
1	EA	PRIMUS CORE	BY OWNER	626	SCH
1	EA	KICK PLATE	8400 200 X LDW	630	IVE
1	EA	WALL STOP	WS406/407CVX	626	IVE

Hardware Group No. 03

For use on Door #(s):
D-104

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 5 X 4.5	630	IVE
1	EA	ELEC CLASSROOM LOCK	CO-100-MS-70-KP-RHO-J 4B BATTERY OPERATED	626AM	SCE
1	EA	PRIMUS CORE	BY OWNER	626	SCH
1	EA	KICK PLATE	8400 200 X LDW	630	IVE
1	EA	WALL STOP	WS406/407CVX	626	IVE

York Regional Police Helicopter Hangar

Hardware Group No. 04

For use on Door #(s):
D-105

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 5 X 4.5 NRP	630	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	EU MORTISE LOCK	L9092TEU 06B RX CON 12/24 VDC	626	SCH
1	EA	PRIMUS CORE	BY OWNER	626	SCH
1	EA	SURFACE CLOSER	1461 CUSH	689	LCN
1	EA	KICK PLATE	8400 200 X LDW	630	IVE
1	EA	SMOKE/SOUND SEAL	188S-BK (1XW 2XH)	BK	ZER
1	EA	WIRE HARNESS	CON-WIDTH		SCH
1	EA	WIRE HARNESS	CON-6W		SCH
1	EA	CARD READER	BY DIV 28		UNK
1	EA	POWER SUPPLY	PS902 FA900 120/240 VAC	LGR	SCE

York Regional Police Helicopter Hangar

Hardware Group No. 05

For use on Door #(s):
D-106

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	L9080T 06B	626	SCH
1	EA	INTERFACE BOX	JB7		VON
1	EA	PRIMUS CORE	BY OWNER	626	SCH
1	EA	ELECTRIC STRIKE	6211 FSE CON 12/16/24/28 VAC/VDC USE DS SWITCH AS REX	630	VON
1	EA	OH STOP	100S ADJ	630	GLY
1	EA	MOUNTING PLATE	9530-18	689	LCN
1	EA	SURF. AUTO OPERATOR	9531 AS REQ (120/240 VAC)	ANCLR	LCN
2	EA	ACTUATOR, TOUCH	8310-852T	630	LCN
2	EA	ESCUTCHEON	8310-876	630	LCN
1	EA	OCCUPANCY INDICATOR	CM-AF500	630	CAM
1	EA	PUSH TO LOCK/ANNUNCIATOR	CM-AF500R	630	CAM
1	EA	RELAY CONTROLLER	CX-33		CAM
1	EA	KICK PLATE	8400 200 X LDW	630	IVE
1	EA	EMERGENCY CALL KIT	CX-WEC10		CAM
1	EA	WIRE HARNESS	CON-6W		SCH
1	EA	DOOR CONTACT	679-05 __TO SUIT DOOR MATL	BLK	SCE

Hardware Group No. 06

For use on Door #(s):
D-108

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 5 X 4.5 NRP	630	IVE
1	EA	ELEC CLASSROOM LOCK	CO-100-MS-70-KP-RHO-J 4B BATTERY OPERATED	626AM	SCE
1	EA	PRIMUS CORE	BY OWNER	626	SCH
1	EA	OH STOP	100S	630	GLY
1	EA	SURFACE CLOSER	4040XP EDA WMS	689	LCN
1	EA	KICK PLATE	8400 200 X LDW	630	IVE
1	EA	SMOKE/SOUND SEAL	188S-BK (1XW 2XH)	BK	ZER
1	EA	DOOR BOTTOM	365AA (1 X WIDTH)	AA	ZER

York Regional Police Helicopter Hangar

Hardware Group No. 07

For use on Door #(s):
D-114

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 5 X 4.5	652	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	EU MORTISE LOCK	L9092TEU 06B RX CON 12/24 VDC	626	SCH
1	EA	PRIMUS CORE	BY OWNER	626	SCH
1	EA	SURFACE CLOSER	1461 REG OR PA AS REQ STD	689	LCN
1	EA	KICK PLATE	8400 200 X LDW	630	IVE
1	EA	WALL STOP	WS406/407CVX	626	IVE
1	EA	WIRE HARNESS	CON-WIDTH		SCH
1	EA	WIRE HARNESS	CON-6W		SCH
1	EA	CARD READER	BY DIV 28		UNK
1	EA	DOOR CONTACT	679-05 __TO SUIT DOOR MATL	BLK	SCE
1	EA	POWER SUPPLY	PS902 120/240 VAC	LGR	SCE

Hardware Group No. 08

For use on Door #(s):
D-115

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 5 X 4.5	652	IVE
1	EA	ELEC CLASSROOM LOCK	CO-100-MS-70-KP-RHO-J 4B BATTERY OPERATED	626AM	SCE
1	EA	PRIMUS CORE	BY OWNER	626	SCH
1	EA	OH STOP	100S	630	GLY
1	EA	SURFACE CLOSER	4040XP ST-1630	689	LCN
1	EA	TOP JAMB MTG PLATE	4040XP-18TJ	689	LCN
1	EA	KICK PLATE	8400 200 X LDW	630	IVE

York Regional Police Helicopter Hangar

Hardware Group No. 09

For use on Door #(s):
D-116 D-117

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 5 X 4.5	652	IVE
1	EA	PRIVACY W/ INDICATOR AND ADA THUMBTURN	L9056T 06B L583-363 OS-OCC	626	SCH
1	EA	KICK PLATE	8400 200 X LDW	630	IVE
1	EA	WALL STOP	WS406/407CVX	626	IVE

Hardware Group No. 10

For use on Door #(s):
D-119 D-120

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 5 X 4.5	630	IVE
1	EA	PRIVACY W/ INDICATOR AND ADA THUMBTURN	L9056T 06B L583-363 OS-OCC	626	SCH
1	EA	KICK PLATE	8400 200 X LDW	630	IVE
1	EA	WALL STOP	WS406/407CVX	626	IVE

Hardware Group No. 11

For use on Door #(s):
~~D-121~~ D-121A D-121B

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 5 X 4.5	630	IVE
1	EA	CLASSROOM LOCK	L9070T 06B	626	SCH
1	EA	PRIMUS CORE	BY OWNER	626	SCH
1	EA	SURFACE CLOSER	4040XP REG	689	LCN
1	EA	KICK PLATE	8400 200 X LDW	630	IVE
1	EA	WALL STOP	WS406/407CVX	626	IVE
1	EA	SMOKE/SOUND SEAL	188S-BK (1XW 2XH)	BK	ZER
1	EA	DOOR BOTTOM	365AA (1 X WIDTH)	AA	ZER

York Regional Police Helicopter Hangar

Hardware Group No. 12

For use on Door #(s):
D-122

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 5 X 4.5 NRP	652	IVE
1	EA	STOREROOM LOCK	L9080T 06B	626	SCH
1	EA	PRIMUS CORE	BY OWNER	626	SCH
1	EA	SURFACE CLOSER	1461 CUSH	689	LCN
1	EA	KICK PLATE	8400 200 X LDW	630	IVE
1	EA	SMOKE/SOUND SEAL	188S-BK (1XW 2XH)	BK	ZER

Hardware Group No. 13

For use on Door #(s):
D-123

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 5 X 4.5	630	IVE
1	EA	STOREROOM LOCK	L9080T 06B	626	SCH
1	EA	PRIMUS CORE	BY OWNER	626	SCH
1	EA	SURFACE CLOSER	1461 REG OR PA AS REQ STD	689	LCN
1	EA	KICK PLATE	8400 200 X LDW	630	IVE
1	EA	WALL STOP	WS406/407CVX	626	IVE
1	EA	SMOKE/SOUND SEAL	188S-BK (1XW 2XH)	BK	ZER

York Regional Police Helicopter Hangar

Hardware Group No. 14

For use on Door #(s):
D-124

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1 5 X 4.5	630	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	CONST LATCHING BOLT	FB52	630	IVE
1	EA	EU MORTISE LOCK	L9092TEU 06B RX CON 12/24 VDC	626	SCH
1	EA	PRIMUS CORE	BY OWNER	626	SCH
1	EA	COORDINATOR	COR X FL	628	IVE
2	EA	OH STOP	100S	630	GLY
2	EA	SURFACE CLOSER	4040XP ST-1630	689	LCN
2	EA	TOP JAMB MTG PLATE	4040XP-18TJ	689	LCN
2	EA	KICK PLATE	8400 200 X LDW	630	IVE
1	EA	SMOKE/SOUND SEAL	188S-BK (1XW 2XH)	BK	ZER
2	EA	MEETING STILE	328AA (2 X H)	AA	ZER
2	EA	DOOR BOTTOM	365AA (1 X WIDTH)	AA	ZER
1	EA	WIRE HARNESS	CON-WIDTH		SCH
1	EA	WIRE HARNESS	CON-6W		SCH
1	EA	CARD READER	BY DIV 28		UNK
2	EA	DOOR CONTACT	679-05 __TO SUIT DOOR MATL	BLK	SCE
1	EA	POWER SUPPLY	PS902 FA900 120/240 VAC	LGR	SCE

Hardware Group No.15.1

For use on Door #(s):
D-125

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 5 X 4.5 NRP	652	IVE
1	EA	ELEC CLASSROOM LOCK	CO-100-MS-70-KP-RHO-J 4B BATTERY OPERATED	626AM	SCE
1	EA	PRIMUS CORE	BY OWNER	626	SCH
1	EA	SURFACE CLOSER	1461 SCUSH STD	689	LCN
1	EA	KICK PLATE	8400 200 X LDW	630	IVE

York Regional Police Helicopter Hangar

Hardware Group No. 16

For use on Door #(s):
D-127

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 5 X 4.5 NRP	652	IVE
1	EA	ELEC CLASSROOM LOCK	CO-100-MS-70-KP-RHO-J 4B BATTERY OPERATED	626AM	SCE
1	EA	PRIMUS CORE	BY OWNER	626	SCH
1	EA	SURFACE CLOSER	1461 DEL CUSH STD	689	LCN
1	EA	KICK PLATE	8400 200 X LDW	630	IVE
1	EA	SMOKE/SOUND SEAL	188S-BK (1XW 2XH)	BK	ZER

Hardware Group No. 17

For use on Door #(s):
D-E-101

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	112XY EPT	628	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	ELEC PANIC HARDWARE	LX-RX-QEL-35A-NL-OP-4'-CON 24 VDC	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	PRIMUS CORE	BY OWNER	626	SCH
1	EA	45 DEGREE OFFSET PULL	8145EZHD 12" STD	630	IVE
1	EA	SURF. AUTO OPERATOR	9542 MS AS REQ (120/240 VAC)	ANCLR	LCN
1	EA	SWITCH	8310-806K (ADO ON/OFF/HOLD)		LCN
2	EA	ACTUATOR, TOUCH	8310-852T	630	LCN
2	EA	ESCUTCHEON	8310-876	630	LCN
1	EA	MOUNTING PLATE	9540-18	ANCLR	LCN
1	EA	WEATHER STRIPPING	BY DOOR AND FRAME SUPPLIER		UNK
1	EA	DOOR SWEEP	8192AA X DR WIDTH	AA	ZER
1	EA	THRESHOLD	625A (1 X WIDTH)	A	ZER
1	EA	WIRE HARNESS	CON-WIDTH		SCH
1	EA	WIRE HARNESS	CON-6W		SCH
1	EA	CARD READER	BY DIV 28		UNK
1	EA	DOOR CONTACT	679-05 __TO SUIT DOOR MATL	BLK	SCE
1	EA	POWER SUPPLY	PS902 900-4RL 120/240 VAC	LGR	SCE
1	**EA**	**INTERCOM**	**BY OTHERS**		

York Regional Police Helicopter Hangar

Hardware Group No. 18

For use on Door #(s):
D-E-124A D-E-124B D-E-128B

Provide each RU door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	HARDWARE	BY ROLL-UP DOOR MANUFACTURER		

Hardware Group No. 19

For use on Door #(s):
~~D-E-125~~ D-E-126

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 5 X 4.5 NRP	630	IVE
1	EA	ELEC CLASSROOM LOCK	CO-100-MS-70-KP-RHO-J 4B BATTERY OPERATED	626AM	SCE
1	EA	PRIMUS CORE	BY OWNER	626	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH X ST-3068	689	LCN
1	EA	KICK PLATE	8400 200 X LDW	630	IVE
2	EA	JAMB SEAL	328AA (2 X H)	AA	ZER
1	SET	HEAD SEAL	429AA (1 X WIDTH)	AA	ZER
1	EA	ASTRAGAL	43STST X SEC SCREW	STST	ZER
1	EA	DOOR SWEEP	8192AA X DR WIDTH	AA	ZER
1	EA	THRESHOLD	625A (1 X WIDTH)	A	ZER
1	EA	DOOR CONTACT	679-05 __TO SUIT DOOR MATL	BLK	SCE

York Regional Police Helicopter Hangar

Hardware Group No. 20

For use on Door #(s):
D-E-128A

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 5 X 4.5 NRP	630	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	ELEC PANIC HARDWARE	LX-RX-QEL-98-NL-4'-CON 24 VDC	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	PRIMUS CORE	BY OWNER	626	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH X ST-3068	689	LCN
1	EA	KICK PLATE	8400 200 X LDW	630	IVE
2	EA	JAMB SEAL	328AA (2 X H)	AA	ZER
1	SET	HEAD SEAL	429AA (1 X WIDTH)	AA	ZER
1	EA	DOOR SWEEP	8192AA X DR WIDTH	AA	ZER
1	EA	THRESHOLD	625A (1 X WIDTH)	A	ZER
1	EA	WIRE HARNESS	CON-WIDTH		SCH
1	EA	WIRE HARNESS	CON-6W		SCH
1	EA	CARD READER	BY DIV 28		UNK
1	EA	DOOR CONTACT	679-05 __TO SUIT DOOR MATL	BLK	SCE
1	EA	POWER SUPPLY	PS902 900-4RL 120/240 VAC	LGR	SCE

York Regional Police Helicopter Hangar

Hardware Group No. 21

For use on Door #(s):
D-E-128C

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1 5 X 4.5 NRP	630	IVE
2	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	MANUAL FLUSH BOLT	FB458	626	IVE
1	EA	DUST PROOF STRIKE	DP1	626	IVE
1	EA	EU MORTISE LOCK	L9092TEU 06B RX CON 12/24 VDC	626	SCH
1	EA	PRIMUS CORE	BY OWNER	626	SCH
2	EA	SURFACE CLOSER	4040XP SCUSH X ST-3068	689	LCN
2	EA	KICK PLATE	8400 200 X LDW	630	IVE
2	EA	JAMB SEAL	328AA (2 X H)	AA	ZER
2	EA	MEETING STILE	328AA (2 X H)	AA	ZER
1	EA	ASTRAGAL	43STST X SEC SCREW	STST	ZER
2	EA	DOOR SWEEP	8192AA X DR WIDTH	AA	ZER
1	EA	THRESHOLD	625A (1 X WIDTH)	A	ZER
1	EA	WIRE HARNESS	CON-WIDTH		SCH
1	EA	WIRE HARNESS	CON-6W		SCH
1	EA	CARD READER	BY DIV 28		UNK
2	EA	DOOR CONTACT	679-05 __TO SUIT DOOR MATL	BLK	SCE
1	EA	POWER SUPPLY	PS902 120/240 VAC	LGR	SCE

Hardware Group No. 22

For use on Door #(s):
D-126

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	L9080T 06B	626	SCH
1	EA	PRIMUS CORE	BY OWNER	626	SCH
1	EA	SURFACE CLOSER	1461 DEL REG OR PA AS REQ STD	689	LCN
1	EA	KICK PLATE	8400 200 X LDW	630	IVE
1	EA	WALL STOP	WS406/407CVX	626	IVE

York Regional Police Helicopter Hangar

Hardware Group No. 23

For use on Door #(s):
D-E-129

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 5 X 4.5 NRP	630	IVE
1	EA	DBL CYL STORE LOCK	L9066T 06B XL11-897	626	SCH
2	EA	PRIMUS CORE	BY OWNER	626	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH X ST-3068	689	LCN
1	EA	KICK PLATE	8400 200 X LDW	630	IVE
1	EA	JAMB SEAL	328AA (2 X H)	AA	ZER
1	SET	HEAD SEAL	429AA (1 X WIDTH)	AA	ZER
1	EA	DOOR SWEEP	8192AA X DR WIDTH	AA	ZER
1	EA	THRESHOLD	625A (1 X WIDTH)	A	ZER
1	EA	DOOR CONTACT	679-05 __TO SUIT DOOR MATL	BLK	SCE

SEE ADD#4
Q#88

York Regional Police Helicopter Hangar

Door#	HwSet#
D-101	01
D-103	02
D-104	03
D-105	04
D-106	05
D-108	06
D-111	02
D-112	02
D-113	02
D-114	07
D-115	08
D-116	09
D-117	09
D-119	10
D-120	10
D-121A ~~(D-121)~~	11
D-121B	11
D-122	12
D-123	13
D-124	14
D-125 ~~(D-126)~~	15.1 ~~(15)~~
D-126	22
D-127	16
D-E-101	17
D-E-124A	18
D-E-124B	18
D-E-126 ~~(D-E-125)~~	19
D-E-128A	20
D-E-128B	18
D-E-128C	21
D-E-129	23

Updated through ADD#8

PART 1 - GENERAL

1.1 GENERAL INSTRUCTIONS

.1 Read and conform to:

.1 the General Conditions and the Supplementary Conditions of the Contract;

.2 Division 1 requirements and documents referred to therein.

1.2 INFORMATION AVAILABLE TO BIDDERS

.1 The following information is available to Bidders and is bound in specifications appended to this document.

.2 The Following reports are for information only. Neither the Consultant nor the Owner assume any liability for items extracted from or contained in the reports.

1.3 GEOTECHNICAL AND ENVIRONMENTAL INVESTIGATION REPORT(S):

.1 A copy of the following geotechnical and environmental investigation reports and related letters, prepared by the Owner's geotechnical consultant for the Place of the Work, are bound herein:

.1 Geotechnical Investigation Proposed Helicopter Hangar, Project 44148, dated August 30, 2024, by Patriot Engineering Ltd.

.2 Partial Site Plan Showing the Approximate Borehole Locations, Project 44148, dated August 2024, by Patriot Engineering Ltd.

.2 Geotechnical investigation documents are not guaranteed to be representative of actual subsurface conditions of the Place of the Work.

.3 When calculating soil volumes for bidding purposes, Bidders should assume flat plane geometric layers formed by straight lines drawn between subgrade elevations, for each material identified in the soils report.

.4 This soils report shall not form part of the Contract Documents. The geotechnical report is provided for information purposes only and the Owner assumes no responsibility for their correctness or completeness.

.5 Bidders shall ensure the Estimated Contract Price in their Bid includes and accounts for any work that is implied in, or reasonably inferable from, the soils report.

1.4 TRAINING CENTRE EFERENCE DRAWINGS

.1 The following Drawings are issued with this Contract for reference only. Be responsible for properly assessing the information contained in these reference Drawings which has affect on the Work of this Contract. Consultant and Owner assumes no responsibility about their accuracy and/or completeness:

.1 Training Electrical Site Plan E-001

.2 Training Centre Site Plan Details E-901

.3 Training Centre Grading Plan C-102

.4 Training Centre Grading Plan C-103

.5 Training Centre Servicing Plan C-100

END OF DOCUMENT

T-24-33

APPENDIX A

RFT PARTICULARS

TABLE OF CONTENTS

A. The Deliverables

The Deliverables include, but are not limited to, the construction of a helicopter hangar and related interior and exterior spaces in the Town of East Gwillimbury, Ontario, as further described in the Specifications and the Drawings included in Appendix C – Form of Contract.

B. Material Disclosures

1. Contract for Deliverables

The selected bidder will be required to enter into a contract with the Board for the provision of the Deliverables in the form of contract attached as Appendix C. Bidders should review the form of contract before submitting their bid. Any concerns or questions regarding the terms and conditions of the contract should be directed to the Board through the 'Submit a Question' feature on the Bidding System before the Closing Time.

2. Term of Contract

The Deliverables shall be completed in accordance with the Contract Time specified in Appendix C.

3. COVID-19

The bidder that enters into a contract with the Board for the provision of the Deliverables will be required to comply with all legislative amendments, controls, regulations, requirements and orders that were or are issued by the Government of Canada, the Province of Ontario, the Region or other municipal authority in response to the global pandemic of the virus leading to COVID-19 including any resurgence or mutation thereof (the "**Pandemic**").

Bidders shall consider all legislative amendments, controls, regulations, requirements and orders that were issued, prior to the Closing Time, by the Government of Canada, the Province of Ontario, the Region or other municipal authority in response to the Pandemic, including any impacts such legislative amendments, controls, regulations, requirements and orders could have on pricing, and the bidder's prices will be deemed to include all costs associated with the foregoing.

4. Electronic Monitoring Policy

The Board has implemented an Electronic Monitoring Policy, as may be amended from time to time. This policy outlines when and how employees and contractors may be electronically monitored while performing work-related duties and activities or while using YRP assets, equipment, systems or information.

5. Examination of the Site

Site investigation(s) have been conducted and the following document(s) are provided for information purposes only:

- Geotechnical Investigation Proposed Helicopter Hangar, Project 44148, dated August 30, 2024, by Patriot Engineering Ltd.;
- Partial Site Plan Showing the Approximate Borehole Locations, Project 44148, dated August 2024, by Patriot Engineering Ltd.; and
- Phase One Environmental Site Assessment dated December 2013 prepared by Conestoga-Rovers and Associates.

The Board and the Region assume no responsibility for the correctness or completeness of any reports or other information provided by the Board in relation to site investigations or conditions. Bidders rely on these documents at their own risk.

Prior to submitting a bid, bidders shall thoroughly acquaint themselves with the RFT and carefully examine the site where the Deliverables will be performed, to fully inform themselves of the existing conditions and limitations. Access to the site may be provided during the bidding period when requested.

Bidders shall not claim, after the submission of their bid, that there was any misunderstanding of the terms and conditions of the contract relating to site conditions.

6. Designated Substances Notice

A site hazard assessment has been conducted and all known designated substances under the Occupational Health and Safety Act, RSO 1990, c O.1 are listed in the Pre-Work Hazard Assessment Form attached as Appendix G.

The Pre-Work Hazard Assessment Form is provided for information purposes only and the Board and the Region assume no responsibility for its correctness or completeness.

7. Award of Contract

The award of the contract will be subject to the approval of the Board or its authorized delegate and, if applicable, the receipt of sufficient funding.

C. Mandatory Submission Requirements

1. Bid Deposit

Bidders shall submit a bid deposit in the amount of not less than 10% of the Subtotal Contract Amount generated on the Bidding System in the Schedule of Prices (the "**Bid Price**"), to act as security for the satisfaction of the pre-conditions of award listed in Section E.

The bid deposit shall be in the form of a digital Bid Bond from a recognized guarantee or surety company acceptable to the Board and the Region and authorized by law to do business in the province of Ontario. The form of Bid Bond acceptable to the Board and the Region is attached as Appendix E. In lieu of the Bid Bond form attached as Appendix E, the Board and the Region may at their sole discretion accept Bid Bonds that are substantially in the form of Appendix E or substantially in the form issued by the Canadian Construction Documents Committee (CCDC220 Form) or the Surety Association of Canada.

Bidders shall upload the digital Bid Bond in the document upload field titled "Bid Bond (Digital Bond)" in the Documents & Bonding step in the Bidding System.

2. Undertaking to Bond

Bidders shall submit a digital Undertaking to Bond. The Undertaking to Bond shall be in the form of a digital Undertaking to Bond from a recognized guarantee or surety company acceptable to the Board and the Region and authorized by law to do business in the province of Ontario. The form of Undertaking to Bond acceptable to the Board and the Region is attached as Appendix F. In lieu of the Undertaking to Bond form attached as Appendix F, the Board and the Region may at their sole discretion accept Undertakings to Bond that are substantially in the form of Appendix F or substantially in the form issued by the Surety Association of Canada, including digital Agreements to Bond or Consents of Surety.

Bidders shall upload the digital Undertaking to Bond in the document upload field titled "Undertaking to Bond (Digital Bond)" in the Documents & Bonding step in the Bidding System.

D. Mandatory Technical Requirements

Not applicable.

E. Pre-Conditions of Award

1. Executed Contract

The selected bidder shall execute a contract with the Board for the provision of the Deliverables.

2. WSIB Certificate of Clearance

The selected bidder shall submit a current Certificate of Clearance from the Workplace Safety and Insurance Board.

3. Insurance

The selected bidder shall provide proof of insurance coverage as specified in Appendix D. Bidders should review the insurance requirements with their insurance provider to ensure that each requirement can be met before submitting their bid. Any concerns or questions regarding the insurance requirements should be directed to the Board through the 'Submit a Question' feature on the Bidding System before the Closing Time.

4. Bonds

The selected bidder shall provide:

(a) a Performance Bond in an amount equal to 100% of the Bid Price and conforming to Form 32 - Performance Bond under Section 85.1 of the Construction Act; and

(b) a Labour and Material Payment Bond in an amount equal to 50% of the Bid Price and conforming to Form 31 - Labour and Material Payment Bond under Section 85.1 of the Construction Act

Form 32 – Performance Bond under Section 85.1 of the Construction Act and Form 31 – Labour and Material Payment Bond under Section 85.1 of the Construction Act can be found at http://ontariocourtforms.on.ca/en/construction-lien-act-forms/.

The bonds shall be issued by a recognized guarantee or surety company acceptable to the Board and authorized by law to do business in the province of Ontario.

5. AODA Training Certificate

The selected bidder shall submit a completed AODA Training Certificate in the form attached as Appendix H.

6. Security Clearances

The selected bidder shall submit a completed Confidential Personal History Form for each individual who will be performing the Deliverables or may be required to enter a YRP facility.

The selected bidder and any individuals who may be involved in the performance of the Deliverables under the contract will be subject to a security clearance by the YRP and the selected bidder hereby consents to the security clearance.

Approval of the selected bidder's employees and subcontractors will be at the sole discretion of the Board.

The Confidential Personal History Form may be reviewed and downloaded from yrp.bidsandtenders.ca.

T-24-33
APPENDIX B
PRICING

Instructions on How to Submit Pricing

Bidders must submit their pricing information electronically in Step 1 – Schedule of Prices within the Bidding Website. Bids that contain pricing information in any location other than the Schedule of Prices may be deemed non-compliant and may be disqualified from further consideration.

Prices shall not include escalation clauses or any other qualifications for the term of the contract.

Rates quoted by the bidder must be all-inclusive and must include, without limitation, all equipment, labour and material costs, all travel and carriage costs, all insurance and bonding costs, all costs of delivery, all costs of installation and set-up, including any pre-delivery inspection charges, profit and all other overhead, disbursements and administrative costs, including any fees or other charges required by law, other than HST.

Evaluation of Pricing

Pricing will be evaluated based on the Subtotal Contract Amount indicated in the Summary Table in the Schedule of Prices.

T-24-33 - General Contractor for the Construction of a Helicopter Hangar and Related Interior and Exterior Spaces in the Town of East Gwillimbury, Ontario

Opening Date: September 10, 2024 9:50 AM

Closing Date: October 1, 2024 2:00 PM

Schedule of Prices

All prices must be quoted in Canadian dollars, (excluding H.S.T.) and shall include all duty, custom clearances, tariffs and exchange, travel time, wages and delivery charges; no other charges shall apply. Shipping shall be FOB destinations within Ontario. YRP reserves the right to award by item or part thereof, groups of items or parts thereof, or all items of the Request for Bid, if in so doing, the best interests of the Board will be served.

*Denotes a "MANDATORY" field.

Bidders/Proponents must insert prices for all mandatory items. If a Bidder/Proponent cannot provide any mandatory item, it shall not submit a Bid/Proposal. If an item is not mandatory and is not being bid on, it should be left blank. If a Bidder/Proponent inserts a price of $0.00 for any item, it will be required to provide that item at no cost to the Board.

Scope of Work - Lump Sum

Item Description	Quantity	Unit of Measure	Unit Price *	Extended Total
Lump sum price to complete the construction of a helicopter hangar and related interior and exterior spaces in the Town of East Gwillimbury, Ontario as specified in the Contract Documents, excluding cash allowances.	1	Lump Sum		
			Subtotal:	

Cash Allowance

Cash Allowance will be administered in accordance with GC 4.1 of the Contract.

Item	Description	Quantity	Unit Price	Extender Price
CA1	Inspection and Testing: For inspection and testing services provided by in-dependent inspection and testing companies and consultants	1	$150,000.0000	$ 150,000.00
CA2	Commissioning of mechanical and electrical work by independent commissioning consultant in compliance with specified requirements. Normal commissioning by mechanical and electrical trades shall be included in Total Bid Price and excluded from this cash allowance item	1	$100,000.0000	$ 100,000.00
CA3	Electrical Municipal Utilities connection charges. All Work shown on the Drawings shall be included as part of Total Bid Price and excluded from this cash allowance	1	$50,000.0000	$ 50,000.00
CA4	Supply and installation of security system and equipment (excluding empty conduit which shall be included in Total Bid Price)	1	$75,000.0000	$ 75,000.00
CA5	Supply and Installation of fuel tank including the fuel tank equipment and its components, layout, testing and engineering fees. The empty conduit shall be included in Total Bid Price and excluded from this cash allowance	1	$150,000.0000	$ 150,000.00
			Subtotal:	$ 525,000.00

Provisional Prices

Refer to GC 4.2 of Appendix C - Form of Contract

Should work noted in the Description below add to the Contract Price, enter Pricing as a positive number. Should work noted in the Description below reduce the Contract Price, enter Pricing as a negative number.

Item	Description	Unit of Measurement	Pricing *
PP1	Reduce extent of snow melt system from entire area noted as 'heated concrete' on drawing A-002 to only the area noted as Separate Price #2 Helicopter Parking. Maintain Boilers B-1 and B-2 for redundancy but reduce capacity to suit reduced area. Revise pumps P2 and P2A, exterior manifolds and all snow melt piping shown of Mechanical drawing M-702 as appropriate for reduced snow melt area.	Lump Sum	
PP2	Delete entire snow melt system from area noted as 'heated concrete' on drawing A-002. Delete Boilers B-1 and B-2, pumps P2 and P2A, all related interior piping and wiring and all exterior manifolds and snow melt piping indicated on Mechanical drawing M-702.	Lump Sum	
PP3	Provide prefinished interior metal liner panel to exposed pre-engineered purlins from ground floor to approximately 5000 AFF on east and north hangar walls	Lump Sum	

Unit Prices

Unit prices are values to be used after contract award to predetermine the cost to add or delete work from the contract.

Item	Description	Unit of Measurement	Pricing *
UP1	Revise underside of footing elevation (per 300mm) from footing elevations indicated on Structural Drawing S100. Footing thickness to remain as shown, increase or decrease pier height as required	per vertical foot of pier height change	

Summary Table

Bid Form	Amount
Scope of Work - Lump Sum	
Cash Allowance	$ 525,000.00
Subtotal Contract Amount:	

Specifications

Corporate Name and Contact

Question	Answer *
Provide your company's legal name as it will appear on the invoice and purchase order.	
Provide the name and job title of the company principal who has the authority to bind your company into this contract. Include this person's email address.	
Provide the name and job title of the main contact for this contract. Include this person's email address.	
Provide your company's Business Registration (HST) Number.	
Provide your company's WSIB Number.	

Documents

It is your responsibility to make sure the uploaded file(s) is/are not defective or corrupted and are able to be opened and viewed by the Board. If the attached file(s) cannot be opened or viewed, your Bid Call Document may be rejected.

Documents & Bonding

Bidders shall submit with their bid a Digital Bid Deposit and Digital Undertaking to Bond in accordance with the RFT documents. Both documents must be capable of verification.

- Digital Bid Bond * (mandatory)
- Digital Undertaking to Bond * (mandatory)

Addenda, Terms and Conditions

1. The Bidder, by submitting this Bid, agrees that it will not claim, in contract, tort, or otherwise, for any costs, expenses, compensation, damages, or anything whatsoever, in respect of this Request for Tender process.
2. The Bidder, by submitting this Bid, represents that it has read and completely understands the terms and conditions of this Request for Tender in full, and agrees to comply with the terms and conditions set out in this Request for Tender, failing which The Regional Municipality of York Police Services Board (the “Board”) may reject the Bid.
3. The Bidder, by submitting this Bid, offers to enter into a contract with the Board to perform the Work described in the Bid Documents, do and fulfill everything indicated in the Contract, and complete the Work strictly in accordance with the Contract Documents within the Contract Time at the unit and lump sum prices submitted in the Schedule of Prices.
4. The Bidder acknowledges that the quantities included in the Schedule of Prices are an estimate of the Board’s requirements and there is no guarantee that the full quantities of products or work will be required or purchased. The Bidder agrees that the unit prices quoted in the Schedule of Prices are not subject to change regardless of whether the final Contract quantities exceed, or are less than, the estimated quantities shown in the Schedule of Prices.
5. The Bidder confirms that all prices submitted are in Canadian funds.
6. The Bidder confirms that its prices exclude Harmonized Sales Tax ("HST"), but include all other taxes and duties, as well as any reduction in the Contractor's operating costs due to rebating of any sales taxes. The Bidder agrees that all work performed under the Contract will be subject to HST only.
7. In the event that the Board requests a breakdown of lump sum prices after the bid closing date, the Bidder agrees to complete, and submit to the Board, a breakdown of its lump sum price for each Division/Part within two Business Days of the Board’s request. The Bidder acknowledges that the sum of the individual prices submitted for each Division/Part shall be the same as the lump sum price submitted for that Division/Part in its electronic Bid submission.
8. The Bidder agrees that this Bid shall remain open for acceptance, and that the prices will remain firm and unchanged, for the irrevocability period specified in the Bid Documents and the Board may, at any time within this period, accept this Bid regardless of whether any other Bid has been previously accepted or not.
9. The Bidder acknowledges that if its Bid is accepted and the Bidder fails to properly execute and return the Contract to the Board, or fails to deliver the bonds, proof of insurance and all other documents required to be delivered to the Board prior to commencing the Work, within eight Business Days of the date of award of the Contract to the Bidder, or if the Bidder withdraws its Bid, the Board may, at its option, consider that the Bidder has abandoned its Bid and the acceptance by the Board shall be null and void and:
    1. the Board may retain the proceeds of the bid deposit as liquidated damages; and
    2. the Bidder shall immediately pay to the Board the difference between the amount of the Bidder’s Bid and any other Bid that the Board accepts if the other Bid is for a greater amount and any costs that the Board incurs by reason of recalling the Bids.
10. In addition, the Bidder shall indemnify, hold harmless and defend the Board, York Regional Police (“YRP”), The Regional Municipality of York (the “Region”), their Council members, board members, employees, agents, partners, successors and assigns (collectively the “Indemnified Parties”), from and against all actions, claims, demands, losses, costs, damages, suits and proceedings whatsoever which may be brought against or made upon the Indemnified Parties and against all losses, liabilities, judgments, claims, suits, demands and expenses which the Indemnified Parties may sustain, suffer or be put to resulting from, or arising out of, the undersigned’s withdrawal of its Bid or failure to execute the Contract.
11. The Bidder agrees that if this Bid is accepted, and the Bidder is non-resident in Ontario or Canada, it shall obtain a GST/HST Registration Number prior to commencement of the Work.
12. The Bidder confirms that it has the necessary experience, skill and expertise required to fulfill the obligations, duties, liabilities and responsibilities of the Contractor under the Contract.
13. The Bidder declares that no person, firm or organization, other than the Bidder, has any interest in this Bid or in the proposed contract for which this Bid is submitted.
14. The Bidder declares that this Bid is made without any connection to, comparison of figures against, arrangement with, or knowledge of, any other corporation, firm or person submitting a Bid and is in all respects fair and without collusion or fraud.
15. The Bidder agrees that no member of Regional Council, YRP, the Board, or officer or employee of the Region, YRP or the Board is, will be, or has become, interested directly or indirectly, as a contracting party, partner, shareholder, surety or otherwise, in the performance of the Work, or in any portion of the profit thereof, or any supplies to be used therein, or in any of the monies to be derived therefrom.
16. The Bidder confirms that it has examined the Site and the Bid Documents and is fully informed as to the nature of the Work and conditions relating to its performance.

17. The Bidder acknowledges that any reports made available by the Board and/or the Region were compiled for the use of the Board and/or the Region and no responsibility will be assumed by the Board or the Region for the correctness or completeness of the reports.
18. The Bidder acknowledges that it has received information regarding the Region's Health and Safety Guide for Construction Contractors and is aware of the hazards identified in the Board's Pre-Work Hazard Assessment Form. The Bidder agrees to execute all of the documentation required under the Region's Health and Safety Guide for Construction Contractors at the pre-construction meeting and to comply with the Occupational Health and Safety Act, RSO 1990, c O.1 and regulations.
19. If the Bidder is an incorporated company, the Bidder represents to the Board that:
    1. the Bidder is a corporation validly subsisting under the laws of Ontario and has full corporate power and capacity to enter into this Bid and any documents arising from this Bid; and
    2. all necessary corporate action has been taken by the Bidder to authorize the execution and delivery of this Bid.
20. The Bidder acknowledges that the Contractor may be subject to a performance evaluation during the course of, and/or at the conclusion of, the Contract.
21. The Bidder agrees to be bound by all terms and conditions contained in the Bid Documents.
22. The Bidder, by submitting this Bid, represents that it has considered all legislative amendments, controls, regulations, requirements and orders that have been issued by the Government of Canada and the Province of Ontario in response to the global pandemic of the virus leading to COVID-19, including any impacts such legislative amendments, controls, regulations, requirements and orders could have on its pricing, and confirms that its prices submitted in the Schedule of Prices include all costs associated with the foregoing.
23. The Bidder agrees that if this Bid is accepted, it shall comply with all legislative amendments, controls, regulations, requirements and orders that have been, or will be, issued by the Government of Canada or the Province of Ontario in response to the global pandemic of the virus leading to COVID-19 including any resurgence or mutation thereof.
24. The Bidder agrees that if this Bid is accepted, it shall comply with the Board's and the Board's policies, protocols and procedures including, but not limited to, the Board's COVID-19 Vaccination Policy for Contractors, as may be amended or replaced from time to time.

☐ I/We, the Undersigned, having examined the Instructions to Bidders, Special Instructions and/or Scope of Work-Specifications, do hereby offer to enter into a Contract with the Board.

The Bidder shall declare any potential conflict of interest that could arise from participating in this bid. Do you have a potential conflict of interest?

○ **Yes** ○ **No**

The Bidder acknowledges and agrees that the addendum/addenda below form part of the Bid Document

Please check the box in the column "**I have reviewed this addendum"** below to acknowledge each of the addenda.

File Name	I have reviewed the below addendum and attachments (if applicable)	Pages
There have not been any addenda issued for this bid.		

APPENDIX B

Health and Safety Guide for Construction Contractors

Human Resource Services – Workplace Health, Safety, Wellness & Benefits Division
Updated: February 2019

Table of Contents

1. Introduction

This Guide is intended to ensure that, pursuant to the *Occupational Health and Safety Act*, the Regional Municipality of York (the "Region") complies with its obligations as Owner and the General Contractor complies with its obligations as Constructor on Construction projects.

This Guide serves as a guideline for bidders to ensure that adequate resources and appropriate measures are utilized to perform the Work safely and to ensure that appropriate procedures are established for monitoring and evaluating health and safety performance.

The purpose of this Guide is to ensure that all Work undertaken by General Contractors is conducted in a manner that:

- Considers and protects the health and safety of York Region residents and members of the public;
- Considers and protects the health and safety of all Workers.

All bidders are required to acknowledge that they have reviewed this Guide and the Pre-Work Hazard Assessment Form. The General Contractor is required to submit a signed copy of the Pre-Work Hazard Assessment Form (template shown at Appendix A) prior to commencing Work.

2. Definitions

***Accessibility for Ontarians with Disabilities Act*:**

The Ontario *Accessibility for Ontarians with Disabilities Act, 2005*, S.O. 2005, c. 11 and its regulations.

Bid Documents:

The documentation issued by the Region in the form of a request for quotation, proposal or tender. Bidders submit their quotes, proposals or tenders in response to Bid Documents.

Competent Person:

A person who:

(a) is qualified because of knowledge, training and experience to organize the Work and its performance,
(b) is familiar with the *Occupational Health and Safety Act* and the regulations that apply to the Work, and
(c) has knowledge of any potential or actual danger to health or safety in the Workplace. (*Occupational Health and Safety Act*, s. 1)

Construction:

The erection, alteration, repair, dismantling, demolition, structural maintenance, painting, land clearing, earth moving, grading, excavating, trenching, digging, boring, drilling, blasting, or concreting, the installation of any machinery or plant, and any Work or undertaking in connection with a project but does not include any Work or undertaking underground in a mine. (*Occupational Health and Safety Act*, s. 1)

Constructor:

A person who undertakes a project for an Owner and includes an Owner who undertakes all or part of a project by himself or by more than one Employer. (*Occupational Health and Safety Act*, s. 1)

Consultant:

The person, firm or corporation, if any, retained by the Region to perform consulting services in relation to the Work.

Contract:

The undertaking by the Region and the General Contractor to perform their respective duties, responsibilities and obligations as prescribed in the Contract Documents and represents the entire agreement between the Region and the General Contractor. The Contract supersedes all prior negotiations, representations or agreements, either written or oral, except to the extent specifically referred to in the Contract.

Contract Documents:

Any documents that form part of the Contract, including any amendments incorporated before the execution of the Contract and any subsequent amendments made pursuant to the provisions of the Contract.

Contractor Safety Specialist:

A person employed or retained by the Region who conducts periodic Site Safety Audits to promote hazard awareness and ensure safe Work practices.

Critical Injury:

An injury of a serious nature that:

(a) places life in jeopardy,
(b) produces unconsciousness,
(c) results in substantial loss of blood,
(d) involves the fracture of an arm or leg, but not a finger or toe,
(e) involves the amputation of an arm, leg or foot, but not a finger or toe,
(f) consists of burns to a major portion of the body, or

(g) causes the loss of sight in an eye.
(*Occupational Health and Safety Act*, Reg. 834, s.1)

Designated Substance:

A biological, chemical or physical agent or combination thereof prescribed as a designated substance to which the exposure to a Worker is prohibited, regulated, restricted, limited or controlled. (*Occupational Health and Safety Act*, s. 1)

Employer:

A person who employs one or more Workers or contracts for the services of one or more Workers and includes a [General] Contractor or Subcontractor who performs Work or supplies services and a [General] Contractor or Subcontractor who undertakes with an Owner, Constructor, [General] Contractor or Subcontractor to perform Work or supply services. (*Occupational Health and Safety Act*, s. 1)

General Contractor:

The person, firm or corporation with whom the Region enters into a Contract as a result of a request for quotation, proposal or tender. The obligations of the General Contractor include those of a Constructor as defined in the *Occupational Health and Safety Act*.

Incident:

An undesired event causing:

(a) personal injury;
(b) no injury, but is described as a near miss or potential for injury; and/or
(c) damage to property or equipment.

***Occupational Health and Safety Act*:**

The Ontario *Occupational Health and Safety Act*, R.S.O. 1990, c. O.1 and its regulations.

Owner:

A trustee, receiver, mortgagee in possession, tenant, lessee, or occupier of any lands or premises used or to be used as a Workplace, or a person who acts for or on behalf of an Owner as an agent or delegate. (*Occupational Health and Safety Act*, s. 1)

In most cases, when the Region procures the services of a Constructor, the Region is considered to be the Owner.

Pre-Work Hazard Assessment Form:

A form which identifies all known hazards existing on the Site at the time the hazard assessment is conducted, including any Designated Substances that may be present on the Site.

Project Administrator/Coordinator:

A person employed by the Region who reports to the Project Manager and is responsible for ensuring that the terms of the Contract are adhered to once the Contract has been awarded to a General Contractor.

Project Manager:

Any person employed by the Region who is responsible for ensuring that the terms of the Contract are adhered to and enforced. A Project Manager may delegate to a Project Administrator/Coordinator.

Site:

The designated site or location of the Work.

Site Safety Audit:

A process performed by the Contractor Safety Specialist to ensure safety compliance that includes, but is not limited to, a visual inspection of the Site, review of relevant documents, and interviews with Workers and representatives of the General Contractor. The results of a Site Safety Audit are produced in a Site Safety Audit Report.

Subcontractor:

A person, firm or corporation having a direct contract with the General Contractor to perform a part or parts of the Work, supply products, or provide a service on behalf of the General Contractor.

Supervisor:

A person who has charge of a Workplace or authority over a Worker. (*Occupational Health and Safety Act*, s. 1)

The Region:

The Regional Municipality of York, its employees, authorized agents and representatives.

Visitor:

Any individual accessing the Site who is not a General Contractor, Subcontractor, Consultant, Worker or representative of the Region.

Work:

The total Construction and related services required by the Contract. Work may include, but is not limited to, the supply of services, labour and materials for the installation, removal, application, demolition, erection, renovation, re-furbishing or construction of a building,

bridge, shaft, tunnel, caisson, trench, excavation, roadway, cofferdam, conduit, sewer, water-main, service connection, duct or well, and other undertakings.

Worker:

A person who performs Work or supplies services for monetary compensation. (*Occupational Health and Safety Act*, s. 1, in part)

Workplace:

Any land, premises, location or thing at, upon, in or near which a Worker works. *(Occupational Health and Safety Act*, s. 1)

Workplace Hazardous Materials Information System (WHMIS):

R.R.O. 1990, Reg. 860 of the *Occupational Health and Safety Act*.

***Workplace Safety and Insurance Act*:**

The Ontario *Workplace Safety and Insurance Act, 1997*, S.O. 1997, c. 16, Sched. A and its regulations.

3. Responsibilities

The Owner shall:

- Conduct a hazard assessment of the Site and provide a copy of the completed Pre-Work Hazard Assessment Form to all bidders.
- Conduct periodic Site Safety Audits and provide a copy of the completed Site Safety Audit Report to the General Contractor to ensure compliance with the *Occupational Health and Safety Act* and with the Contract.

Bidders shall:

- Review the Pre-Work Hazard Assessment Form completed by the Region prior to submitting any bid(s).

General Contractors shall:

- Comply with all of the terms of the Contract.
- Comply with all health and safety requirements under the *Occupational Health and Safety Act* and the *Workplace Safety and Insurance Act*, and ensure that all Workers, Subcontractors and Visitors conduct themselves in a safe manner.
- Acknowledge the appointment of Constructor as defined under the *Occupational Health and Safety Act*.
- Review this Health and Safety Guide for Construction Contractors.

- Ensure all required documentation has been submitted to the Project Manager prior to commencing any Work.
- Disclose any additional hazards located on the Site, apart from those identified on the Pre-Work Hazard Assessment Form, prior to and at any time during Construction activities to the Project Manager and individuals present at the Site.
- Obtain any necessary information regarding the hazards located at the Site and communicate that information to all individuals present at the Site.
- Allow the Contractor Safety Specialist to enter the Site to conduct periodic, unannounced Site Safety Audits to ensure the General Contractor is fulfilling its health and safety obligations under the Contract.
- Understand that the Region may take any action to remedy any contravention of the *Occupational Health and Safety Act*, including stopping unsafe Work or terminating the Contract.

4. Education and Prevention

General Contractors:

All General Contractors must ensure that their employees have completed training regarding all of the hazards associated with the Work, have valid trade certificates and/or licences, and follow established Work procedures.

General Contractors are responsible for ensuring Site safety, including Site access for all persons. Where Region employees require Site-specific training to enter the Site, the General Contractor is responsible for the provision of such training. This may be in the form of a Site induction and/or orientation.

5. Pre-Work Hazard Assessment Form

The intent of the Pre-Work Hazard Assessment Form is to promote hazard awareness and to inform all bidders of any actual hazards that exist or may pose a potential problem during Construction, such as overhead or underground power lines or the presence of asbestos, etc.

The Pre-Work Hazard Assessment Form assists bidders with making informed decisions about the hazards involved and enables them to budget the necessary time and resources to perform the Work safely. The Pre-Work Hazard Assessment Form is a communication tool only and is not intended to be a comprehensive account or analysis of all possible hazards present on the Site.

The Pre-Work Hazard Assessment Form identifies all known hazards existing on the Site at the time of the assessment, including but not limited to the following:

- Electrical/Equipment Hazards
- Physical Hazards
- Chemical Hazards

- Biological Hazards
- Hazardous Conditions
- Public Safety Hazards
- Designated Substances/Other materials

All bidders will be provided with a copy of the completed Pre-Work Hazard Assessment Form. All General Contractors must acknowledge the hazards identified at the time of the hazard assessment and agree, by signing the Pre-Work Hazard Assessment Form, to take every precaution reasonable in the circumstances to protect Workers from those hazards at all times.

6. General Health and Safety Requirements

Separation of Adjacent Construction Projects or Workplaces

The General Contractor is expected to fully cooperate with the Region and its Consultant(s) to ensure a safe separation between two or more Construction projects or Workplaces. To ensure the Owner does not assume the role of Constructor, the General Contractor shall separate the Construction project(s) by space (physical) and/or time (schedule) as per the requirements of the *Occupational Health and Safety Act*.

Public Safety

The Region prioritizes the safety of all persons and the General Contractor must ensure that Work activities do not put members of the public in danger. Ensuring public safety during Construction activities includes but is not limited to:

Site Access:

- Managing Site access with suitable fencing/barriers that physically prevent people from entering the Site and prevent objects or material from unintentionally escaping the Site.
- All materials and equipment shall be stored within the Site perimeter, preferably in secure compounds.
- Prior to leaving the Site at any time, all openings of surfaces, excavations and fall/impalement hazards must be secured/covered and identified.

Signage/Public Awareness:

- The General Contractor shall make the public aware of all hazards. All Sites must have clear signs displayed along the perimeter of the Site and, at any entrance to the Site which is visible to pedestrians, specify the particular hazard(s) and advise that Construction is in progress.

Sidewalks:

- In the event that a sidewalk is within the perimeter of or adjacent to the Site, the sidewalk shall be closed and identified as such well in advance of the closure, and an alternate route shall be provided, even if temporary.
- All sidewalks and paths must be clean and free from debris. Consideration should be given to those individuals with mobility impairments, e.g. those who use wheelchairs.
- Uniform surfaces and ramps shall be provided, as necessary, to comply with the *Accessibility for Ontarians with Disabilities Act*. It is important that the General Contractor ensure that pedestrians are inconvenienced by the Work as little as possible.

Transit Bus Stops:

- In the event that a bus stop is within the perimeter of or adjacent to the Site, it shall be relocated at the direction of York Region Transit.

Vehicles/Equipment:

- The General Contractor must take measures to ensure that vehicles entering and leaving the Site do not hit pedestrians.
- Work areas are to be clearly identified per Ontario Traffic Manual Book 7 and separated from public roadways or walkways, e.g. paths and sidewalks.
- In some situations, as per Ontario Traffic Manual Book 7, it will be necessary for the General Contractor to employ a traffic control person or retain a paid duty police officer(s) to direct traffic and maintain the safe flow of traffic per the *Occupational Health and Safety Act*.

Designated Substances

The Region shall ensure a current Designated Substance Survey (DSS) of the Site is conducted prior to procuring a General Contractor as per the requirements of the *Occupational Health and Safety Act*. The DSS will be a component of the Pre-Work Hazard Assessment and will be provided to all bidders if Designated Substances are present at the Site.

WHMIS and Controlled Materials

In addition to complying with WHMIS, the General Contractor shall inform the Region of the location of controlled substances and materials and shall ensure that these materials are not stored or used on the Site without the Region’s prior approval.

Site Supervisor

As per the *Occupational Health and Safety Act*, the General Contractor shall appoint a Competent Person as the Supervisor of the Site. In the event that the Site Supervisor must temporarily leave the Site for any time period, a designate Site Supervisor must be appointed and must also be a Competent Person.

Stopping Unsafe Work/Stop Work Order

- Region employees are not permitted to direct or instruct Workers on how to perform their regular duties. However, in the event that a dangerous circumstance (as per the *Occupational Health and Safety Act*, s. 44) is observed by the Contractor Safety Specialist or a Region representative, they may intervene and stop the unsafe act or condition from continuing.

- The Region and its Consultant(s) shall have the right to issue warnings and/or to stop Work if the General Contractor violates the *Occupational Health and Safety Act* or any health and safety requirement of the Contract.

- A written stop work order will be issued when imminent danger is identified or where significant damage to equipment or property or environmental degradation could occur if the unsafe act or condition continues.

- Stop work orders only involve those areas of the Site immediately concerned in the identified hazardous situation and are to be included in the order.

- Written warnings and/or stop work orders shall be provided to individuals representing the General Contractor and the Region.

- Work may not resume until the Region is satisfied that the imminent danger is eliminated. Notification to restart Work will be made to all parties advised of the original stop work order.

- The Region reserves the right to have a hazard eliminated at the expense of the General Contractor.

Reporting Incidents and Ministry of Labour Visits

The General Contractor shall:

- Immediately investigate all Incidents and immediately report the Incidents to the Project Manager and/or Ministry of Labour (if required). This includes all Critical Injuries, fatalities and those Incidents prescribed under Sections 11 and 12 of Regulation 213/91 of the *Occupational Health and Safety Act*.

- Provide proof of Incident investigation to the Project Manager for any Incidents that occurred on the Site.

- Notify the Region and its Consultant(s) of any report issued by the Ministry of Labour. All documentation, including investigation reports, Site visit reports and/or orders issued, shall immediately be forwarded to the Region and its Consultant(s).

7. Site Safety Audits

York Region Site Safety Audit Process

- The Contractor Safety Specialist may arrive at the Site unannounced and will report to the Site Supervisor.

- If available, the Site Supervisor or Site health and safety representative will accompany the Contractor Safety Specialist to perform a Site walkthrough to conduct a Site Safety Audit.

- If any deficiencies are noted or Workers are observed not to be performing their duties in a safe manner, the Site Supervisor will remedy any deficiencies and/or direct the Workers to perform their duties safely.

- In the event that the Site Supervisor or their designate is unavailable, the Contractor Safety Specialist will conduct the Site Safety Audit on their own.

- In the event that a dangerous circumstance is observed by the Contractor Safety Specialist, they will intervene and stop the unsafe act or condition from continuing and a written stop work order will be issued.

- The Contractor Safety Specialist will not direct Workers on how to perform their regular duties.

- All observations and recommendations will be documented in the Site Safety Audit Report (template shown at Appendix B).

- The Site Safety Audit Report will be sent by email to individuals representing both the General Contractor and the Region, including Consultants and Project Administrators.

- The General Contractor must review all concerns and comments, if any, made on the Site Safety Audit Report and take appropriate action(s) to immediately address and/or correct the concerns and comments.

- After corrective action is taken, the General Contractor must advise all parties who received the Site Safety Audit Report in writing of the specific actions that were taken to correct the deficiencies.

Consultant Site Safety Audit Process

- In addition to the Contractor Safety Specialist conducting Site Safety Audits, the Consultant may conduct periodic inspections of the Site to ensure health and safety compliance. Inspections may include visual inspections as well as testing and sampling, as required.

The General Contractor shall be responsible for any and all costs associated with delays as a result of the General Contractor's failure to comply with the health and safety requirements outlined in the Contract.

The General Contractor shall immediately address any non-compliance issues identified by the Consultant and shall provide the Consultant with a written report of action(s) taken to correct non-compliance of health and safety issues identified.

The Consultant may stop the Work if non-compliance of health and safety regulations is not corrected.

The Region and its Consultant shall have the right to document all health and safety concerns regarding the General Contractor's health and safety compliance.

8. Program Review

The Region will review this Guide and make amendments as required.

9. Non-Compliance

The Region does not tolerate or condone unsafe Work procedures. The failure of a General Contractor to comply with this Guide may result in the Region stopping the Work, terminating the Contract, and/or the General Contractor being subject to penalties, including but not limited to those set out in the *Occupational Health and Safety Act* and the *Workplace Safety and Insurance Act*.

10. Applicable Regulations and References

Occupational Health and Safety Act, R.S.O. 1990, c. O.1

Workplace Safety and Insurance Act, 1997, S.O. 1997, c. 16, Sched. A

Ontario Traffic Manual Book 7 (OTM) 2014

Edwards, C. & Conlin, R. *Employer Liability for Contractors Under the Ontario Occupational Health and Safety Act*, *2nd Edition.* 2007 Thomson Carswell, Toronto, ON.

11. Appendices

A – Pre-Work Hazard Assessment Form
B – Site Safety Audit Report

Appendix A

Pre-Work Hazard Assessment Form

This Pre-Work Hazard Assessment Form is a field observation of the physical conditions existing at the proposed work location as at the time of the hazard assessment. The intent of this form is to promote hazard awareness and incident prevention, and to inform all bidders/General Contractors of any existing hazards that may pose a potential risk during work activities. This form is a communication tool only and is not intended to be a comprehensive account or analysis of all possible and potential hazards present at the work site.

Name of Project Manager:	Project Number:
Name, Title and Organization of person performing assessment:	
Proposed Work Location:	Assessment Date:
Description of Proposed Work:	Assessment Time:

Identify **all** known hazards existing at the time of the hazard assessment. Check off if applicable ☑

ELECTRICAL/EQUIPMENT		BIOLOGICAL	
Overhead wires/lines		Increased risk of mould proliferation	
Live systems or high voltage equipment		Bird or bat droppings	
Overhead crane (**must** be re-certified before use)		Rodent or insect infestation	
Moving equipment (e.g. drive shafts, belts, gears)		Wildlife	
PHYSICAL		Contaminated sharps, syringes, broken glass	
Fire/explosion risk		Sewage, sludge, biohazards	
Heat		HAZARDOUS CONDITIONS	
High noise levels		Working at heights	
Vibration		Water/drowning/flooding	
High pressure or compressed air systems		Slip/trip hazards and uneven footing	
Indoor air quality issues (e.g. fumes, mists, dusts)		Excavation/ditch/culvert	
Non-ionizing radiation (e.g. UV, IR, radio frequency or lasers)		Concealed/buried services in ground OR in structure walls/floors (e.g. conduit, pipe, hydro, gas, water)	
Sufficient lighting and visibility of all work areas		Confined Space (Provide Confined Space Assessment)	
CHEMICAL		Is PPE required to enter the work area?	
Existing products in use e.g. chemicals, lubricants, solvents, treatments (Provide Safety Data Sheets)		Are site specific rescue plans required for the area?	
		Traffic, railway and active roadway nearby	
Fuels (e.g. gasoline, diesel, natural gas, propane)		PUBLIC SAFETY	
Chemicals stored in approved cage/cabinet/room		Does the public have access to the work area?	
Explosion proof or grounded containers		Is the work area at/near a public transit stop?	
Compressed gas cylinders		Is there a history of violent/behavioural incidents?	
DESIGNATED SUBSTANCES/OTHER MATERIALS		OTHER	
Note: A Designated Substance Survey (DSS) **must** be completed when a designated substance is present in the work area		Are other contractors/services entering the work area (e.g. snow clearing, landscaping, deliveries, hauling)? If yes, contact Property Services Branch	
Asbestos (e.g. walls, tiles, pipe insulation, coatings)		Is a security system currently in use?	
Lead (e.g. paint)		List others/comments:	
Mercury (e.g. thermostats, switches, bulbs)			
Silica (e.g. concrete blocks, mortar, bricks, floors)			
PCB's (e.g. light ballasts, transformers, capacitors)			
Ozone depleting substances (e.g. coolants)			
Contaminated soil or water (e.g. oil, waste)			

All bidders/General Contractors shall release and hold harmless York Region, its consultants, the local municipalities and their respective directors, officers, agents and employees from and against any claims, demands, losses, costs, damages, actions, suits or proceedings (including by any government agency) arising as a result of any omissions, misrepresentation, inconsistencies, or errors in the information or content stated in this form.

All General Contractors must:

- Advise anyone who may be affected of any additional hazards located on site prior to and at any time during work activities
- Visit the proposed work location (if possible) to become familiar with the surroundings and any potential hazards that may be present
- Understand that in the event of any conflicts, the requirements of *Occupational Health and Safety Act* and its regulations take precedence over any requirements of the contract or any directions provided
- Ensure that training is provided to their employees and/or subcontracted employees to perform work based on the hazards identified in this form
- Comply with all requirements under the *Occupational Health and Safety Act* and its regulations
- Sign this form to acknowledge the hazards and conditions identified as existing at the time of this assessment, prior to the commencement of any work on site.

To be completed by General Contractor

By signing this form, I acknowledge, as the Authorized Representative of the General Contractor, the hazards outlined above in this Pre-Work Hazard Assessment Form and agree to take every precaution reasonable in the circumstances to protect employees, subcontractors, visitors and the public from those hazards at all times.

(Please Print)

Name of General Contractor: _____

Name and Title of Authorized Representative: _____

Signature of Authorized Representative: _____

Date: _____

Note: All shaded areas must be completed prior to commencing work.

Appendix B

SITE SAFETY AUDIT REPORT

Name or Location of Project:	Audit Date:	Time In:	Time Out:
Project Manager (General Contractor):	Project Manager (York Region):	Project Manager (Consultant):	
Site Supervisor (General Contractor):	Project Number (York Region):	Auditor (York Region):	
Description of Project Activity:			

Item *(☑ - Items Audited)*	Comments/Observations
☐ Site Supervisor present/available onsite	
☐ Notices/permits/reports/regulations posted	
☐ Emergency Preparedness/Fire Safety	
☐ Site Orientation/Safety Meetings	
☐ Site Hazards Identified & Communicated	
☐ Site Conditions/Housekeeping & Hygiene	
☐ Equipment/Machinery Use and Condition	
☐ Chemical Handling/Materials Handling	
☐ Access/Egress	
☐ Scaffolds and Work Platforms	
☐ Fall Prevention/Protection	
☐ Protective Clothing, Equipment & Devices	
☐ Confined Spaces	
☐ Excavations	
☐ Underground Locates (Utilities)	
☐ Electrical Hazards	
☐ Traffic Control	
☐ Other hazards:	

☐ Site Supervisor informed verbally	Auditor Comments:
Site Representative (Contractor/Constructor):	Action is required for Comments/Observations (#) to (#). Please advise the Project Manager in writing when the required actions are taken.
Project Manager (Client/Owner):	

This Site Safety Audit Report represents a brief observation of the physical conditions of the project site. The intent of the report is to promote hazard awareness and/or alert the General Contractor to items that may result in injury or illness to workers, the general public, or other personnel and/or damage to property or equipment.

This Site Safety Audit Report is not intended to be a complete or comprehensive report of all occupational health and safety contraventions present on the site and is not intended to identify all occupational health and safety requirements that the General Contractor must comply with under the *Occupational Health and Safety Act* and its regulations. This Site Safety Audit Report does not, in any way, diminish or otherwise affect a General Contractor's duties and obligations as a Constructor pursuant to the *Occupational Health and Safety Act*.

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APPENDIX C
FORM OF CONTRACT – SUPPLEMENTARY CONDITIONS
REVISED ADDENDUM 15

SC 1. WORKING HOURS

The Contractor will be able to work at the Site during the hours of 8:00 a.m. to 4:00 p.m., Monday through Friday (the "**Working Hours**"). Should the Contractor need to work at the Site outside of the Working Hours, including on weekends, they must notify and receive written approval from YRP's project manager (the "**YRP Project Manager**").

SC 2. PROVISION FOR TRAFFIC

Access shall be maintained at all times from the road to all driveways and parking lots not affected by the Work.

SC 3. OTHER CONTRACTORS

Other work may be in progress within, and/or adjacent to, the Site.

The Contractor shall keep itself informed of any current, or new, local development projects which may impact construction activities and services, and shall coordinate its activities with the developers.

The Contractor shall coordinate its work with the work of Other Contractors and shall not restrict access to the working areas or operations of the Other Contractors.

The Contractor shall maintain a separation of time and space from Other Contractors to ensure that the Board is not placed in the position of "Constructor" within the meaning prescribed in the *Occupational Health and Safety Act*, RSO 1990, c O.1 and shall comply with all other requirements stipulated in GC 10 – Other Contractors. No extension of Contract Time and/or an increase to the Contract Price will be granted for delays resulting from this construction coordination.

SC 4. PERMITS AND APPROVALS

The Contractor shall adhere to all requirements, conditions and restrictions as specified in the permits and approvals required for the completion of the Work.

Site plan application has been submitted to the Town of East Gwillimbury, Ontario.

SC 5. CRITICAL PATH SCHEDULE

Frequency of Schedule Submissions

The Contractor shall submit four colour paper copies and one electronic copy of its initial construction schedule to the Board within ten (10) Working Days of receipt of notification of acceptance of its Bid.

If the Contractor has revised its initial schedule prior to the first Site meeting, the revised schedule shall be submitted to the Board at least three (3) Days prior to the meeting.

After the first Site meeting, schedule updates shall be submitted as follows:

(a) Four colour paper copies and one electronic copy of the updated schedule shall be prepared and submitted to the Board:

  (i) not less than three (3) Days prior to all regularly scheduled Site meetings; and

  (ii) with each application for progress payment.

The release of payment may be withheld in the event that the schedule is not adequately maintained and submitted to the satisfaction of the Board.

All revisions to the original schedule shall be highlighted on the updated schedules. Updated schedules shall reflect the actual progress of the Work and any additions, deletions and revisions to the Work that have arisen since the previous update. At regularly scheduled Site meetings, the Contractor shall explain the basis for all revisions and any corresponding increase or decrease in resources required to complete the Work on time. Upon the Board's request, and at no additional cost to the Board, the Contractor shall submit an updated schedule within seven (7) Days of any major increase/decrease in quantities of materials, or major change in the staging or perceived change in the character of the Work.

All printed copies shall be legible and shall show the date that the schedule was prepared.

Schedule Format and Content

All schedules shall consist of a Gantt chart prepared in Microsoft Project (Microsoft Project Professional 2010 or newer version acceptable to the Board).

The critical path method shall be used to prepare and update the construction schedule. Activities on the critical path shall be identified, and those activities on the critical path that are subject to Working Day charges shall show the expected number of Working Days required for each activity. The activities on the critical path will assist in determining the controlling operation for the purpose of charging Working Days.

The schedule shall show:

- the sequence and interdependence of all activities required to complete the Work, including time for review of working drawing and mix design submissions;
- early start date;
- early finish date;
- float times;

- all network connections used to create a logical schedule and the corresponding durations.

The time scale of the schedule may be divided into days or weeks.

The schedule shall reflect operational constraints, interim completion dates, and other scheduling requirements specified in the Contract.

The Contractor shall select activities for inclusion in the schedule so that the Work is identifiable and the progress of each activity can be determined. The Board reserves the right to limit or increase the number of activities presented within the schedule.

Each activity in the schedule shall include a description of the operation and the number of Days allocated, or actually used, for it. When the duration of an activity is dependent on weather conditions, the number of Days allocated shall include an allowance for the normal frequency of inclement weather. When the activity has an associated item quantity, the approximate quantity shall also be shown.

A delay for an activity shall be deemed to have occurred when the activity is not complete on its late finish date as established in the construction schedule and/or when it exceeds the specified number of Working Days for the Contract.

The construction time shown on the initial schedule shall not exceed the Contract Time.

The Contractor will not be permitted to start the Work until a schedule, conforming to subparagraphs requirements above is received by the Board. If, for whatever reason, the Contractor cannot produce an acceptable schedule within 30 Working Days of its initial submission of the schedule, the Contractor may be deemed to be in default of the Contract.

SC 6. SUBSTANTIAL PERFORMANCE OF THE CONTRACT

The Work will not be deemed to be ready for use or being used for the purposes intended pursuant to section 2 of the Construction Act until the following conditions have been met at a minimum:

- each item of electrical equipment and other cabling installed under this Contract has been tested to demonstrate compliance with the performance requirements of this Contract;
- each electrical and other cabling system installed or modified under this Contract has been tested in accordance with the specified requirements;
- the Work has satisfactorily passed all required inspection and performance testing and can be used for the purposes intended;
- all test results have been submitted to the Board;

- all operating manuals, maintenance manuals, and "As-Built" drawings have been completed and submitted to the satisfaction of the Board;
- all training required under the Contract has been completed and instructions have been provided to the Board's staff to enable the Board to operate the facility;
- all spare parts and materials have been supplied; and
- all warranty certificates have been submitted.

No deviations from these requirements will be permitted.

SC 7. ON-SITE SOIL MANAGEMENT

General

The Contractor shall perform the Work in accordance with the requirements of Ontario Regulation 406/19 – On-Site and Excess Soil Management made under the *Environmental Protection Act*, RSO 1990, c E.19 ("**O. Reg. 406/19**") and the Rules for Soil Management and Excess Soil Quality Standards (the "**Soil Rules and Standards**").

The Contractor shall, as necessary, excavate, track, transport, stockpile, sample, test, process, reuse onsite and dispose of off Site and complete any other handling required for proper management reuse and/or disposal of soil.

On-Site Soil Management

Soil Storage

Unless otherwise indicated in the Contract Documents, the Contractor shall not store any soil at the Site without the prior written approval of the Board. The Contractor shall ensure soil management at the Site is carried out in accordance with O. Reg. 406/19, including section 24 as it pertains to any instruments applicable to soil management at the Site, the Soil Rules and Standards, applicable federal and provincial laws, and municipal by-law requirements, including but not limited to:

(a) soil and crushed rock shall be managed in such a way as to prevent any adverse effects associated with the receiving, processing, storage and movement of soil, including management of:

  (i) noise;

  (ii) dust;

  (iii) mud tracking;

  (iv) leaching;

  (v) run-off and erosion; and

(vi) potential outdoor air impact(s), including odour issue(s).

(b) dry soil and crushed rock must be segregated and stored in stockpiles.

(c) soil and crushed rock that has not been sampled and analyzed, and is required to complete sampling and analysis, must be kept segregated from other soil and crushed rock.

(d) the soil stored must not be stored at a location:

(i) within 30 metres of a water body; and

(ii) within 10 metres of the property line (boundary), unless any of the following apply:

(A) 500 cubic metres or less of excess soil will be stored at any one time on the Site;

(B) excess soil storage at the Site will be for a period of time of less than one week;

(C) the storage location has a physical barrier (e.g., concrete wall) between the excess soil and the property boundary; or

(D) the storage is taking place in a public road right-of-way.

(e) despite paragraph (d)(i), sediment that is dredged from a water body or any soil that is to be excavated from within 30 metres of a water body may be temporarily stored within 30 metres of that water body if the following criteria are satisfied:

(i) there are no visual or olfactory signs that the soil or sediment is affected by contamination;

(ii) the soil or sediment is stored no longer than 1 week from the day it is excavated, except the soil or sediment may be stored for the amount of time that is necessary to:

(A) reuse the soil at the Site as part of the project; or

(B) to dewater liquid soil before transportation or reuse; and

(iii) a sediment and erosion control plan has been prepared and is being implemented for the Site for the duration of the time that soil or sediment is temporarily managed, to prevent any impairment to the water body and any other adverse effects resulting from the storage of the sediment or soil near the water body (e.g., silt runoff, consideration for floodplains, natural hazards, etc.).

(f) soil shall be stored in a manner that prevents any contaminants from the soil from leaching into the groundwater.

Soil Processing

No soil processing at the Site is permitted without the Board's prior written consent. Only soil processing activities permitted under section 6 of O. Reg. 406/19 will be considered unless the Contractor has obtained the applicable Environmental Compliance Approval, as defined in the *Environmental Protection Act*, RSO 1990, c E.19 (the "**EPA**"). In the event the Board provides consent, all such processing shall be performed in accordance with O. Reg. 406/19, the Soil Rules and Standards, the EPA, the *Ontario Water Resources Act*, RSO 1990, c O.40, local instruments, and, if the soil is designated as waste under O. Reg. 406/19, the Environmental Compliance Approval.

The Contractor shall ensure all soil processing activities at the Site conform to the methods described in O. Reg. 406/19, and that such activities would not result in the excavated soil at the Site being designated as waste due to processing.

If a procedure is required by section 6 of O. Reg. 406/19 for the purposes of dewatering or solidifying soil by mixing with a substance that contains a natural or synthetic polymer, the Contractor shall ensure it provides the Consultant with any information that is relevant to the use of the substance to develop the written procedures and document as required under section 6, subsection (4) and (5) of O. Reg. 406/19 respectively. The Contractor, as operator of the Site, shall ensure a copy of the document is provided to the owner or operator of the reuse site. The required information shall be provided to the Consultant a minimum of twenty (20) Business Days prior to beginning any soil mixing at the Site.

The Contractor shall not remove any processed soils from the Site until written approval has been provided by the Board or the Consultant.

Receiving Excess Soil for Reuse at the Site

If the Contractor has determined at the time of bidding for the Work to use Excess Soil from a non-Board or non-Regional project to meet clean fill needs for the Work, the Contractor shall submit an imported Soil management plan for the import of Soil to the Board's Qualified Person and the Consultant, for review and approval within thirty (30) Business Days after award of the Contract. The imported Soil management plan shall include the following at a minimum:

(a) the location of the proposed source sites and confirmation (with appropriate supporting documentation) as to whether or not the proposed source sites have filed notices with the Registry in accordance with section 8 of O. Reg. 406/19;

(b) Soil sampling results, chain of custody, sampling plan and location maps for proposed soil that is to be imported;

(c) the quantity of proposed Soil to be imported from each location for placement at the Site;

(d) the applicable Excess Soil quality standards, as determined in accordance with the Soil Rules and Standards;

(e) the documents and reports prepared by the source sites for the proposed Soil to be imported as required by sections 11, 12 and 13 of O. Reg. 406/19, including assessments of past uses, sampling and analysis plans, soil characterization reports, and Excess Soil destination assessment reports;

(f) confirmation of the geotechnical suitability of the Soil to meet the requirements of the intended use;

(g) procedures for load management, on-site storage and inspection of incoming loads in accordance with section 19 of O. Reg. 406/19, chain of custody and record management and a process for the Board's acceptance of the loads of Excess Soil; and

(h) any other relevant information as requested by the Board's Qualified Person and/or the Consultant.

The Contractor acknowledges the Board must provide written consent in a form acceptable to the Board to the source site owners identified by the Contractor. The consent shall not be executed and no other commitments or agreements shall be made with the owner or operator of the source site of the Excess Soil without the Board's prior written approval. The Contractor shall not be entitled to any compensation on account of any delay or refusal in the Board providing written approval.

The Contractor shall ensure reliance is extended to the Board on reports, data and recommendations used to identify suitability of Excess Soil from a source site to be reused at the Site. Reliance under this section means reliance on terms acceptable to the Board.

Procedure for Observations of Soil Affected by Contaminant Discharge

Without limiting any of the Contractor's other obligations under the Contract Documents relating to toxic or hazardous substances or materials, if any person working at the Site makes an observation during soil excavation within the Site, including any visual or olfactory observation, that suggests that the soil being excavated may be affected by the discharge of a contaminant, the Contractor shall ensure the following actions are performed:

(a) The person shall immediately notify the Contractor of the observation of potential contamination.

(b) The Contractor shall immediately cease all soil excavations in the Site.

(c) The Contractor shall immediately notify the Board and the Consultant of the observation, verbally and in writing.

(d) The Contractor shall identify the area that may be impacted by the discharge of a contaminant and ensure that any excavated soils from that area are segregated from other excavated soil in the Site.

(e) The Contractor shall coordinate with the Consultant and perform the work for the determination and development of recommendations for the following:

(i) the portion of the Site that is affected by the discharge of a contaminant;

(ii) confirmation that all excavated soil that is affected by the discharge of a contaminant is identified and segregated from other excavated soil at the Site;

(iii) appropriate disposal options for any excess soil from that portion of the Site that was affected in accordance with O. Reg. 406/19 and other applicable regulations; and

(iv) requirement for any revisions to any documents required under O. Reg. 406/19.

(f) The Contractor shall consult with the Board and the Consultant to ensure the recommendations noted in (e) above have been satisfactorily executed prior to directing excavations be resumed.

SC 8. SECURITY CLEARANCES

The Contractor and any individuals who may be involved in the performance of the Work under the Contract will be subject to a security clearance by the YRP and the Contractor hereby consents to the security clearance.

The Contractor must submit to the Board a completed Confidential Personal History Form for each individual who will be performing the Work or may be required to enter a YRP facility. Each principal of a company, project manager and employee or person engaged by the Contractor must have an approved YRP security clearance prior to commencing Work under the Contract. The Contract may be terminated should any security clearance fail to be approved by YRP.

Approval of the Contractor's employees and Subcontractors will be at the sole discretion of the Board.

Maintenance of the security clearance is mandatory throughout the term of the Contract. The Contractor must notify the Board as soon as a new employee or Subcontractor is hired to work on the Contract and submit the completed form of such employee or Subcontractor for security clearance.

Security clearances are valid for a one-year period only and must be provided annually throughout the term of the Contract, if applicable.

The Confidential Personal History Form may be downloaded from yrp.bidsandtenders.ca.

SC 9. POST-AWARD MEETING

Within one week of receiving the Contract award notice, a post-award meeting will be held with the Contractor and members of YRP to review the Specifications, Drawings, and details. The YRP Project Manager will be introduced at the meeting.

The Contractor shall provide YRP a detailed timeline within two Days following the post-award meeting. Details shall include, but not be limited to, the delivery of materials and equipment to the Site and work to be performed on Site.

Additional meetings between the Contractor and the YRP Project Manager will take place to monitor the Contractor's performance. The interval of these meetings will be determined by the YRP Project Manager and/or the Contractor's performance.

SC 10. CONTRACTOR'S RESPONSIBILITIES

The Contractor shall be responsible for the supply and maintenance of any and all tools necessary to perform the Work. Any equipment, tools, supplies, etc. delivered to the Site by the Contractor or its Subcontractors in order to complete the Work will be the responsibility of the Contractor. The Contractor shall be entirely responsible for any loss or damage to their materials, supplies and equipment and to the personal property of any of their employees or Subcontractors while they are in or at a YRP facility.

The Contractor, including employees of the Contractor, and/or its Subcontractors shall promptly report to the YRP Project Manager:

- any hazardous conditions;
- any abnormal plumbing, electrical and mechanical conditions; and
- any damage caused to the building or grounds by the Contractor or others.

The Contractor shall abide by all security orders and is not permitted to provide any person access to the building and/or premises at any time.

Unauthorized use of YRP buildings, policing equipment or police related information (verbal, written or visual) is strictly prohibited. Violation of the requirements under this Supplementary Condition may result in termination of the Contract by the Board.

Reference to YRP in the Contractor's advertising without express written consent and approval is prohibited.

SC 11. CONTRACTOR'S EMPLOYEES AND SUBCONTRACTORS AND AODA

The Contractor shall employ sufficient skilled and experienced employees and Subcontractors to adequately perform the Work. The Contractor shall supervise all employees and Subcontractors and inform them of YRP's requirements.

The Contractor shall ensure that all employees and Subcontractors engaged in the performance of Contract are uniformed and identified as an employee or Subcontractor of the Contractor.

If YRP advises the Contractor in writing that an employee and/or Subcontractor under its supervision and performing work under the Contract is for any reason objectionable, unsatisfactory or undesirable, the Contractor must immediately remove the said person from the Contract.

The Contractor shall ensure that all employees and Subcontractors maintain an appropriate and respectful level of conduct in dealing with YRP staff and the general public while in performance of their duties under the Contract.

The Contractor shall ensure that all of its employees, agents, Subcontractors, and others engaged by the Contractor in the performance of the Work receive training in accordance with Sections 7 and 80.49 of Ontario Regulation 191/11 made under the Accessibility for Ontarians with Disabilities Act, 2005, SO 2005, c.11 (the "**AODA**"). Accordingly, the Contractor shall:

- comply with the requirements of the AODA; and
- complete and submit to the Board a copy of the AODA Training Certificate on or before the commencement of Work under the Contract or as periodically required by the Board.

A link to an AODA Training Video and the AODA Certificate can be found at https://www.yrp.ca/en/about/Bids-and-Tenders.asp.

SC 12. USE OF PREMISES

The Contractor's use of the Site is limited to the assigned work area in order to permit the continued use of existing facilities with the least amount of interference and disruption possible.

The Contractor shall take reasonable measures in the execution of the Contract to:

- place necessary barriers and warning signs around all work areas where operations may endanger individuals or create a dangerous situation;
- control noise during work on Site;
- maintaining all work areas in a neat, orderly and dust/debris free condition at all times; and
- comply with all restrictions relating to parking and entrances to the Site at all times.

The Contractor must accept full responsibility for assigned work areas from the time the Work commences to the time the Work is completed.

The Contractor shall be entirely responsible for any damage to YRP facilities or for any loss or damage to any property belonging to YRP or YRP staff when such loss or damage may be attributable to the Contractor's actions or negligence of the Contractor's staff. The Contractor shall be fully responsible for any and all costs incurred to correct any deficiencies to the satisfaction of YRP; these costs will not be borne by YRP.

The Contractor shall work in a safe manner. If in the opinion of the YRP Project Manager or the on-Site facility operator unsafe conditions, practices and procedures are present, work may be shut down by order of the YRP Project Manager until such conditions are corrected.

Upon completion of the Work, and prior to final inspection, the Contractor shall clean all areas affected by the Work and remove all waste and surplus materials from the Site. All waste materials resulting from service activities belong to the Contractor and shall be removed from the Site at the Contractor's expense.

The Contractor will be responsible for providing a portable washroom facility for their employees and Subcontractors on the Site.

SC 13. BOARD SUPPLIED SERVICES

YRP will, where possible, supply electricity (120 Volts), light, heat, power (designated outlets), and hot and cold water, as may be required to perform the Work. The YRP Project Manager or the on-Site facility operator will designate exactly which services and outlets are available to the Contractor. The Contractor is required to provide all other power and water sources required to complete the Work.

SC 14. ALTERNATIVE PRICES

The Contract contains alternative pricing options which are set out in the Schedule of Prices of the Bid Form. The Board shall have the right, at any point in time during the course of the Contract, in its sole and unfettered discretion, to exercise any of the alternative pricing options listed the Schedule of Prices of the Bid Form. Upon the Board providing written notice to the Contractor of its decision to exercise one or more of the alternative pricing options listed in the Bid Form, the Contract Price shall be immediately deemed adjusted to reflect the alternative pricing option(s) and such adjustment shall be promptly recorded by way of a Change Order which both parties shall execute. The Contractor shall, following receipt of the written notice from the Board advising of its election to use an alternative pricing option, promptly and duly perform the applicable Work in accordance with the particular alternative pricing option. The cost of any Work performed on account of alternative pricing shall be included in the Contractor's monthly applications for payment in accordance with the terms of the Contract.

SC 15. PROVISIONAL WORK

1 The Schedule of Prices on the Bidding Website includes certain Provisional Work should it be deemed necessary by the Board during the course of the Contract.

2 The purpose of inclusion of the Provisional Work in the Schedule of Prices is to cover the cost of work that is anticipated but may not be required due to operations requirements and/or budgetary restraints. The Contractor shall not perform any Provisional Work unless the Contractor has received prior written authorization from the Board. Some, none, or all the Provisional Work may be required to be completed at the sole discretion of the Board. The Contractor shall have no claim on any unused portion of the Provisional Work, including claims for loss of anticipated profits.

3 An all-inclusive price, including all profit, overhead and disbursements, for the Provisional Work shall be entered in the Schedule of Prices. The Provisional Work costs shall be included in the Contract Price.

4 Payment for the Provisional Work will only be made if it is completed with the prior written authorization of the Board and shall not include any mark-ups.

T-24-33
APPENDIX C
FORM OF CONTRACT

THE REGIONAL MUNICIPALITY OF YORK POLICE SERVICE BOARD

CONTRACT NO. T-24-33

AMENDMENTS TO CCDC 2 STIPULATED PRICE CONTRACT 2020

The Standard Construction Document for Stipulated Price Contract (CCDC 2 - 2020), English version, consisting of the Agreement Between Owner and Contractor, Definitions, and General Conditions of the Stipulated Price Contract, Parts 1 to 13 inclusive, governing same is hereby made part of these Contract Documents, with the following amendments, modifications, deletions and additions.

In the event that a paragraph is deleted, the numbering of the remaining paragraphs shall remain unchanged, and the numbering of the deleted paragraph will be retained, unused.

AGREEMENT BETWEEN OWNER AND CONTRACTOR

The Agreement Between Owner and Contractor of the Stipulated Price Contract, CCDC-2 2020 is hereby amended as follows:

ARTICLE A-1 THE WORK

Article 1.1

Add the word "diligently" to the beginning of Article 1.1.

Article 1.3

Delete Article 1.3 in its entirety and replace it with the following:

1.3 attain:

.1 *Substantial Performance of the Contract* within 165 Working Days;

.2 *Total Performance of the Contract* within175 Working Days

from the commencement date specified in the Owner's written notice to commence the Work, (the "***Commencement Date***") subject to potential adjustment pursuant to PART 6 – CHANGES IN THE WORK; and

New Article 1.4

Add new Article 1.4 as follows:

1.4 provide all labour, materials, *Construction Equipment*, machinery, Products and work including, without limitation, all *Commissioning* services required by the *Contract Documents* to fully complete and construct the Work in accordance with, and to the satisfaction of, all applicable federal, provincial, municipal and local laws, regulations, rules, bylaws, guidelines, standards, permits, statutes, ordinances, codes, approvals, directions, instructions, authorizations, applicable to the *Place of the Work* (collectively the *"**Laws and Regulations**"*) including, without limitation, those relating to occupational health and safety and any and all obligations, responsibilities and duties required by or set out in any site plan agreement or approval, attributable to the Place of the Work or the proposed development therein, and furnish efficient

business and construction administration and superintendence consistent with the interests of the Owner.

ARTICLE A-2 AGREEMENTS AND AMENDMENTS

Article 2.1

Delete Article 2.1 in its entirety and replace it with the following:

2.1 The *Contract* represents the entire agreement between the *Contractor* and the *Owner* and supersedes all prior negotiations, representations or agreements, either written or oral, relating in any manner to the *Work*, including the bid documents that are not expressly listed in Article A-3 of the Agreement – CONTRACT DOCUMENTS AND REFERENCE DOCUMENTS. There are no agreements, representations, warranties, terms, conditions or commitments regarding the subject matter of this agreement except as expressed in this *Contract*.

ARTICLE A-3 CONTRACT DOCUMENTS

Delete Article A-3 in its entirety and replace it with the following:

ARTICLE A-3 CONTRACT DOCUMENTS AND REFERENCE DOCUMENTS

3.1 The following is a list of the *Contract Documents* referred to in Article A-1 of the Agreement – THE WORK and as defined in the DEFINITIONS. This list is subject to subsequent amendments in accordance with the provisions of the *Contract*. Unless otherwise indicated, terms used in the *Contract Documents* which are defined in the DEFINITIONS shall have the meanings designated in the DEFINITIONS.

- *Bid*
- CCDC 2 STIPULATED PRICE CONTRACT – 2020
  - Agreement between the Owner and Contractor
  - Definitions
  - The General Conditions of the Stipulated Price Contract (CCDC2- 2020)
- Amendments to CCDC 2 STIPULATED PRICE CONTRACT – 2020
  - Amendments to Agreement Between Owner and Contractor
  - Amendments to Definitions
  - Amendments to the General Conditions of the Stipulated Price Contract
- Supplementary Conditions
- Forms
- Permits
- *Specifications*
- *Drawings*
- Appendices
  - Appendix D to RFT – Insurance Requirements

- Health and Safety Guide for Construction Contractors
- Addenda

3.2 The following documents are provided for information purposes only and do not form part of the *Contract Documents*:

- *Reports*
  - Geotechnical Investigation Proposed Helicopter Hangar, Project 44148, dated August 30, 2024, by Patriot Engineering Ltd.;
  - Partial Site Plan Showing the Approximate Borehole Locations, Project 44148, dated August 2024, by Patriot Engineering Ltd.; and
  - Phase One Environmental Site Assessment dated December 2013 prepared by Conestoga-Rovers and Associates.

ARTICLE A-4 CONTRACT PRICE

Add the following to the end of Article 4.1:

Notwithstanding the foregoing, the *Contractor* shall not be entitled to any increases in the *Contract Price*, or to the prices for any individual items, for any reason whatsoever including, but not limited to, increases in prices due to inflation or the escalation of labour or material costs.

ARTICLE A-5 PAYMENT

Delete Article A-5 in its entirety and replace it with the following:

ARTICLE A-5 PAYMENT

5.1 Provided the *Contractor* is not in default under the *Contract*, and subject to the provisions of the *Contract*, the *Owner* shall pay the *Contractor* the undisputed amounts payable under *Proper Invoices* given to the *Owner* in accordance with the *Contract*, on account of the *Contract Price*.

5.2 Payment shall be made in Canadian funds.

5.3 Subject to the provisions of the *Contract*, and in accordance with the *Construction Act* the *Owner* will:

.1 pay to the *Contractor* the undisputed amounts payable under the *Proper Invoices* given by the *Contractor* to the *Owner* in accordance with the *Contract*, subject to the 10% statutory holdback and a 3% maintenance security;

.2 pay the 10% basic holdback, together with such *Value Added Taxes* as may be applicable, to the *Contractor* in accordance with the *Construction Act*;

.3 pay the 10% holdback for finishing work, together with such *Value Added Taxes* as may be applicable, to the *Contractor* in accordance with the *Construction Act*; and

.4 subject to any deductions made by the *Owner* in accordance with GC 5.11 – MAINTENANCE SECURITY, pay the 3% maintenance security, together with such *Value Added Taxes* as may be applicable, to the *Contractor* upon the expiration of the *Warranty Period* and the correction of all deficiencies and warranty issues to the satisfaction of the *Consultant* (whether they have occurred during the *Warranty Period* or thereafter).

5.4 If the *Contractor* is a non-resident of Canada, the applicable provisions of the *Income Tax Act*, RSC 1985, c 1 shall apply.

5.5 As such payments become due, the *Contractor* shall, in accordance with the terms of its agreements with any *Subcontractors*, *Suppliers* and workers, pay all of its *Subcontractors*, *Suppliers* and workers in full on account of *work* properly performed or *Products* properly supplied, as applicable, less any holdback monies retained in compliance with the *Construction Act*. If requested, the *Contractor* shall promptly provide evidence of all such payments to the *Owner* and the *Consultant*.

5.6 In the event of loss or damage occurring where payment becomes due under the property and other required insurance policies, payments shall be made to the *Contractor*, the *Owner* or the *Region*, as the case may be, in accordance with the provisions of GC 11.2 - INSURANCE.

5.7 The *Contractor* agrees to substantiate to the *Owner* and the *Consultant*, if requested, the amounts of all accounts representing any portion of the *Contract Price*, including without limitation, providing back up documents evidencing accounts or payments due to employees, *Subcontractors* and *Suppliers*.

5.8 The *Contractor* shall not be entitled to claim, demand or receive any interest as a result of delays in approval or payment by the *Owner* except as expressly permitted under the *Construction Act*.

ARTICLE A-6 RECEIPT OF AND ADDRESSES FOR NOTICES IN WRITING

Article 6.2

Add the words “by email” after the words “by prepaid first class mail”.

Add the following to the end of Article 6.2:

Notices in Writing and instructions given to the *Contractor’s Project Manager* or the *Site Supervisor* shall be deemed to have been received by the *Contractor*.

Article 6.3

Add the words “prepaid first class” before the word “mail”.

Delete the words “Working Day” and replace them with “Business Day”.

Article 6.4

Delete the words “the end of normal business hours” and replace them with “4:30 p.m. (Eastern Time)”.

Delete the words “Working Day” and replace them with “Business Day”.

New Article 6.6

Add new Article 6.6 as follows:

6.6 Any notices required to be given under the *Construction Act*, including without limitation notices of non-payment, shall be given in accordance with the requirements for Notices in Writing prescribed by this Article A-6 of the Agreement – RECEIPT OF AND ADDRESSES FOR NOTICES IN WRITING. *Proper Invoices* shall be given in accordance with the requirements of GC 5.2 – APPLICATIONS FOR PAYMENT.

NEW ARTICLES

Add the following new Articles to the Agreement Between Owner and Contractor:

ARTICLE A-9 TIME OF THE ESSENCE

9.1 Time shall be of the essence in this Agreement.

ARTICLE A-10 CONFLICT OF INTEREST

10.1 The *Contractor*, all of the *Subcontractors*, and any of their respective advisors, partners, directors, officers, employees, agents, and volunteers shall not engage in any activity or provide any services where such activity or the provision of such services creates a conflict of interest (actually or potentially, in the sole opinion of the *Owner*) with the provision of the *Work* pursuant to the *Contract*.

10.2 The *Contractor* shall disclose to the *Owner*, in writing, without delay any actual or potential situation that may be reasonably interpreted as either a conflict of interest or a potential conflict of interest, including the retention of any *Subcontractor* or *Supplier* that is directly or indirectly affiliated with or related to the *Contractor*.

10.3 A breach of this Article by the *Contractor*, any of the *Subcontractors*, or any of their respective advisors, partners, directors, officers, employees, agents, and volunteers shall entitle the *Owner* to terminate the *Contract* in accordance with the provisions of GC 7.1 - OWNER'S RIGHT TO PERFORM THE WORK OR STOP THE WORK OR TERMINATE THE CONTRACT, in addition to any other rights and remedies that the *Owner* has in the *Contract*, in law, or in equity.

ARTICLE A-11 SEVERABILITY

11.1 Each provision of the *Contract* shall be valid and enforceable to the fullest extent permitted by law. If any provision of the *Contract* or the application thereof to any person or circumstance is determined to be invalid or unenforceable to any extent:

.1 the remainder of the *Contract* or the application of such provision to any other person or circumstance shall not be affected thereby; and

.2 the parties shall negotiate in good faith to amend the *Contract* to eliminate such invalidity, unenforceability and to restore this Agreement as near as possible to its original intent and effect.

ARTICLE A-12 LIQUIDATED DAMAGES

12.1 For the purposes of GC 5.9 – LIQUIDATED DAMAGES, liquidated damages will be assessed in accordance with the following:

.1 $1,500.00 for each Day that the *Contractor* fails to achieve *Substantial Performance of the Contract* beyond the 165 *Working Days* specified in Article A-1 of the Agreement – THE WORK, paragraph 1.3.1; and

.2 $1,500.00 for each Day that the *Contractor* fails to achieve *Total Performance of the Contract* beyond the 175 *Working Days* specified in Article A-1 of the Agreement – THE WORK, paragraph 1.3.2.

ARTICLE A-13 WARRANTY PERIOD

13.1 For the purpose of GC 12.3 - WARRANTY, the *Warranty Period* for *Work* completed under this *Contract* shall be as follows:

.1 24 months from the date of *Substantial Performance of the Contract* for all *Work* completed on, or before, the date of *Substantial Performance of the Contract*; and

.2 24 months from the date of *Total Performance of the Contract* for all *Work* completed after the date of *Substantial Performance of the Contract*.

13.2 In addition to the *Warranty Period* specified above, the *Work* may be subject to extended warranties pursuant to GC 12.3 – WARRANTY, paragraph 12.3.6.

ARTICLE A-14 COUNTERPARTS

14.1 This *Contract* may be executed in counterparts, each of which shall be deemed to be an original, and all of which such counterparts, together, shall constitute one and the same *Contract*. Counterparts may be executed in original or electronic form, and the parties shall accept any signatures received in electronic form as if they were original signatures of the parties.

DEFINITIONS

The Definitions of the Stipulated Price Contract CCDC – 2020 are hereby amended as follows:

Change Directive

Delete the words "within the general scope of the *Contract Documents*".

Consultant

Add the following sentence after the last sentence:

Wherever used in the *Contract Documents*, the words "Engineer", "Architect" and "*Consultant*" shall be regarded as synonymous.

Contract Documents

Delete in its entirety and replace with the following:

The *Contract Documents* consist of those documents listed in Article A-3 of the Agreement – CONTRACT DOCUMENTS AND REFERENCE DOCUMENTS and amendments agreed upon in writing between the parties.

Contract Time

Delete in its entirety and replace with the following:

The *Contract Time* is the timeframe stipulated in paragraph 1.3 of Article A-1 of the Agreement – THE WORK for completion of the *Work*.

Contractor

Add the following sentence after the last sentence:

Wherever used in the *Contract Documents*, the words "*Contractor*" and "*General Contractor*" shall be regarded as synonymous.

Drawings

Delete in its entirety and replace with the following:

Drawings means all plans, profiles, drawings, sketches or copies thereof, used or prepared for, or in connection with, the *Work* and are included in the *Contract Documents*. Wherever used in the *Contract Documents*, the words "*Drawings*" and "*Contract Drawings*" shall be regarded as synonymous.

Other Contractor

Delete in its entirety and replace with the following:

Other Contractor means a person, firm or corporation or entity, not employed by or having a contract with the *Contractor,* and who is performing work at or near the *Site* directly or

indirectly on behalf of the *Owner*, the *Municipalities* or any other governmental agencies, property owners, developers or utility companies and their respective contractors.

Owner

Add the words "or its authorized agent or representative as designated to the *Contractor* but does not include the *Consultant*" after the word "Agreement".

Payment Legislation

Delete in its entirety.

Place of the Work

Add the following sentence after the last sentence:

Wherever used in the *Contract Documents*, the terms "*Place of the Work*" and "*Site*" shall be regarded as synonymous.

Ready for Takeover

Delete in its entirety.

Shop Drawings

Delete "which the *Contractor* provides" and replace with "to be provided by the *Contractor*".

Subcontractor

Delete in its entirety and replace with the following:

Subcontractor means a person, firm or corporation not contracting with or employed directly by the *Owner*, but who performs a part or parts of the *Work* or supplies *Products* under an agreement with the *Contractor* or under an agreement with another subcontractor.

Substantial Performance of the Work

Delete in its entirety

Working Day

Delete in its entirety and replace with the following:

Working Day means any Day when the Contractor is allowed to perform Work as specified in the Contract Documents.

Add the following new definitions:

As-Built Drawings

As-Built Drawings means drawings prepared by the *Contractor* by marking on a copy of the *Drawings* the changes from the *Drawings* which occur during construction including, but not limited to, the exact location of major building components that were shown generally on the *Drawings*.

Authorities Having Jurisdiction

The phrase *Authorities Having Jurisdiction* or the term Authorities means those authorities having jurisdiction under law over the *Work* or parts thereof.

Bid

Bid means the *Contractor's* response to the Request for Tender for this *Contract*.

Business Day

Business Day means any Day except Saturdays, Sundays and statutory holidays in the Province of Ontario.

Cash Allowance Disbursement Authorization

A *Cash Allowance Disbursement Authorization* is an authorization to the Contractor to expend monies from cash allowances included in the Contract Price.

Changes in the Work

Changes in the Work means means additions, deletions, extensions, increases , decreases or other revisions to the work within the general scope of the Contract.

Commission

Commission means, and *Commissioning* refers to, the procedure which includes checking, testing, adjusting and measuring *Work* performed by the *Contractor* to demonstrate and verify the installation, operation and performance of all components and the entire system.

Construction Act

Construction Act means Ontario's *Construction Act*, RSO 1990, c. C.30 as amended or replaced from time to time.

Constructor

Constructor is as defined pursuant to the *Occupational Health and Safety Act*, RSO 1990, c O.1. as amended or replaced from time to time.

Contemplated Change Order

Contemplated Change Order or *CCO* means a document prepared by the *Owner* describing a proposed *Change in the Work* that is issued to the *Contractor*.

Contract Schedule

Contract Schedule means the schedule indicating the timing of major activities of the *Work* submitted by the *Contractor* and approved in writing by the *Owner* including attaining *Substantial Performance of the Contract* by the Substantial Performance of the Contract date.

Day

Day means a calendar day.

Equivalent

Equivalent means an alternative *Product*, material or manufacturer proposed by the *Contractor* during the course of the *Contract* and demonstrated to the *Owner's* and the *Consultant's* satisfaction as being equivalent to the particular *Product*, material or manufacturer prescribed by the *Contract Documents* taking into consideration factors which include suitability with operational requirements and compatibility, interchangeability or interoperability with existing equipment.

Install

Install means completion of the following activities, including the associated labour, services, plant, construction machinery and equipment required to:

.1 Remove *Products* from storage and locate for placement,

.2 Position and adjust *Products* for final placement,

.3 Affix and anchor *Products* in final placement, in accordance with manufacturers' instructions and *Contract Documents*,

.4 *Commission* and adjust *Products* for proper operation.

Interim Milestone

Interim Milestone means a scheduled event signifying the completion of a major deliverable or a set of related deliverables.

Make Good

Make Good means repairing, restoring, refurbishing, rehabilitating, or performing filling operation on any existing components disturbed due to Work of this *Contract*, to at least the condition existing at the commencement of the *Work*, in terms of construction integrity, finishes, alignment with existing adjoining surfaces, compatibility of materials, sound

attenuation criteria, exfiltration/infiltration requirements, air/vapour barrier and thermal continuity.

Municipalities

Municipalities means the lower-tier municipality or municipalities and upper-tier municipality or municipalities, as defined in the *Municipal Act, 2001*, SO 2001, c 25, in which the *Work* will be undertaken.

Payment Period

Payment Period means a one-month period during which work was performed. The start and end dates of the *Payment Period* will be determined by the *Owner* and the *Contractor* at the pre-construction meeting. In the event the *Owner* and the *Contractor* do not determine the start and end dates of the *Payment Period*, the start and end dates of the *Payment Period* are deemed to be the first Day of the month and the last Day of the month, respectively.

Pre-Invoice Submission Meeting

Pre-Invoice Submission Meeting shall have the meaning prescribed in GC 5.2 – APPLICATIONS FOR PAYMENT, paragraph 5.2.5.

Preliminary Estimate for Payment (PEP)

Preliminary Estimate for Payment (PEP) means the document that contains a description of the *Work* performed during a *Payment Period* (or such other period as may be expressly stipulated in the *Contract*) in the form attached as Form 1.

Professional Engineer

Professional Engineer means a person, firm or corporation legally qualified to practice professional engineering in the Province of Ontario.

Project Manager

Project Manager shall have the meaning prescribed in GC 3.5 – Contractor's Personnel Commitment, paragraph 3.5.2.

Proper Invoice

Proper Invoice shall have the meaning given to it in the *Construction Act*.

Proper Invoice Submission Date

Proper Invoice Submission Date shall have the meaning prescribed in GC 5.2 – APPLICATIONS FOR PAYMENT, paragraph 5.2.7.

Provide

Provide means to *Supply* and *Install*.

Region

Region means The Regional Municipality of York or its authorized agent or representative.

Reports

Reports means the *Reports* set out in Article A-3 of the Agreement – CONTRACT DOCUMENTS AND REFERENCE DOCUMENTS.

Site

Site shall have the same meaning as the *Place of the Work* as defined in the Definitions.

Site Supervisor

Site Supervisor shall have the meaning prescribed in GC 3.5 – Contractor's Personnel Commitment, paragraph 3.5.2.

Submittals

Submittals are documents or items required by the *Contract Documents* to be provided by the *Contractor*, such as:

1. *Shop Drawings*, samples, models, mock-ups to indicate details or characteristics, before the portion of the *Work* that they represent can be incorporated into the *Work*; and
2. *As-Built Drawings* and manuals that provide instructions for the operation and maintenance of the *Work*.

Substantial Performance of the Contract

Substantial Performance of the Contract means when the *Contract* is substantially performed pursuant to the *Construction Act*. The *Contract* may specify additional requirements which must be met in order to obtain *Substantial Performance of the Contract*.

Supply

Supply means completion of the following activities, including the associated labour, services, plant, construction machinery and equipment required to:

.1 Fabricate or purchase *Products*;

.2 Deliver Products to the Place of the Work;

.3 Unload *Products*; and

.4 Store *Products* in accordance with manufacturers' instructions.

Wherever used in the *Contract Documents*, the words "*Supply*" and "*Furnish*" shall be regarded as synonymous.

The Regional Municipality of York Police Service Board (the Board)

The Regional Municipality of York Police Service Board means the *Board* or its authorized agent or representative as designated in writing to the *Contractor* but does not include the *Consultant*.

Total Performance of the Contract

Total Performance of the Contract means when the *Contract* is deemed to be completed pursuant to the *Construction Act*. If such legislation is not in force or does not contain such definition, *Total Performance of the Contract* shall have been reached when the entire *Work*, except those items arising from the provisions of GC 12.3 - WARRANTY, has been performed to the requirements of the *Contract* as certified by the *Owner*. The *Contract* may specify additional requirements which must be met in order to obtain *Total Performance of the Contract*.

Warranty Period

The *Warranty Period* shall have the meaning prescribed in GC 12.4 – Warranty, paragraph 12.3.1.

Working Day

Working Day means any Day when the Contractor is allowed to perform Work as specified in the Contract Documents.

GENERAL CONDITIONS

The General Conditions of the Stipulated Price Contract CCDC 2 – 2020 are hereby amended as follows:

PART 1 GENERAL PROVISIONS

GC 1.1 CONTRACT DOCUMENTS

Paragraph 1.1.1

Delete in its entirety and replace it with the following:

1.1.1 The intent of the *Contract Documents* is to include the construction, labour, *Products*, *Construction Equipment* and other services necessary, complementary or ancillary, for the performance and completion of the *Work* by the *Contractor* in accordance with the *Contract Documents* or reasonably inferable from them.

Paragraph 1.1.4

Delete in its entirety.

Paragraph 1.1.5

Delete in its entirety and replace it with the following:

1.1.5 In the event of conflicts or inconsistencies between *Contract Documents*, the following shall apply:

.1 figured dimensions shown on a Drawing shall govern even though they may differ from dimensions scaled on the same Drawing;

.2 *Drawings* of larger scale shall govern over those of smaller scale of the same date;

.3 *Specifications* shall govern over *Drawings*;

.4 Division 1 of the *Specifications* shall govern over all other *Specifications*;

.5 the *Specifications* shall govern over the *Bid*;

.6 Definitions shall govern over the *Specifications*;

.7 General Conditions shall govern over Definitions;

.8 Supplementary Conditions shall govern over General Conditions;

.9 Permits shall govern over *Supplementary Conditions*;

.10 the Agreement between the *Owner* and the *Contractor* shall govern over all other documents;

.11 executed amendments to specific parts of the *Contract Documents* shall govern over the executed specific parts in *Contract Documents* affected by the amendments;

.12 later dated documents shall govern over earlier dated documents of the same type; and

.13 in case of discrepancies, noted materials and annotations shall take precedence over graphic indications in the *Contract Documents*.

Paragraph 1.1.9

Add the following after the word "Suppliers":

or in establishing the extent of the *Work* to be performed by a trade. The *Specifications* are divided into divisions and sections for convenience but shall be read as a whole and neither such division nor anything else contained in the *Contract Documents* will be construed to place responsibility on the *Consultant* to settle disputes among the *Subcontractors* and *Suppliers* or as between them and the *Contractor* with respect to such divisions.

Paragraph 1.1.10

Delete in its entirety and replace it with the following:

1.1.10 *Specifications*, *Drawings*, models, and copies thereof furnished by the *Consultant* are not the *Contractor*'s property, with the exception of the signed sets of the *Contract Documents*, which shall belong to each party to the *Contract*. All *Specifications*, *Drawings* and models furnished by the *Consultant* are to be used only with respect to the *Work* and are not to be used on other work. These *Specifications*, *Drawings* and models are not to be copied or altered in any manner without the written authorization of the *Consultant*

New Paragraphs

Add the following new paragraphs to GC 1.1:

1.1.12 All documents and data furnished by the *Owner* to the *Contractor* are and shall remain the property of the *Owner*, with the exception of the signed sets of the *Contract Documents* which shall belong to each party to the *Contract*. The *Contractor* may, at its cost, copy, use and communicate any such documents for the sole purposes of performing the Work. Such documents shall not, without the written authorization of the *Owner*, be used, copied or communicated to a third party by the *Contractor* except as necessary for the sole purposes of performing the Work.

1.1.13 All documents developed in connection with the *Work* by the *Contractor* shall become the sole property of the *Owner* with full and absolute title thereto. The *Contractor* shall execute and deliver and shall cause the *Subcontractors* and *Suppliers* to execute and deliver for no additional consideration all such transfers, assignments, deeds and other conveyances as the *Owner* may require to give effect to the foregoing. The *Owner* shall provide or cause to be provided without royalty, fee or other costs to the *Contractor* all licenses necessary to enable the *Contractor* to use such documents in connection with the Work, including the correction of defects and deficiencies during the *Warranty Period*.

1.1.14 The *Contractor* declares and represents that in entering into the *Contract* with the *Owner* for the performance of the *Work*, it has reviewed the *Contract Documents* including, without limitation, the *Reports* provided by the *Owner* and has satisfied itself of the character of the *Work* to be done and all local conditions including, without limitation, the position of all pole lines, conduits, watermains, sewers and other underground and overground utilities and structures identified in or reasonably inferable from the *Contract Documents*, and the *Contractor* has assumed and does hereby assume all risk of conditions now existing or arising in the course of the *Work* which are identified in, or reasonably inferred from, the *Contract Documents*, which might or could make the *Work*, or any items thereof more expensive in character, or more onerous to fulfill, than was contemplated or known when the *Contract* was signed.

1.1.15 Headings of all General Conditions of the Stipulated Price Contract and of all sections of the *Specifications* are inserted for reference convenience only and shall not affect the *Work*, nor the interpretation of the *Contract Documents*.

1.1.16 Syntax

.1 Where the words “accepted“, ”reviewed”, “designated” “directed”, “inspected“, “instructed”, “permitted”, “required”, and “selected” are used in standards or in the *Contract Documents*, they are deemed to be followed by the words “by the *Consultant* and the *Owner*”, unless the context provides otherwise.

.2 Where the words “acceptable”, “submit” and “satisfactory” are used in standards or in the *Contract Documents*, they are deemed to be followed by the words “to the *Consultant* and the *Owner*”, unless the context provides otherwise.

.3 Where the masculine is used in the *Contract Documents*, it shall be read and interpreted as if the feminine or neuter had been used when the context of the statement so requires, and the rest of the sentence, clause,

paragraph or item shall be interpreted as if all changes in grammar, gender or terminology thereby rendered necessary had been made.

.4 The words "include", "includes" or "including" mean "include without limitation", “includes without limitation" and "including without limitation", respectively, and the words following "include", "includes" or "including" shall not be considered to set forth an exhaustive list.

.5 Wherever words “indicated”, “shown”, “noted”, “listed”, “specified” or similar words are used in the *Contract Documents* they are understood, unless otherwise defined, to mean “indicated”, “shown”, “noted”, listed”, or “specified” on the *Contract Documents*, unless the context provides otherwise.

.6 Reference to the word “Section” or “Sections” in the *Contract Documents* shall mean a Section or Sections of the Divisions of the *Specifications*, if applicable.

1.1.17 Unless otherwise expressly provided herein, whenever in the *Contract* any matter is subject to the consent, approval, determination, authorization, consideration or authority of the *Owner* or is to be acceptable or to the satisfaction of the *Owner*, such consent, approval, determination, authorization, consideration, authority or determination of acceptability or satisfaction shall be in the sole discretion of the *Owner* acting reasonably.

1.1.18 No implied terms or obligations of any kind by or on behalf of the *Owner* shall arise from anything in the *Contract* and the express covenants and agreements therein contained and made by the *Owner* are the only covenants and agreements upon which any rights against the *Owner* are to be founded.

1.1.19 Any *Notice in Writing,* including requests, demands, instructions, consents, authorizations, approvals, certificates, determinations or other communications, with the exception of *Proper Invoices* under PART 5 - PAYMENT shall be in writing and shall be given in the manner set forth in Article A-6 of the Agreement – RECEIPT OF AND ADDRESSES FOR NOTICES IN WRITING, and unless a specific time period for the giving of such notice is specified in the *Contract Documents*, such notice shall not be unreasonably delayed.

1.1.20 The *Contract Documents* may contain references to requirements, practices, codes, regulations, manuals, standards, specifications and drawings of associations, societies, councils, boards, foundations and other government bodies, including Ontario Provincial Standards (“***OPS***”) specifications and drawings, which are incorporated into the *Contract* by reference, and have the same force and effect as if printed in full.

1.1.21 Where reference is made to a requirement, practice, code, regulation, manual, standard, specification or drawings of an association, society, council, board, foundation or other government body, including *OPS* specifications and drawings, it is understood that the latest revision shall apply, unless indicated otherwise in the *Contract Documents*.

1.1.22 Where applicable, *OPS* specifications and drawings shall be amended as follows:

"Engineer", "Ministry" and "Authority" shall mean the *Owner*.

1.1.23 Any reference in the *Contract Documents* to a statute shall be deemed to mean the statute which is, or becomes, in force during the performance of the Work, as amended or replaced from time to time, and also mean all regulations enacted under such statute.

1.1.24 It is the parties' mutual intention that the *Contract Documents* comply with section 4 of the Canada-European Union Comprehensive Economic and Trade Agreement and section 3 of the Canadian Free Trade Agreement. Any reference in the *Contract Documents* to a particular *Product*, material or manufacturer shall be deemed to include the words "or *Equivalent*" immediately following such reference (unless the words "or *Equivalent*" already follow the *Product*, material or manufacturer reference). Where the words "No *Equivalent*", "No *Equivalent*s" or "No Other *Equivalent*s" follow the *Product*, material or manufacturer reference, the *Owner* may deny or refuse to consider a proposal for an *Equivalent* for reasons which include suitability with operational requirements and compatibility, interchangeability or interoperability with existing equipment.

1.1.25 At the request of the *Contractor*, the *Owner* may provide printed copies of the *Contract Documents* at the *Contractor*'s expense.

GC 1.2 LAW OF THE CONTRACT

New Paragraph

Add new paragraph 1.2.2 as follows:

1.2.2 The Contractor covenants and agrees to abide by and comply with all *Laws and Regulations* applicable or related to this Agreement.

GC 1.3 RIGHTS AND REMEDIES

Paragraph 1.3.2

Delete the word "No" from the beginning of the first sentence and replace it with the words "Except with respect to the notice requirements set out in GC 6.4 – CONCEALED OR UNKNOWN CONDITIONS, paragraph 6.4.1, GC 6.5 – DELAYS, paragraph 6.5.4, and GC 6.6 – CLAIMS FOR A CHANGE IN CONTRACT PRICE, paragraph 6.6.1, no".

New Paragraph

Add the following new paragraph to GC 1.3:

1.3.3 Notwithstanding paragraph 1.3.1, the *Owner* shall not be liable, whether in contract, tort, or any other theory of law or statute, for any claim arising from any prior negotiation, representation, or agreement, whether written or oral, which is superseded by the *Contract* under Article A-2 of the Agreement - AGREEMENTS AND AMENDMENTS.

GC 1.4 ASSIGNMENT

Paragraph 1.4.1

Delete in its entirety and replace it with the following:

1.4.1 The *Contract*, or any part thereof, including, the *Work* to be performed thereunder or any monies payable thereunder shall not be transferred, assigned (including an assignment by way of security) or otherwise disposed of by the *Contractor* without the written consent of the *Owner*. It is further agreed that the said written consent shall not, under any circumstances, relieve the *Contractor* of its liabilities and obligations under the *Contract*.

New Paragraph

Add the following new paragraphs to GC 1.4:

1.4.2 If the *Owner* terminates the *Contractor's* right to continue with the *Work* or terminates the *Contract* pursuant to GC 7.1 - OWNER'S RIGHT TO PERFORM THE WORK OR STOP THE WORK OR TERMINATE THE CONTRACT*,* the *Owner* shall have the right to require the *Contractor* to provide an assignment or transfer forthwith of any contract between the *Contractor* and a *Subcontractor* or a *Supplier* for the performance of the *Work.*

1.4.3 The *Contractor* shall include in its contacts with *Subcontractors* and *Suppliers* a requirement to assign their contract with the *Contractor* to the *Owner* in instances where the *Owner* terminates the *Contract* in accordance with GC 7.1.7, if required by the *Owner*.

NEW GENERAL CONDITIONS

Add the following new General Conditions to PART 1 – GENERAL PROVISIONS

GC 1.5 CO-OPERATION, CONSULTATION AND CO-ORDINATION

1.5.1 The *Contractor* shall, at all times and as part of the *Work*, fully assist, co-operate, consult and co-ordinate with the *Consultant* and any other consultants or other entities retained or identified by the *Owner* which are related to the *Project* (collectively, the "***Other Entities***"). The objective of such assistance, co-operation,

consultation and co-ordination is to make certain the *Work* is properly coordinated with and integrated with the work and services of the *Other Entities*.

1.5.2 Without limiting the generality of any other provision in the *Contract*, the *Contractor* shall attend all design, construction, general co-ordination and progress meetings relating to the *Work* between the *Consultant*, the *Owner* and *Other Entities* and any other meeting relating to the *Project* as requested by the *Owner* to discuss and resolve all matters and issues relating to the *Project*. The *Contractor* shall, on a timely basis, prepare and distribute detailed minutes to the *Owner* of the construction and progress meetings which it attends, if requested by the *Owner*.

GC 1.6 NON-RESIDENT

1.6.1 If the *Contractor* is non-resident in Ontario or Canada it shall obtain a GST/HST Registration Number prior to commencement of the *Work*.

1.6.2 The *Contractor* shall ensure that all *Subcontractors* whom it proposes to use for carrying out any of the *Work* and who are non-resident in Ontario or Canada have obtained a GST/HST Registration Number before they commence any *Work* under the *Contract*.

GC 1.7 REVIEW BY OWNER AND REVIEW BY CONSULTANT

1.7.1 Neither the *Owner*'s or *Consultant*'s receipt, review or approval of any documents or the *Work* nor the failure of the *Owner* or *Consultant* to provide comment shall limit, waive or diminish the *Contractor's* obligations, responsibilities, duties or liabilities under the *Contract*. The review or approval by the *Owner* or *Consultant* is intended only to ascertain that the document or the performance of the *Contractor's* duties, liabilities, responsibilities or obligations under the *Contract* including, without limitation, the *Work* generally meets the intention of the *Contract* and is not an assurance or confirmation of the adequacy, quality, fitness, suitability or correctness of the *Contractor's* obligations, responsibilities, duties and liabilities under the *Contract* including, without limitation, the *Work*, for which the *Contractor* is solely responsible in accordance with the *Contract*.

GC 1.8 DOCUMENT REVIEW BY THE CONTRACTOR

1.8.1 The *Contractor* shall review the *Contract Documents* and shall report promptly to the *Consultant* any error, inconsistency, or omission the *Contractor* may discover. Such review by the *Contractor* shall be undertaken with the standard of care described in GC 3.9 – PERFORMANCE BY CONTRACTOR, paragraph 3.9.1. Except for its obligation to make such review and report the result, the *Contractor* does not assume any responsibility to the *Owner* or to the *Consultant* for the accuracy of the *Contract Documents*. The *Contractor* shall not be liable for damage or costs

resulting from such errors, inconsistencies, or omissions in the *Contract Documents*, which the *Contractor* could not reasonably have discovered through the exercise of the required standard of care.

1.8.2 If the *Contractor* does discover any error, inconsistency, or omission in the *Contract* Documents, the *Contractor* shall not proceed with the Work affected until the *Contractor* has received corrected or missing information from the *Consultant* or until the error, inconsistency or omission has been otherwise addressed. In dealing with such error, inconsistency or omission the *Contractor* shall co-operate with the *Owner* in good faith to resolve such errors, inconsistency or omission so as to avoid any increase in the *Contract Price* or delay in the progress of the *Work*.

1.8.3 The lack of reference on a Drawing or in a Specification to labour or *Products* that are required or normally recognized within the applicable trade practice as being necessary for the complete execution of the Work shall not constitute an error, inconsistency or omission.

1.8.4 The issuance of requests for information by the *Contractor* shall not entitle the *Contractor* to any increases to the *Contract Price* or *Contract Time*.

1.8.5 If, at any time, the *Contractor* finds errors, inconsistencies, or omissions in the *Contract Documents* or has any doubt as to the meaning or intent of any part thereof, the *Contractor* shall immediately notify the *Consultant*, and request *a Supplemental Instruction*, *Change Order*, or *Change Directive*, as the case may require. Neither the *Owner* nor the *Consultant* will be responsible for the consequences of any action of the *Contractor* based on oral instructions.

PART 2 ADMINISTRATION OF THE CONTRACT

GC 2.2 ROLE OF THE CONSULTANT

Paragraph 2.2.3

Add the following sentence after the last sentence:

The presence of such *Project* representatives at the *Place of the Work* will not abrogate any of the *Contractor's* responsibility to perform the Work as required by the *Contract Documents*.

Paragraph 2.2.4

Delete the words "and will issue certificates for payment as provided in Article A-5 of the Agreement – PAYMENT, GC 5.3 – PAYMENT and GC 5.5 – FINAL PAYMENT" and replace them with ", subject to the Owner's approval and the conditions of the Contract".

Paragraph 2.2.5

Add the words " to the Contractor" after the words "The *Consultant* will not be responsible" in both the first and second sentences.

Add the word "schedules" after the word "techniques" in the first sentence.

Paragraph 2.2.6

Delete the words "Except with respect to GC 5.1 – FINANCING INFOMRATION REQURIED OF THE OWNER, the" and replace them with "The".

Paragraph 2.2.12

Add the following after the last sentence:

If, in the opinion of the *Contractor*, performance of the *Supplemental Instruction* will result in an increase in the *Contract Price* or to the *Contract Time*, the *Contractor* shall, within 5 *Working Days* of receipt of the *Supplemental Instruction*, provide the *Consultant* with *Notice in Writing* of the cause and duration of the delay and of any increase in *Contract Price*. Failure to provide the *Notice in Writing* shall be a deemed acceptance of the *Supplemental Instruction* by the *Contractor* without adjustment in the *Contract Price* or *Contract Time*.

Paragraph 2.2.13

Delete in its entirety and replace with the following:

2.2.13 The *Consultant* will review and take appropriate action upon *Shop Drawings*, samples and other *Contractor's Submittals* which are provided, in accordance with the *Contract Documents*. The *Consultant's* review of the *Shop Drawings*, samples and *Submittals* and on-site observation of the construction work is to determine if the *Contractor's Submittals* and *Work* appear to be in general conformance with the design set forth in the *Contract Documents* prepared by the *Consultant*.

Paragraph 2.2.15

Delete the words "Work and verify that Ready for Takeover has been attained" and replace them with "Contract as provided in GC 5.4 – SUBSTANTIAL PERFORMANCE OF THE CONTRACT AND PAYMENT OF HOLDBACK".

Paragraph 2.2.16

Add the words "to the Contractor" after the words "does not guarantee".

Paragraph 2.2.18

Delete the words "against whom the Contractor makes no reasonable objection and".

New Paragraphs

Add the following new paragraphs to GC 2.2:

2.2.19 The *Consultant* will conduct reviews of the *Work* to determine the date of *Total Performance of the Contract* as provided in GC 5.6 – FINAL PAYMENT.

2.2.20 The *Consultant* shall not be required to decide on questions arising under agreements or *Contracts* between the *Contractor* and the *Contractor's Subcontractors* or *Suppliers*.

2.2.21 The *Consultant's* review under this GC 2.2 shall not be considered to be complete in every detail or exhaustive and shall also not relieve any *Contractor*, *Subcontractor*, *Supplier*, manufacturer, fabricator, or other third party of responsibility for any deficiency that may exist or for any departures or deviations from the requirements of the *Contract Documents* or of the responsibility to co-ordinate the *Work*, or portion of the *Work*, of one trade with another.

2.2.22 The *Consultant's* services will be performed solely for the benefit of the *Owner* and no *Contractor*, *Subcontractor*, manufacturer, *Supplier*, fabricator or other third party shall have any claim against the *Consultant* as a result of the contract between the *Consultant* and the *Owner* or the performance or non-performance of the *Consultant's* services. The *Contractor* shall bring this provision to the attention of the parties with whom it contracts and have them do the same with those with whom they contract.

GC 2.3 REVIEW AND INSPECTION OF THE WORK

Paragraph 2.3.1

Add the words "and Owner" after the words "the *Consultant*" in the second sentence.

Paragraph 2.3.2

Delete the words "Laws or ordinances" and replace them with "*Laws and Regulations*".

Paragraph 2.3.6

Delete in its entirety and replace with the following:

2.3.6 The *Contractor* shall pay the cost of making any test or inspection, including the cost of samples required for such test or inspection, if such test or inspection is required, by the *Contract Documents* or the *Consultant*, to be performed by the *Contractor*, or if such test or inspection is required by the *Laws and Regulations*. The cost of the testing required by the *Consultant* will be payable by the *Contractor* only if the test results show that the specification requirements have not been met because of the *Contractor's* negligence.

Paragraph 2.3.7

Delete the words “designated in” and replace them with “required by”.

New Paragraphs

Add the following new paragraphs to GC 2.3:

2.3.8 The *Contractor* shall immediately inform the *Owner* and the *Consultant* of any notices, warnings or asserted violations issued by the *Authorities Having Jurisdiction* relating to the *Work*.

2.3.9 The *Consultant's* or *Owner's* review shall not be considered to be complete in every detail or exhaustive and shall also not relieve any *Contractor*, *Subcontractor*, *Supplier*, manufacturer, fabricator, or other third party of responsibility for any deficiency that may exist or for any departures or deviations from the requirements of the *Contract Documents* or of the responsibility to co-ordinate the *Work*, or portion of the *Work*, of one trade with another.

2.3.10 Where standards of performance are specified in the Contract Documents and the Work does not comply with the performance specified, such deficiency shall be corrected as directed by the *Consultant*. Any testing of work identified as defective in accordance with GC 2.4 – DEFECTIVE WORK, including retesting required by the *Owner* to verify performance, shall be done at the *Contractor's* expense.

GC 2.4 DEFECTIVE WORK

Delete in its entirety and replace with the following:

GC 2.4 DEFECTIVE WORK

2.4.1 The *Contractor* shall promptly correct defective work that has been rejected by the *Consultant* or *Owner* as failing to conform to the *Contract Documents*, at the *Contractor's* expense, whether or not the defective work has been incorporated in the *Work* and whether or not the defect is the result of poor workmanship, use of defective *Products* or damage through carelessness or other act or omission of the *Contractor*.

2.4.2 The *Contractor* shall promptly correct, at its own expense, defects or deficiencies in the *Work* which appear prior to and during the *Warranty Period* specified in the *Contract Documents*. The *Contractor* shall rectify, at its own expense, in an acceptable manner all other defective work and like deficiencies throughout the *Work* whether or not they are specifically identified by the *Owner* or the *Consultant*.

2.4.3 The *Contractor* shall prioritize the correction of any defective work which, in the sole discretion of the *Owner* acting reasonably, adversely affects the day-to-day operation of the *Owner*.

2.4.4 The *Contractor* agrees to correct and pay for damage resulting from corrections made under the requirements of paragraphs 2.4.1 and 2.4.2.

2.4.5 The *Contractor* shall pay the *Owner* for costs incurred by the *Owner*, the *Owner's* own forces or the *Other Contractors*, for work destroyed or damaged or any alterations necessitated by the *Contractor's* removal, replacement or re-execution of defective work within 10 *Business Days* upon receipt of the Owner's *Notice in Writing*. The *Owner* may appoint the *Contractor* to rectify any such deficiencies at the *Contractor's* expense.

2.4.6 If in the opinion of the *Consultant* or *Owner* it is not expedient to correct defective work or work not performed as provided in the *Contract Documents*, the *Owner* may deduct from the amount otherwise due to the *Contractor* the value of such work as is necessary to correct any non-compliance with the *Contract Documents*, the amount of which will be determined by the *Owner* acting reasonably and in accordance with GC 5.12 - WITHHOLDING OF PAYMENT.

2.4.7 The *Contractor* shall prioritize the correction of any defective work which, in the sole discretion of the *Owner* acting reasonably, adversely affects the day-to-day operations of the *Owner*.

2.4.8 The *Consultant* shall not have any power to waive any obligations of the *Contractor* for the furnishing by the *Contractor* of good materials and of its performing good work as herein described and in full accordance with the *Contract Documents*. No failure or omission of the *Owner* or the *Consultant* to condemn any defective work or material shall release the *Contractor* from the obligation to at once tear out, remove and properly replace the same at any time upon the discovery of said defective work or material, at the *Contractor's* expense. In case the *Contractor* should refuse or neglect to remove any rejected work or material within 48 hours after written notice from the *Owner* or, if the removal would reasonably require more than 48 hours to complete, the *Contractor* has failed to commence the removal work within 48 hours, such work or material may be removed by order of the *Owner* at the *Contractor's* expense and the *Owner* may deduct the cost of same from any monies otherwise due or that may become due to the *Contractor*.

2.4.9 The carrying out of replacement *Work* and *Making Good* of defects shall be executed at times convenient to the *Owner* and may require work outside of normal working hours at the *Contractor's* expense.

2.4.10 The remedies of the *Owner* set forth above shall not deprive the *Owner* of any action, right or remedy otherwise available to it for breach of any provisions of the *Contract Documents*.

PART 3 EXECUTION OF THE WORK

GC 3.1 CONTROL OF THE WORK

New Paragraphs

Add the following new paragraphs to GC 3.1:

3.1.3 Prior to commencing the *Work* and individual procurement, fabrication and construction activities, the *Contractor* shall verify, at the *Place of the Work*, all relevant measurements and levels necessary for the proper fabrication, assembly, installation and completion of the *Work* and shall further carefully compare such field measurements and conditions with the requirements of the *Contract Documents*. Where dimensions are not included, or contradictions exist, or exact locations are not apparent in the *Contract Documents*, the *Contractor* shall immediately notify the *Consultant* in writing and obtain *Supplemental Instructions* from the *Consultant* before proceeding with any part of the affected *work*.

3.1.4 Without limiting the generality of the foregoing, the *Contractor* is responsible for the coordination of the various parts of the *Work* so that no part is left in an unfinished or incomplete condition.

3.1.5 The *Contractor* shall have the sole responsibility for the design, erection, operation, maintenance and removal of temporary structural and other temporary facilities and the design and execution of construction methods required in their use. The *Contractor* shall engage and pay for registered professional engineering personnel skilled in the appropriate disciplines to perform these functions where required by law or by the *Contract Documents* and in all cases where such temporary facilities and their method of construction are of such a nature that professional engineering skill is required to produce safe and satisfactory results.

3.1.6 The *Contractor* is solely responsible for the quality of the *Work* and shall undertake any quality control activities specified in the *Contract Documents*.

GC 3.2 CONSTRUCTION BY THE OWNER OR OTHER CONTRACTORS

Delete in its entirety and replace with the following:

GC 3.2 CONSTRUCTION BY THE OWNER OR OTHER CONTRACTORS

3.2.1 The *Owner* reserves the right, at any time during the *Contractor's* performance of the Work or the *Warranty Period*, to request that the *Contractor* grant, to the *Owner*, its agents or *Other Contractors*, access to the *Place of the Work* for the purpose of constructing or installing collateral work as the *Owner* may deem necessary.

3.2.2 The *Contractor* shall co-ordinate the *Work* with the work of *Other Contractors* and, where applicable, prepare all connections as specified or shown in the *Contract Documents*.

3.2.3 The *Contractor* agrees not to interfere with, or prevent, the performance of such collateral work by the agents or *Other Contractors* of the *Owner*. In the event that the *Contractor* is delayed in the performance of a critical path activity on the *Construction Schedule* by the construction or installation of such collateral works, this shall be considered a delay event pursuant to GC 6.5 – DELAYS, paragraph 6.5.1.

3.2.4 Entry by the *Owner*, its agents or *Other Contractors* to the *Place of the Work* does not constitute acceptance of the *Work* and does not relieve the *Contractor* of its responsibilities under the *Contract*.

3.2.5 The placement, installation and connection of collateral work by the *Owner*, its agents or *Other Contractors* on, and to, the *Contractor's Work* does not relieve the *Contractor* of its responsibilities under the *Contract* including any warranty obligations.

3.2.6 In the event that the *Work* coincides with the work of the *Owner*, the *Region*, *Other Contractors*, utility companies or *Municipalities*, the *Contractor* shall cooperate with the *Owner*, the *Region*, *Other Contractors*, utility companies and *Municipalities* in order to facilitate free access to their work at all times. The *Owner* reserves the right to alter the method of operations on this *Contract* to avoid interference with other work. The *Contractor* shall also provide separations in time or space (a minimum of 50 metres from the proposed work areas of the *Owner*, the *Region*, *Other Contractors*, utility companies or *Municipalities*) in order to avoid placing the *Owner* or the *Region* in the position of "constructor" within the meaning prescribed in the Occupational Health and Safety Act, RSO 1990, c O.1.

3.2.7 Where separations in time and/or space cannot be provided from the proposed work areas of the *Owner*, the *Region*, *Other Contractors*, utility companies and/or the *Municipalities*, the *Contractor* agrees to be the "Constructor" for and in respect of all work being performed at the *Site*.

3.2.8 The *Contractor* shall have right to remove representatives of *Other Contractors*, the *Consultant* and the *Owner* from the *Site* for failure to adhere to reasonable safety instructions.

GC 3.3 TEMPORARY WORK

Paragraph 3.3.3

Delete in its entirety.

GC 3.4 CONSTRUCTION SCHEDULE

Delete in its entirety and replace with the following:

GC 3.4 CONSTRUCTION SCHEDULE

3.4.1 The *Contractor* shall:

.1 prior to commencement of construction, prepare and submit to the *Owner* and the *Consultant* for their review and acceptance a construction schedule indicating the critical path for the *Project*, using "Microsoft Project" or *Equivalent*, demonstrating that the *Work* will be performed in conformity with the *Contract Time*, and shall conform to the phasing and sequencing requirements for the *Work* as set out in the *Contract Documents* or as otherwise required by the *Consultant* or the *Owner* including, without limitation, a *Products* delivery schedule with respect to the *Products* whose delivery is critical to the schedule of the *Work*. The *Contractor* shall provide the schedule information required by this paragraph 3.4.1.1 in both electronic format and hard copy. Once approved by the *Owner* and the *Consultant*, the construction schedule submitted by the *Contractor* under this paragraph 3.4.1.1, as updated by the *Contractor* and approved by the *Owner*, shall become the "***Construction Schedule***";

.2 monitor the progress of the *Work* on a weekly basis relative to the *Construction Schedule* and update and submit to the *Owner* and the *Consultant* the *Construction Schedule* on a monthly basis;

.3 perform the *Work* in accordance with the *Construction Schedule*;

.4 advise the *Consultant* of any revisions required to the *Construction Schedule* as a result of an extension of the *Contract Time* in accordance with PART 6 – CHANGES IN THE WORK; and

.5 identify potential variances between scheduling and scheduled completion dates and implement necessary adjustments in the *Construction Schedule* in order to meet the Substantial Performance of the Contract date.

3.4.2 On request of the *Consultant* the *Contractor* shall provide information regarding the progress of the *Work* or any part of it, or copies, schedules and orders covering materials, components and services. The *Contractor* shall cooperate fully with the *Consultant* and shall ensure that all *Subcontractors* and *Suppliers* and anyone for whom the *Subcontractors* and *Suppliers* may be responsible also cooperate and make available on request the same documents.

3.4.3 Without limiting the other obligations of the *Contractor* under GC 3.4 – CONSTRUCTION SCHEDULE, the *Contractor* shall not amend the *Construction Schedule* (including, without limitation, any changes to the critical path) without the prior written approval of the *Owner*. Without limiting the foregoing, any delivery of an updated Construction Schedule by the *Contractor* to the *Owner* from time to time shall not be deemed to amend the *Contract Time*. The *Contract Time* shall only be amended in strict accordance with the terms of the *Contract* .

3.4.4 If, at any time, the *Owner* or the *Consultant* advise the *Contractor* that it appears that the actual progress of the *Work* is behind the *Construction Schedule* or is likely to become behind the Construction Schedule, or if the *Contractor* has given notice of such to the *Owner* or the *Consultant*, the *Contractor* shall take appropriate steps to cause the actual progress of the *Work* to conform to the *Construction Schedule* or minimize the resulting delay and shall produce and present to the *Owner* and the *Consultant* a recovery plan demonstrating how the *Contractor* will achieve the recovery of the Construction Schedule. If the *Contractor* intends to apply for a change in the *Contract Price* or claim compensation for delay in relation to the *Construction Schedule* recovery plan, then the *Contractor* shall proceed in accordance with GC 6.5 – DELAYS.

GC 3.5 SUPERVISION

Delete in its entirety and replace with the following:

GC 3.5 CONTRACTOR'S PERSONNEL COMMITMENT

Delete in its entirety and replace with the following:

GC 3.5 CONTRACTOR'S PERSONNEL COMMITMENT

3.5.1 The *Contractor* shall furnish competent and adequate staff, who shall be in attendance at the *Place of the Work* at all times, as necessary, for the proper administration, co-ordination, supervision and superintendence of the *Work*; organize the procurement of all materials and equipment so that they will be available at the time they are needed for the *Work*; and keep an adequate force of skilled workers on the job to complete the *Work* in accordance with all requirements of the *Contract Documents*.

3.5.2 Prior to commencement of the Work, the *Contractor* shall select a competent and experienced full time project manager (the "***Project Manager***") who shall be engaged in the Work at all times, and a competent and experienced full time site supervisor (the "***Site Supervisor***") who shall be in attendance at the *Place of the Work* at all times. The *Project Manager* shall have full responsibility for the prosecution of the *Work*, with full authority to act in all matters as may be necessary for the proper co-ordination, supervision, direction and technical administration of the *Work*, who shall attend site meetings in order to render reports on the progress of the *Work* and who shall have authority to bind the *Contractor* in all matters related to this *Contract*. The *Project Manager* and the *Site Supervisor* shall be satisfactory to the *Owner* and shall not be changed except for good reason and with the prior written approval of the *Owner*.

3.5.3 The *Project Manager* and *Site Supervisor* shall represent the *Contractor* at the *Place of the Work.*

3.5.4 The *Contractor* may not change its *Project Manager* or its *Site Supervisor* without the *Owner's* prior written approval which shall not be unreasonably withheld. Further, the *Contractor* shall not employ or continue to employ on the *Work* anyone to whom the *Owner* may reasonably object.

3.5.5 The *Contractor* shall provide the *Owner* and the *Consultant* with the names, addresses and telephone numbers of the *Project Manager*, the *Site Supervisor* and other responsible field persons who may be contacted for emergency and other reasons during non-working hours.

GC 3.6 SUBCONTRACTORS AND SUPPLIERS

Paragraph 3.6.4

Delete in its entirety

New Paragraphs

Add the following new paragraphs to GC 3.6:

3.6.7 The *Contractor* acknowledges and agrees that it shall not retain the services of any *Subcontractors* not identified in the Schedule of *Subcontractors* in its *Bid* without the prior written authorization of the *Owner* or *Consultant* which consent shall not be unreasonably withheld. In no event will the *Contract Time* be extended, or the *Contract Price* be increased in the event of such a change.

3.6.8 In the event that the *Contractor* requires a change of, replacement to or addition of a named *Subcontractor* or *Supplier*, the *Contractor* shall advise the *Owner* in writing, giving reasons therefore, and shall obtain the prior written approval of the *Owner* to such change, replacement or addition. In no event will

the *Contract Price* be increased, or the *Contract Time* extended as a result of such change, replacement or addition.

3.6.9 Nothing contained in the *Contract Documents* shall create any contractual relationship between the *Owner*, a *Subcontractor*, a *Supplier* or their respective agents, employees or any other persons performing any part of the *Work*.

3.6.10 The *Contractor* shall, in the case of its *Subcontractors*, be responsible for ensuring that they obtain all necessary permits, fees, licences, certifications and all insurance in connection with the *Work* as may be required by *Laws and Regulations* and that they comply with all *Laws and Regulations* and the *Contract Documents*.

GC 3.7 LABOUR AND PRODUCTS

Paragraph 3.7.1

Delete in its entirety and replace with the following:

3.7.1 The *Contractor* shall maintain good order and discipline among its employees, agents, *Subcontractors* and *Suppliers* engaged on the *Work* and shall not employ on the *Work* anyone not skilled in the task assigned. The *Contractor* shall submit site rules for the review and approval of the *Owner*. Any such site rules prepared by the *Contractor* shall be consistent with the *Contractor's* duties and obligations under all applicable *Laws and Regulations* and shall also include provisions making consumption of alcohol or non-prescription drugs at the *Place of the Work* the subject of disciplinary proceedings or termination of employment at the *Work*. Whenever the *Owner* or the *Consultant* shall inform the *Contractor* in writing that any person performing the *Work*, in its opinion:

.1 is incompetent or disorderly;

.2 interferes with the ability of the *Contractor*, *Subcontractors* or *Suppliers* to perform the *Work*;

.3 carries on an unlawful activity;

.4 acts in a manner inconsistent with the timely completion of the *Work*;

.5 injures or attempts to injure any person or causes any damage to any property;

.6 is not using all reasonable efforts to work safely;

.7 has failed to comply with a direction from the *Owner*, the *Consultant* or the *Owner's* health and safety auditor, including a direction to stop Work; or

.8 acts in a manner that is abusive or offensive to representatives of the *Owner*, the *Consultant* or any member of the public

such person or persons shall be discharged from the *Work* and shall not again be employed on this *Contract* without the *Owner's* prior written consent.

Paragraph 3.7.3

Delete in its entirety and replace with the following:

3.7.3 Unless otherwise specified in the *Contract Documents*, *Products Provided* shall be new, free from defects, and as specified or *Equivalent*. The *Contractor* shall not *provide* substitutions for specified *Products* without the express written consent of the *Consultant* and the *Owner*. *Products* which are not specified should be of a quality best suited to the purpose required and their use shall be subject to the approval of the *Consultant* or *Owner*.

New Paragraphs

Add the following new paragraphs to GC 3.7:

3.7.4 Without limiting any other obligation of the *Contractor* under the *Contract Documents* or any rights of the *Owner*, including the rights set out in GC 5.3 - PAYMENT, the *Contractor* shall, within 10 Days of becoming aware of or receiving notice from the *Owner* or the *Consultant*, secure the discharge, release, vacating or withdrawal of any lien that has been registered or otherwise preserved or any written notice of lien that has been advanced, provided that the lien or notice of lien has been registered, preserved or given by a *Subcontractor*, *Supplier*, labourer, mechanic or any other lien claimant or person claiming under or through the *Contractor* or in respect of the *Work*.

3.7.5 If a lien action is commenced against the *Owner* or the *Region* and such action arises out of or relates to a lien that was registered or otherwise preserved by a *Subcontractor*, *Supplier*, labourer, mechanic or any other lien claimant or person claiming under or through the *Contractor* or in respect of the *Work*, the *Contractor* shall indemnify and hold the *Owner* and the *Region* harmless in such action and take all reasonable steps to remove the *Owner* and/or the *Region* from such action. Without limiting the foregoing, the *Owner* may, at its option, require the *Contractor* to defend the *Owner* and/or the *Region* in the action or the *Owner* may assume carriage and control of the action. Any costs the *Owner* and the *Region* incurs or suffers as a result of such action, including legal costs, may be deducted by the *Owner* from any monies otherwise due or that may become due to the *Contractor*.

3.7.6 If the *Owner* or the *Region* receives a written notice of a lien or claim for lien in respect of the *Work*, the *Contractor* shall pay to the *Owner* the amount of the lien plus an additional 25% of the lien amount, to be retained as a holdback until the *Owner* is satisfied that all accounts have been paid in full and any liens have been vacated, withdrawn or discharged, as applicable.

3.7.7 If the *Contractor* fails to secure the discharge, release, vacating or withdrawal of a lien or notice of lien in accordance with the requirements of paragraph 3.7.4, the *Owner* may at its option take such steps as it, in its absolute discretion, may deem necessary to release, vacate or discharge the lien or notice of lien and may, without limiting its other rights and remedies hereunder, deduct from the monies held pursuant to paragraph 3.7.6 (or from any other monies due or that may become due to the *Contractor*), the amount of such lien, together with all costs and expenses incurred by the *Owner* and the *Region* in connection therewith (including the amounts incurred by the *Owner* in taking any of the steps described above).

3.7.8 Unless otherwise specified, all materials existing at the *Place of the Work* at the time of execution of the *Contract* shall remain the property of the *Owner*. All *Work*, *Products* and materials delivered by the *Contractor* delivered to the *Place of the Work* shall be the property of the *Owner*. The *Contractor* shall remove all supplies or rejected materials as its property when notified in writing to do so by the *Consultant*. All materials, *Work* and *Products* delivered by the Contractor shall remain at the risk of the *Contractor* who shall be held responsible for the safe keeping of same.

3.7.9 The *Contractor* is responsible for the safe on-site storage of *Products* and their protection (including *Products* supplied by the *Owner* and *Other Contractors* to be installed under the *Contract*) in such ways as to avoid dangerous conditions or contamination to the *Products* or other persons or property and in locations at the *Place of the Work* to the satisfaction of the *Owner* and the *Consultant*. The *Owner* shall provide all relevant information on the *Products* to be supplied by the *Owner*.

3.7.10 The *Contractor* represents and warrants that the *Products* it *Supplied* in accordance with the *Contract* are not subject to any conditional sales contract and are not subject to any security rights obtained by any third party which may subject any of the *Products* to seizure or removal from the *Place of the Work*.

GC 3.8 SHOP DRAWINGS

Delete in its entirety and replace with the following:

GC 3.8 SHOP DRAWINGS AND OTHER SUBMITTALS

3.8.1 The *Contractor* shall provide *Shop Drawings* and *Submittals* as required in the *Contract* Documents or as the *Consultant* may reasonably request.

3.8.2 The *Contractor* shall provide *Shop Drawings* and *Submittals* to the *Consultant* in orderly sequence and sufficiently in advance so as to cause no delay in the *Work* or in the work of *Other Contractors* or the *Owner*.

3.8.3 Prior to the first application for payment, the *Contractor* and the *Consultant* shall jointly prepare a schedule of the dates for submission and return of *Shop Drawings* and *Submittals*.

3.8.4 The *Contractor* shall provide *Shop Drawings* and *Submittals* in the forms specified, or if not specified, as directed by the *Consultant*.

3.8.5 *Shop Drawings* and *Submittals* provided by the *Contractor* to the *Consultant* shall indicate by stamp, date and signature of the person responsible for the review that the *Contractor* has reviewed each one of them.

3.8.6 The *Consultant*'s review is for conformity to the design concept and for general arrangement only.

3.8.7 *Shop Drawings* and *Submittals* which require approval of any *Authority Having Jurisdiction* shall be provided to such *Authority* by the *Contractor* for approval.

3.8.8 The *Contractor* shall review all *Shop Drawings* and *Submittals* before providing them to the *Consultant*. The *Contractor* represents by this review that:

.1 the *Contractor* has determined and verified all applicable field measurements, field construction conditions, *Product* requirements, catalogue numbers and similar data, or will do so, and

.2 the *Contractor* has checked and coordinated each *Shop Drawing* and *Submittal* with the requirements of the *Work* and of the *Contract Documents*.

3.8.9 At the time of providing *Shop Drawings* and *Submittals*, the *Contractor* shall expressly advise the *Consultant* in writing of any deviations in a *Shop Drawing* and *Submittals* from the requirements of the *Contract Documents.* The *Consultant* shall indicate the acceptance or rejection of such deviation expressly in writing.

3.8.10 The *Consultant*'s review shall not relieve the *Contractor* of responsibility for errors or omissions in the *Shop Drawings* or *Submittals* or for meeting all requirements of the *Contract Documents*.

3.8.11 The *Contractor* shall provide revised *Shop Drawings* and *Submittals* to correct those which the *Consultant* rejects as inconsistent with the *Contract Documents*, unless otherwise directed by the *Consultant*. The *Contractor* shall notify the

Consultant in writing of any revisions to the *Shop Drawings* and *Submittals* other than those requested by the *Consultant*.

3.8.12 The *Consultant* will review and return *Shop Drawings* and *Submittals* in accordance with the schedule agreed upon in paragraph 3.8.3, or, in the absence of such schedule, within 10 *Business Days* or such longer period as may be reasonably required by the *Consultant*. If, for any reason, the *Consultant* cannot process them within the time periods specified therein, the *Consultant* shall notify the *Contractor* and they shall meet to review and arrive at an acceptable revised schedule for processing. The *Contractor* shall update the *Shop Drawings* and *Submittals* schedule to correspond to changes in the *Construction Schedule*. Changes in the *Contract Price* or *Contract Time* may be made only as otherwise provided in the *Contract*.

NEW GENERAL CONDITIONS

Add the following new General Conditions to PART 3 – EXECUTION OF THE WORK

GC 3.9 PERFORMANCE BY CONTRACTOR

3.9.1 In performing its services and obligations under the *Contract*, the *Contractor* shall exercise the standard of care, skill, and diligence that would normally be provided by an experienced and prudent contractor supplying similar services for similar projects. The *Contractor* acknowledges and agrees that throughout the *Contract*, the performance of the *Contractor's* obligations, duties, and responsibilities shall be judged against this standard. The *Contractor* shall exercise the same standard of care, skill, and diligence in respect of any *Products*, personnel, or procedures which it may recommend to the *Owner*.

3.9.2 The *Contractor* further represents, covenants and warrants to the *Owner* that:

.1 the personnel it assigns to the *Project* are appropriately experienced;

.2 it has a sufficient staff of qualified and competent personnel to replace any of its appointed representatives, subject to the *Owner's* approval, in the event of death, incapacity, removal or resignation; and

.3 there are no pending, threatened or anticipated claims that would have a material effect on the financial ability of the *Contractor* to perform the Work under the *Contract*.

GC 3.10 INTERFERENCE

3.10.1 If the Work, in whole or in part, involves the renovation of, or addition to, existing and occupied premises:

.1 the *Contractor* shall maintain normal business operations and traffic flow, with a minimum of inconvenience to the tenants and occupants of the *Place of the Work*;

.2 subject to the provisions of the *Contract Documents*, the *Contractor* shall ensure that no essential services such as electric power, water supply or other public utilities are interrupted; and

.3 in every case where an interruption to existing services or utilities is to occur during execution of the *Work*, the *Contractor* shall give the *Owner* 5 *Business Days'* prior *Notice in Writing*. The *Contractor* shall reschedule any such interruption, at no additional cost to the *Owner*, if requested to do so in writing by the *Owner*.

GC 3.11 OPERATIONAL RISKS

3.11.1 The position of all pole lines, conduits, water mains, sewers and other underground and overground utilities and structures is not necessarily shown on the *Drawings*, and, where shown, the accuracy of the position of such utilities and structures is not guaranteed. Before starting Work, the *Contractor* shall inform itself of the exact locations of such utilities and structures, and shall be liable for damages to any utilities identified or which reasonably should have been identified, as a result of any negligent act or omission of the *Contractor* or those for whom the *Contractor* is responsible. Unless otherwise specified, the *Contractor* shall temporarily support or relocate such utilities and structures, or temporarily remove them, and restore them, to the satisfaction of the owners of the utilities and structures. The *Contractor* waives any claim and releases the *Owner*, the *Region*, and their respective directors, officers, council members, board members, partners, agents and employees from all liability for damages suffered as a result of such *Drawings* or any operation required under this paragraph.

3.11.2 The *Consultant* will provide the *Contractor* in writing with bench marks and points of reference to be used by the *Contractor* in setting out the *Work*. From these bench marks and points of reference the *Contractor* will do its own setting out. The setting out by the *Contractor* shall include but shall not be limited to the preparation of grade sheets, the installation of centre lines stakes, grade stakes, offsets and site rails.

GC 3.12 DOCUMENTS AT THE SITE AND PROJECT RECORDS

3.12.1 The Contractor shall keep one copy of current Contract Documents, Supplemental Instructions, *Contemplated Change Orders*, *Change Orders*, *Change Directives*, *Cash Allowance Disbursement Authorizations*, reviewed Shop Drawings,

Submittals, reports, and records of meetings at the Place of the Work, in good order and available to the Owner and the *Consultant*.

3.12.2 The *Contractor* shall maintain and keep accurate *Project* records (which means all tangible records, daily reports, daily logs, documents, computer printouts, electronic information, books, plans, *Drawings*, *Specifications*, accounts or other information relating to the *Work*) in its office in Ontario in accordance with requirements of law, but in any event for not less than 6 years from the date of *Substantial Performance of the Contract* or until all claims have been settled, whichever time period is longer. The records shall include detailed records of all actions taken by the *Contractor* related to security and health and safety legislation in the *Place of the Work*. During this time, the *Contractor* shall allow the *Owner* access to the *Project* records during normal business hours upon the giving of reasonable notice. The *Contractor* shall ensure that equivalent provisions to those provided herein are made in each subcontract and shall require the *Subcontractors* and *Suppliers* to incorporate them into every level of contract thereunder for any part of the *Work*.

GC 3.13 CONTRACTOR'S USE OF PERMANENT EQUIPMENT OR SYSTEMS

3.13.1 With the prior written approval of the *Owner*, the *Contractor* may make use of elements of the mechanical and electrical systems or equipment comprising a permanent part of the *Work* for the purpose of providing heat or power to the *Site* during the final stages of construction. In such event, before making its written application for *Substantial Performance of the Contract*, and again, immediately prior to final takeover by the *Owner* of such systems and equipment, the *Contractor* shall clean and *Make Good*, to the satisfaction of the *Consultant*, such systems and equipment as it had been permitted to use. The *Contractor* shall pay any and all costs associated with such use, cleaning and *Making Good*.

GC 3.14 USE OF THE WORK

3.14.1 The *Contractor* shall confine *Construction Equipment*, *Temporary Work*, storage of *Products*, waste products and debris, and operations of employees and *Subcontractors* to limits indicated by laws, ordinances, permits, or the *Contract Documents* and shall not unreasonably encumber the *Place of the Work*.

3.14.2 The *Contractor* shall not load or permit to be loaded any part of the *Work* with a weight or force that will endanger the safety of the *Work*.

GC 3.15 CUTTING AND REMEDIAL WORK

3.15.1 The *Contractor* shall perform the cutting and remedial work required to make the affected parts of the *Work* come together properly.

3.15.2 The *Contractor* shall co-ordinate the *Work* to ensure that the cutting and remedial work is kept to a minimum.

3.15.3 Should the *Owner*, the *Consultant*, *Other Contractors* or anyone employed by them be responsible for ill-timed work necessitating cutting or remedial work to be performed, the cost of such cutting or remedial work shall be valued as provided in GC 6.1 –CHANGES IN THE WORK, GC 6.2 - CHANGE ORDER and GC 6.3 - CHANGE DIRECTIVE.

3.15.4 Cutting and remedial work shall be performed by specialists familiar with the *Products* affected and shall be performed in a manner to neither damage nor endanger the *Work*.

GC 3.16 CLEANUP

3.16.1 The *Contractor* shall maintain the *Work* in a safe and tidy condition and free from the accumulation of waste products and debris, other than that caused by the *Owner*, *Other Contractor*s or their employees.

3.16.2 Before applying for *Substantial Performance of the Contract* as provided in GC 5.4 – SUBSTANTIAL PERFORMANCE OF THE CONTRACT AND PAYMENT OF HOLDBACK, the *Contractor* shall remove waste products and debris, other than that resulting from the work of the *Owner*, Other Contractors or their employees, and shall leave the *Place of the Work* clean and suitable for use or occupancy by the *Owner*. The *Contractor* shall remove *Products*, tools, *Construction Equipment*, and *Temporary Work* not required for the performance of the remaining work.

3.16.3 Prior to application for the final payment, the *Contractor* shall remove any remaining *Products*, tools, *Construction Equipment*, *Temporary Work*, and waste products and debris, other than those resulting from the work of the *Owner*, *Other Contractors* or their employees.

3.16.4 The *Owner* shall have the right to back charge cleaning to the *Contractor* if it is not done within 2 *Business Days* of *Notice in Writing* to clean and the *Owner* shall have the right to back charge cost of damage to the *Place of the Work* caused by *Contractor's*, *Subcontractor's* or *Supplier's* transportation in and out of the *Place of the Work* if not repaired within 5 *Working Days* of *Notice in Writing* to repair or before final payment, whichever is earlier.

GC 3.17 RIGHT OF ENTRY

3.16.1 The *Owner* shall have the right to enter or occupy the *Place of the Work* in whole or in part for the purpose of placing materials, fittings and equipment or for other uses at any time before *Substantial Performance of the Contract*, if, in the reasonable opinion of the *Consultant*, such entry or occupation does not prevent

or substantially interfere with the *Contractor's* completion of the *Contract* or achieving *Substantial Performance of the Contract* within the timeframe specified in Article A-1 of the Agreement – THE WORK, paragraph 1.3.1. Such entry or occupation or use of equipment or systems shall not be considered as acceptance of the *Work* in whole or in part, or in any way relieve the *Contractor* from its responsibility as constructor under the *Occupational Health and Safety Act*, RSO 1990, c O.1 or to complete the *Contract*.

PART 4 ALLOWANCES

Delete the heading in its entirety and replace it with the following:

PART 4 ALLOWANCES AND PROVISIONAL ITEMS

GC 4.1 CASH ALLOWANCES

Paragraph 4.1.3

Delete in its entirety and replace with the following:

4.1.3 Expenditures under cash allowances must be authorized by the *Owner* in writing.

Paragraph 4.1.4

Delete the word "*Consultant's*" and replace it with "Owner's" in the first sentence.

Delete the words "as set out in the Contract Documents" from the end of the last sentence.

Paragraph 4.1.5

Add the following sentence at the beginning of the paragraph:

The *Contractor* shall have no claim on any unused portion of any cash allowance item.

Paragraph 4.1.6

Add the following to the end of the paragraph:

The *Contractor* shall submit, with its *Proper Invoice*, documentation showing the date of purchase, the vendor from which the purchase was made, the date of delivery of the *Product* or service, and the price, including delivery to the *Site* and all applicable taxes. Cash allowance payments will only be made with the written authorization of the *Owner*, and shall not include any mark-ups whatsoever, unless the *Contractor* is entitled to mark-up on excess cash allowance under paragraph 4.1.4.

Paragraph 4.1.7

Delete in its entirety and replace with the following:

4.1.7 The *Contractor* shall consult with the *Owner* or the *Consultant* in the selection of the *Products*, services and vendors required to carry out the work under the cash allowance, and shall obtain the *Owner's* approval for the selection of *Products*, services and/or vendor(s) in relation to the cash allowance.

New Paragraphs

Add the following new paragraphs to GC 4.1:

4.1.8 The *Contractor* shall obtain competitive bids from a minimum of three vendors for portions of the *Work* to be paid for out of cash allowances unless otherwise directed by the *Owner*. The *Contractor* shall submit the bids received to the *Owner* for approval.

4.1.9 At the commencement of the *Work*, the *Contractor* shall prepare for the review and acceptance of the *Owner* and the *Consultant*, a schedule indicating the times, within the *Construction Schedule* referred to in GC 3.4 – CONSTRUCTION SCHEDULE, that items called for under cash allowances and items that are specified to be *Owner* purchased and *Contractor* installed or hooked up are required at the *Site* to avoid delaying the progress of the *Work*.

GC 4.2 CONTINGENCY ALLOWANCE

Delete in its entirety and replace with the following:

GC 4.2 PROVISIONAL ITEMS

4.2.1 The purpose of provisional items in the *Bid* is to cover the cost of *Work* that is anticipated but may not be required. The *Contractor* shall not be entitled to use these prices unless the *Contractor* has received prior written approval from the *Owner*. Each provisional price item may be used at the sole discretion of the *Owner*.

4.2.2 If the *Owner* requests that a provisional item be completed by the *Contractor*, the *Contractor* shall consult with the *Consultant* about the selection of *Product*s, services, and *Subcontractors* required to carry out the *Work* under the provisional items, and shall obtain the *Consultant*'s approval for the selection of *Product*s, services and *Subcontractor(s)* in relation to the selected provisional items.

4.2.3 The *Contractor* shall submit, as part of its *Proper Invoice* submitted in accordance with GC 5.2 – APPLICATIONS FOR PAYMENT, an invoice for the provisional *Work* showing the date of purchase/service, the *Work* included in the service, and the price, including all applicable taxes.

4.2.4 Provisional item payments will only be made in accordance with the previous written authorization of the *Owner*, and shall not include any mark-ups. The

Contractor shall have no claim on any unused portion of any provisional items, including but not limited to any claims for loss of anticipated profits.

4.2.5 Provisional item payments will be made according to the service or *Work* invoiced and approved by the *Owner*.

4.2.6 The *Contractor* shall have no claim on any unused portion of any provisional item. The net amount of any unexpended provisional item shall be deducted from the *Contract Price* by *Change Order* without any adjustment for the *Contractor*'s overhead and profit on such amount.

PART 5 PAYMENT

Delete in its entirety and replace with the following:

PART 5 PAYMENT

GC 5.1 FINANCING INFORMATION REQUIRED

5.1.1 The *Contractor* shall provide the *Owner* with *Notice in Writing* of any material change in the *Contractor's* financial ability to fulfil its obligations under the *Contract* within 5 *Business Days* of such change.

GC 5.2 APPLICATIONS FOR PAYMENT

5.2.1 Applications for payment on account as provided in Article A-5 of the Agreement - PAYMENT may be made as the *Work* progresses by the submission of a *Proper Invoice*.

5.2.2 The amount claimed shall be for the value, proportionate to the amount of the *Contract*, of *Work* performed and *Products* delivered to the *Place of the Work* as of the last Day of the *Payment Period*.

5.2.3 The *Contractor* shall submit to the *Owner* and the *Consultant*, within 15 Days of receipt of the *Owner's* notice to commence the *Work* and prior to the first *Pre-Invoice Submission Meeting*, a schedule of values for the parts of the *Work*, aggregating the total amount of the *Contract Price*, so as to facilitate evaluation of applications for payment. The schedule of values shall be made out in such form and supported by such evidence as the *Consultant* may reasonably direct and when accepted by the *Consultant*, shall be used as the basis for applications for payment, unless it is found to be in error. The *Contractor* shall include a statement based on the schedule of values with each application for payment.

5.2.4 Applications for payment for *Products* delivered to the *Place of the Work* but not yet incorporated into the *Work* shall be supported by such evidence as the *Consultant* may reasonably require to establish the value and delivery of the *Products*. Any *Products* delivered to the *Place of the Work* but not yet

incorporated into the Work shall remain at the risk of the *Contractor* notwithstanding that title has passed to the *Owner* pursuant to GC 3.7 – LABOUR AND PRODUCTS, paragraph 3.7.8.

5.2.5 5 Days prior to the end of the *Payment Period*, or at such other time agreed to by the *Owner* and the *Contractor* in writing, the *Contractor*, *Owner* and *Consultant* shall attend a meeting to discuss and review the percentage of *Work* completed during the *Payment Period* for each item indicated in the schedule of values (the "***Pre-Invoice Submission Meeting***"). In the event that the scheduled date for the *Pre-Invoice Submission Meeting* is not a *Business Day*, the *Pre-Invoice Submission Meeting* shall occur on the next *Business Day*, or on another Day as may be agreed to by the *Contractor* and the *Owner* in writing.

5.2.6 The *Contractor* shall bring with it to the *Pre-Invoice Submission Meeting* the following:

.1 its *Preliminary Estimate for Payment* for the current *Payment Period*;

.2 any documents the *Contractor* is required to bring to the *Pre-Invoice Submission Meeting* as stipulated in the *Specifications*; and

.3 any other documents reasonably required by the *Consultant*.

5.2.7 The *Contractor* shall give a *Proper Invoice* to the *Owner* and *Consultant*, in accordance with paragraph 5.2.8, for work performed during a *Payment Period* on the 14th Day following the conclusion of the *Payment Period* to which the *Proper Invoice* relates (the "***Proper Invoice Submission Date***"), subject to the following:

.1 if the 14th Day following the conclusion of the *Payment Period* to which a *Proper Invoice* relates falls on a Day that is not a *Business Day*, the *Proper Invoice Submission Date* shall be deemed to fall on the next *Business Day*; and

.2 if the 14th Day following the conclusion of the *Payment Period* to which a *Proper Invoice* relates falls on a Day during the month of December, the *Proper Invoice Submission Date* shall be deemed to fall on the next *Business Day* in January of the following year.

5.2.8 *Proper Invoices* shall be given in accordance with the following:

.1 *Proper Invoices* shall be uploaded to https:constructioninvoices.york.ca (the "***PI Portal***");

.2 *Proper Invoices* shall be uploaded during the hours of 8:30 a.m. to 4:30 p.m. (ET) on the *Proper Invoice Submission Date*;

.3 If a *Proper Invoice* is uploaded after 4:30 p.m. on the applicable *Proper Invoice Submission Date*, the *Proper Invoice* will not be considered or reviewed by the *Owner* and *Consultant* until the next *Proper Invoice Submission Date*, at which point the *Proper Invoice* will be deemed to have been given to the *Owner* and the *Consultant*. Notwithstanding the immediately preceding sentence and paragraph 5.2.7, if a *Proper Invoice* is uploaded after 4:30 p.m. (ET) on the *Proper Invoice Submission Date*, the *Owner* reserves the right, in its sole discretion, to consider the *Proper Invoice* as being given in accordance with the *Construction Act* on the date and at such time as it was uploaded. The *Owner's* exercise of the right conferred to it in this paragraph shall not be construed as a waiver of any of its rights or waive or release the *Contractor's* obligations to strictly comply with the requirements prescribed in paragraphs 5.2.7 to 5.2.12 inclusive.

.4 If the *Proper Invoice* is uploaded before the *Proper Invoice Submission Date*, the *Proper Invoice* will not be considered or reviewed by the *Owner* and *Consultant* until the applicable *Proper Invoice Submission Date*, at which point the *Proper Invoice* will be deemed to have been given to the *Owner* and *Consultant*.

5.2.9 The parties hereby consent to the giving and receiving of *Proper Invoices* in accordance with the requirements of paragraph 5.2.8 and without limiting the generality of the foregoing, consent to the giving and receiving of *Proper Invoices* through the *PI Portal* and the giving and receiving of notices of non-payment by email.

5.2.10 The requirements of paragraph 5.2.8 are of the essence. In order for a *Proper Invoice* to be considered received by the *Owner* in accordance with the *Construction Act*, it must be given in accordance with the requirements of paragraph 5.2.8.

5.2.11 *Proper Invoices* shall be submitted substantially in the form attached as Form 2.

5.2.12 *Proper Invoices* must contain, in addition to the information prescribed by section 6.1 of the *Construction Act*, the following:

.1 *Proper Invoice* application number

.2 *Contract* number and brief description of the *Contract*

.3 purchase order number

.4 references to item number(s) and item description(s) when describing the services and materials supplied

.5 a breakdown of approved *Change Orders* or *Change Directives* and percentage completed of each

.6 a valid WSIB Certificate of Clearance

.7 a critical path schedule if requested by the *Owner*

.8 contemplation, and reflection in the amount payable, of all of the following to the extent they are applicable:

(1) statutory holdback

(2) statutory lien holdbacks

(3) maintenance security

(4) applicable taxes

.9 for all *Proper Invoices* except the first one, either:

(1) a declaration, in the form contained in the form of *Proper Invoice* attached as Form 2, that all accounts for labour, subcontracts, *Products*, construction machinery and equipment and other indebtedness which may have been incurred by the *Contractor* in performing the Work, and for which the *Owner* may in any way be held responsible, have been paid in full except for statutory holdback monies properly retained; or

(2) a declaration by the *Contractor* as to the distribution made of the amounts received using document CCDC 9A – Statutory Declaration of Progress Payment Distribution by Contractor

5.2.13 An invoice the *Contractor* submits which it purports to be a *Proper Invoice*, but which does not meet the requirements of paragraphs 5.2.11 and 5.2.12 shall not constitute a *Proper Invoice* and the *Owner* shall be under no obligation to consider or review such invoice. Invoices submitted by the *Contractor* will be considered to be a *Proper Invoice*, properly received by the *Owner* in accordance with the requirements of the *Contract* and the *Construction Act*, unless the *Owner* or the *Consultant* advises the *Contractor* otherwise.

5.2.14 The requirements of paragraphs 5.2.7 to 5.2.13 are of the essence.

5.2.15 The services or materials, including quantity(ies), supplied that are described in a *Proper Invoice* are not required to be made by strict measurement or with exactness, but may be approximate only.

5.2.16 The *Contractor* shall prepare current *As-Built Drawings* during the course of the Work, which shall be maintained by the *Contractor* and made available to the *Consultant* for review with each application for payment. If current *As-Built Drawings* are not available for the *Consultant's* review, the *Consultant* may retain

an amount reasonably determined by the *Consultant* to be the value of the *As-Built Drawings* not available for review from the progress draw.

5.2.17 Payment by the *Owner* pursuant to the *Contract* shall not preclude the *Owner* from thereafter disputing any of the items involved and shall not be construed as acceptance of any part of the *Work*.

GC 5.3 PAYMENT

5.3.1 The *Owner* and the *Consultant* shall review the *Contractor's* application for payment, including the *Proper Invoice*, and advise the *Contractor* of any disputed amounts in accordance with the *Construction Act*.

5.3.2 The *Owner* may retain amounts as determined by the *Consultant* to ensure correction of deficient work done or unacceptable *Products provided*.

5.3.3. Provided the *Owner* and the *Region* have not received a claim for lien or written notice of a lien under the *Construction Act*, the *Owner* shall pay all undisputed amounts to the *Contractor* in accordance with the provisions of Article A-5 of the Agreement – PAYMENT and the *Construction Act*.

5.3.4 The *Owner* reserves the right, in its sole, absolute and unfettered discretion, to permit the *Contractor* to correct an error in an invoice that the *Contractor* purported to be a *Proper Invoice* and gave to the *Owner*. The *Owner* shall be under no obligation to exercise the right conferred to it under this paragraph 5.3.4.

5.3.5 Without limiting any other remedy available to the *Owner*, the *Owner* may withhold all, or any part, of any payment, or revise any previous payment certificate(s) made because of subsequently discovered evidence or the results of subsequent inspections or tests, but only to the extent that is necessary to protect the *Owner* from loss because:

.1 the *Work* does not conform to the requirements of the *Contract Documents* or completed *Work* has been damaged requiring correction or replacement; or

.2 the *Contract Price* has been reduced by *Change Order*; or

.3 the *Owner* has been required to correct non-conforming *Work* or complete *Work* in accordance with GC 2.4 – DEFECTIVE WORK, or

.4 the *Owner* has actual knowledge of the occurrence of any of the events enumerated in GC 7.1 – OWNER'S RIGHT TO PERFORM THE WORK OR STOP THE WORK OR TERMINATE THE CONTRACT, justifying suspension or termination; or

.5 claims have been made against the *Owner* or the *Region* on account of the *Contractor's* performance or furnishing of the Work; or

.6 written notice of a lien or a claim for lien under the *Construction Act* has been received by the *Owner* or the *Region* or a lien has been registered or filed, in either case, in connection with the *Work*, except where the *Contractor* has delivered a bond, acceptable to the *Owner*, to secure the satisfaction and discharge, vacation or withdrawal of such lien; or

.7 there are other items entitling the *Owner* to a set-off against the amount for which application is made in accordance with the provisions of the *Contract Documents*; or

.8 the *Contractor* has not delivered all of the documentation required with its application for payment.

GC 5.4 SUBSTANTIAL PERFORMANCE OF THE CONTRACT AND PAYMENT OF HOLDBACK

5.4.1 When the *Contractor* considers that the *Contract* to be substantially performed, and the *Contractor* has supplied all documentation required to be provided prior to the granting of Substantial Performance as specified in the *Contract Documents*, the *Contractor* shall submit an application for *Substantial Performance of the Contract* to the *Owner* and the *Consultant*. The application shall include the following:

.1 A comprehensive list of all items of work remaining to be completed or corrected. Failure to include an item on the list will not release the *Contractor* from its responsibility to complete all items of work in accordance with the terms of the *Contract*;

.2 A *Preliminary Estimate for Payment* covering all work performed up to the date of *Substantial Performance of the Contract* since the last *Proper Invoice* submission;

.3 All outstanding guarantees required pursuant to the *Specifications*;

.4 All outstanding manufacturers' guarantees covering rated output, efficiency and performance for all operating equipment forming part of the *Work*;

.5 All outstanding test results;

.6 Complete operating and maintenance instructions for equipment and apparatus furnished under the *Contract*, including maintenance manuals, training manuals, operating instructions, equipment calibration sheets, maintenance and operating tools, and replacement/spare parts and materials, if not already provided;

.7 All required *As-Built Drawings* and related data, if not already provided;

.8 All permits, licenses, approvals, certificates and authorizations required by any *Authorities Having Jurisdiction* over the *Work* or the *Place of the Work*;

.9 Any other documents specified in the Specifications; and

.10 Any other documents reasonably required by the *Consultant*.

5.4.2 Before submitting its application for *Substantial Performance of the Contract*, the *Contractor* shall remove waste products and debris, other than that resulting from the work of the *Owner*, *Other Contractors* or their employees, and shall leave the *Place of the Work* clean and suitable for use or occupancy by the *Owner*. The *Contractor* shall remove *Products*, tools, *Construction Equipment*, and *Temporary Work* not required for the performance of the remaining work.

5.4.3 After submitting its application for *Substantial Performance of the Contract*, the *Contractor* shall meet with the *Owner* and the *Consultant* to review and reconcile the value of work performed, deficient work and outstanding work.

5.4.4 Provided the *Contractor* meets the requirements for *Substantial Performance of the Contract*, the *Owner* shall issue a certificate of *Substantial Performance of the Contract* in the prescribed form (the "***Certificate of Substantial Performance***") to the *Contractor*, specifying the date upon which *Substantial Performance of the Contract* was attained.

5.4.5 The *Contractor* shall arrange, at its own expense, for the publication of the *Certificate of Substantial Performance* in the Daily Commercial News.

5.4.6 The publication of the *Certificate of Substantial Performance*, as arranged for by the *Contractor*, shall constitute a waiver by the *Contractor* of all claims whatsoever against the *Owner* and the *Region* under this *Contract* up to the date of *Substantial Performance of the Contract* whether for a change in the *Contract Price*, extension of *Contract Time*, or both, except those made in writing prior to the *Contractor's* application for *Substantial Performance of the Contract* and still unsettled.

5.4.7 No later than 15 Days after the issuance of the *Certificate of Substantial Performance*, the *Contractor* shall submit the following to the *Owner* and the *Consultant* in accordance with GC 5.2 – APPLICATIONS FOR PAYMENT, paragraph 5.2.8:

.1 a *Proper Invoice* that covers the unpaid work completed up to the date of *Substantial Performance of the Contract* and which complies with the requirements for a *Proper Invoice* as specified in GC 5.2 – APPLICATIONS FOR PAYMENT, paragraphs 5.2.11 and 5.2.12;

.2 proof of publication of the *Certificate of Substantial Performance*;

.3 a release, in the form attached as Form 4, releasing the *Owner* and the *Region* from all further claims relating to the *Contract* except for claims for work performed after the date of *Substantial Performance of the Contract* and claims pursuant to PART 8 – DISPUTE RESOLUTION made prior to *Substantial Performance of the Contract* and still unsettled; and

.4 a declaration by the *Contractor* as to the status of ongoing adjudications with respect to the *Contract* using the form of declaration attached as Form 3.

5.4.8 The requirements of paragraph 5.4.7 are of the essence.

5.4.9 Provided the *Owner* and the *Region* have not received a claim for lien or written notice of a lien under the *Construction Act*, the *Owner* shall pay all undisputed amounts to the *Contractor* in accordance with the provisions of Article A-5 of the Agreement – PAYMENT and the *Construction Act*.

5.4.10 The *Owner* and the *Consultant* shall review the documents submitted by the *Contractor* pursuant to paragraph 5.4.7 and advise the *Contractor* of any amounts of the basic holdback that the *Owner* refuses to pay and shall, in accordance with the *Construction Act*, arrange for the publication of a notice of non-payment of holdback in the prescribed form in the Daily Commercial News.

5.4.11 Provided the *Owner* and the *Region* have not received a claim for lien or written notice of a lien under the *Construction Act*, and provided the time period for preserving any claims for liens for materials or services supplied prior to *Substantial Performance of the Contract* have expired, the *Owner* will pay the undisputed amount of the basic holdback to the *Contractor* in accordance with the provisions of Article A-5 of the Agreement – PAYMENT and the *Construction Act*.

5.4.12 Release of the statutory holdback funds shall not relieve the *Contractor*, or its surety, from any obligations under this *Contract*.

GC 5.5 PROGRESSIVE RELEASE OF HOLDBACK

5.5.1 When the *Contractor* considers a subcontract (the "***Subcontract***") to be complete, and all required inspection and testing of the Work covered by the *Subcontract* have been finished, the Contractor may submit an application for certification of completion of the *Subcontract* to the *Owner* and the *Consultant*.

5.5.2 The application for certification of completion of the *Subcontract* shall include the following information and documentation with supporting particulars, at a minimum:

.1 the final *Subcontract* price;

.2 a Declaration of Last Supply under subsection 31(5) of the *Construction Act* from the *Subcontractor*;

.3 valid WSIB Certificates of Clearance from the *Contractor* and the *Subcontractor*;

.4 a statutory declaration from the *Subcontractor*, in a form attached as Form 6, that all accounts for labour, subcontracts, *Products,* construction machinery and equipment and other indebtedness which may have been incurred by the *Subcontractor* in performing the work under the *Subcontract*, and for which the Owner or the *Region* might in any way be held responsible, have been paid in full except for statutory holdback monies properly retained;

.5 a release from the *Contractor* and the *Subcontractor,* in the form attached as Form 7, releasing the Owner and the *Region* from all further claims relating to the *Subcontract*.

.6 a declaration by the *Contractor* as to the status of ongoing adjudications with respect to the *Contract* using the form of declaration attached as Form 3.

5.5.3 Upon receipt of the application for certification of completion of the *Subcontract*, the *Owner* and the *Consultant* may, at their sole discretion, review the application to determine whether the *Subcontract* is complete.

5.5.4 Provided the *Subcontract* is complete, the *Owner* may, at its sole discretion, issue a Certificate of Completion of *Subcontract*, in the prescribed form, to the Contractor specifying the completion date of the *Subcontract*.

5.5.5 No later than 15 Days following the issuance of the Certificate of Completion of *Subcontract*, the Contractor shall submit a Proper Invoice for the release of holdback with respect to the completed *Subcontract* (the "***Proper Invoice for Subcontract Holdback***") to the Owner and *Consultant* in accordance with GC 5.2 – APPLICATIONS FOR PAYMENT, paragraph 5.2.8. The *Proper Invoice for Subcontract Holdback* shall comply with the requirements of GC 5.2 – APPLICATIONS FOR PAYMENT, paragraphs 5.2.11 and 5.2.12.

5.5.6 The requirements of paragraph 5.5.5 are of the essence.

5.5.7 The *Owner* and the *Consultant* shall review the *Proper Invoice for Subcontract Holdback* and advise the Contractor of any disputed amounts.

5.5.8 Provided the *Owner* and the *Region* have not received a claim for lien or written notice of a lien under the *Construction Act*, the Owner shall pay all undisputed

amounts under the *Proper Invoice for Subcontract Holdback* to the Contractor in accordance with the provisions of Article A-5 of the Agreement - PAYMENT.

5.5.9 Immediately upon receipt of the statutory holdback funds the *Contractor* shall give to the *Subcontractor* the payment due under the *Subcontract*.

5.5.10 Release of the statutory holdback funds shall not relieve the *Contractor,* or its surety, from any obligations under this *Contract*.

GC 5.6 FINAL PAYMENT

5.6.1 When the *Contractor* considers the *Contract* to be complete, the *Contractor* shall submit an application for *Total Performance of the Contract* to the *Owner* and the *Consultant*. The application shall include:

.1 a comprehensive list of all items of work remaining to be completed or corrected. Failure to include an item on the list shall not release the *Contractor* from its responsibility to complete all items of *Work* in accordance with the terms of the *Contract*;

.2 a *Preliminary Estimate for Payment* covering all *Work* performed up to the date of *Total Performance of the Contract* since the last *Proper Invoice* submission;

.3 all outstanding guarantees required pursuant to the *Specifications*;

.4 all outstanding manufacturers' guarantees covering rated output, efficiency and performance for all operating equipment forming part of the *Work*;

.5 complete operating and maintenance instructions for equipment and apparatus furnished under the *Contract* if not already provided;

.6 all *Contractor's As-Built Drawings*, records and related data;

.7 all permits, licenses, approvals, certificates and authorizations required by any *Authorities Having Jurisdiction* over the *Work* or the *Place of the Work*;

.8 any other documents specified in the *Specifications*; and

.9 any other documents reasonably required by the *Consultant*.

5.6.2 After submitting its application for *Total Performance of the Contract*, the *Contractor* shall meet with the *Owner* and the *Consultant* in order to review and reconcile the value of work performed, deficient work and outstanding work.

5.6.3 Provided the *Contract* meets the requirements for *Total Performance of the Contract*, the *Owner* shall issue a certificate of *Total Performance of the Contract* (the "***Certificate of Total Performance***") to the *Contractor*, specifying the date upon which *Total Performance of the Contract* was attained. Following the

issuance of the *Certificate of Total Performance*, the *Contractor* shall promptly execute the *Certificate of Total Performance*.

5.6.4 The *Contractor's* execution of the *Certificate of Total Performance* shall constitute a waiver by the *Contractor* of all claims whatsoever against the *Owner* and the *Region* under this *Contract* up to the date of *Total Performance of the Contract*, whether for a change in the *Contract Price*, an extension of the *Contract Time,* or both, except those made in writing prior to the *Contractor's* application for *Total Performance of the Contract* and still unsettled.

5.6.5 No later than 15 Days following the issuance of the *Certificate of Total Performance*, the *Contractor* shall submit the following to the *Consultant* and the *Owner* in accordance with GC 5.2 – APPLICATIONS FOR PAYMENT, paragraph 5.2.8:

.1 a *Proper Invoice* that covers the unpaid work completed up to the date of *Total Performance of the Contract* and which complies with the requirements for a *Proper Invoice* as specified in GC 5.2 – APPLICATIONS FOR PAYMENT, paragraphs 5.2.11 and 5.2.12;

.2 a signed copy of the *Certificate of Total Performance*;

.3 a release from the *Contractor*, in the form attached as Form 5, releasing the *Owner* and the *Region* from all further claims relating to the *Contract* except for claims for work performed after the date of *Total Performance of the Contract* and claims pursuant to PART 8 – DISPUTE RESOLUTION made prior to *Total Performance of the Contract* which remain unresolved; and

.4 a declaration by the *Contractor* as to the status of ongoing adjudications with respect to the *Contract* using the form of declaration attached as Form 3.

5.6.6 The requirements of paragraph 5.6.5 are of the essence.

5.6.7. The *Owner* and the *Consultant* shall review the *Proper Invoice* and advise the *Contractor* of any disputed amounts in accordance with the *Construction Act*.

5.6.8 Provided the *Owner* and the *Region* have not received a claim for lien or written notice of a lien under the *Construction Act*, the *Owner* shall pay all undisputed amounts to the *Contractor* in accordance with the provisions of Article A-5 of the Agreement - PAYMENT and the *Construction Act*.

5.6.9 The *Owner* and the *Consultant* shall review the documents submitted by the *Contractor* pursuant to paragraph 5.6.5 and advise the *Contractor* of any amounts of the holdback for finishing work that the *Owner* refuses to pay and shall, in accordance with the *Construction Act*, arrange for the publication of a notice of non-payment of holdback in the prescribed form in the Daily Commercial News.

5.6.10 Provided the *Owner* and the *Region* have not received a claim for lien or written notice of a lien under the *Construction Act* and provided the time period for preserving any claims for liens for materials or services supplied prior to *Total Performance of the Contract* have expired, the *Owner* shall pay the undisputed amount of the holdback for finishing work to the *Contractor* in accordance with the provisions of Article A-5 of the Agreement - PAYMENT and the *Construction Act*.

5.6.11 Release of the statutory holdback funds shall not relieve the *Contractor*, or its surety, from any obligations under this *Contract*.

5.6.12 Upon receipt of final payment under the *Contract*, the *Contractor* shall be deemed to have expressly waived and released the *Owner* and the *Region* from all claims including, without limitation, those that might have arisen from the negligence or breach of contract by the *Owner*, except those made pursuant to PART 8 – DISPUTE RESOLUTION prior to the *Contractor's* submission of the final *Proper Invoice* which remain unresolved.

5.6.13 In the event of a conflict between the provisions of PART 5 - PAYMENT and GC 1.3 - RIGHTS AND REMEDIES, the provisions of PART 5 - PAYMENT shall govern.

GC 5.7 DEFERRED WORK

5.7.1 Subject to the *Construction Act*, if because of climatic or other conditions reasonably beyond the control of the *Contractor*, or if the *Owner* and the *Contractor* agree that, there are items of *Work* that must be deferred, payment in full for that portion of the *Work* which has been performed as certified by the *Consultant* shall not be withheld or delayed by the *Owner* on account thereof, but the *Owner* may withhold, until the remaining portion of the *Work* is finished, only such an amount that the *Consultant* determines is sufficient and reasonable to cover the cost of performing such deferred *Work*.

GC 5.8 NON-CONFORMING WORK

5.8.1 No payment by the *Owner* under the *Contract*, or partial or entire use or occupancy of the *Work* by the *Owner*, nor the fact that the *Owner* did not give a notice of non-payment pursuant to the *Construction Act* in respect of a *Proper Invoice*, shall constitute an acceptance of any portion of the *Work* or *Products* which are not in accordance with the requirements of the *Contract Documents*.

GC 5.9 LIQUIDATED DAMAGES

5.9.1 Without prejudice to any other remedy available to the *Owner*, if the *Contractor*:

.1 fails to complete the *Work* within the *Contract Time*, the *Contractor* shall pay to the *Owner* the amount per Day specified in Article A-12 of the Agreement - LIQUIDATED DAMAGES until the *Work* is complete; or

.2 fails to meet any of the *Interim Milestone(s)* stipulated in the *Contract Documents*, the *Contractor* shall pay to the *Owner* the amount(s) per Day specified in Article A-12 of the Agreement – LIQUIDATED DAMAGES until the *Interim Milestone(s)* has been met.

5.9.2 The amounts payable to the *Owner* pursuant to paragraph 5.9.1 shall be payable on demand. The *Owner's* failure to demand the amounts payable under paragraph 5.9.1 shall in no way waive the *Owner's* right to such payment and the *Owner* shall have the right to refuse to pay all or any portion of amounts payable under *Proper Invoices* on account of amounts that are payable to the *Owner* under paragraph 5.9.1.

5.9.3 The *Contractor* acknowledges and agrees that the liquidated damages amounts specified in Article A-12 of the Agreement - LIQUIDATED DAMAGES are a genuine estimate of the actual costs/damages that will be incurred by the *Owner* as a result of the failure of the *Contractor* to complete the *Work*, including any *Interim Milestone(s)*, within the allotted time and is not a penalty.

GC 5.10 SET-OFF

5.10.1 Subject to the *Construction Act*, and without limiting the specific rights of set-off in favour of the *Owner* provided for in this *Contract*, the *Owner* shall have the right to set-off against any and all monies due, or which may become due, to the *Contractor* under this *Contract*, any reasonable and substantiated amounts due or to become due from the *Contractor* to the *Owner* under the *Contract* and in the event of an insolvency of the *Contractor*, in relation to any other contracts between the *Contractor* and the *Owner*. Without limiting the generality of the foregoing, any rights conferred to the *Owner* under this *Contract* or at law to set-off against or deduct from monies otherwise owing to the *Contractor* shall also constitute grounds for the *Owner* to refuse to pay all or any portion of amounts payable under *Proper Invoices*.

GC 5.11 MAINTENANCE SECURITY

5.11.1 The *Owner* may deduct from the maintenance security any amounts owing to the *Owner* under this *Contract*, or in the event the *Contractor* becomes insolvent, any other contract between the *Owner* and the *Contractor*, whether the amounts relate to outstanding or deficient *Work*, or any other claims which the *Owner* may have including, but not limited to, outstanding claims under GC 13 –

INDEMNIFICATION, CLAIMS HANDLING AND WAIVER OF CLAIMS and GC 3.7 – LABOUR AND PRODUCTS.

5.11.2 The balance of the maintenance security, if any, shall be eligible for release to the *Contractor* upon the expiration of the Warranty Period and only after all deficiencies and all other warranty issues have been resolved to the satisfaction of the *Owner* (whether they have occurred during the Warranty Period or thereafter).

GC 5.12 WITHHOLDING OF PAYMENT

5.12.1 In the event that any portion of the *Work* is defective or is not performed in accordance with the *Contract Documents*, the *Owner* may retain an amount equal to twice the estimated cost which the *Owner* or the *Consultant* estimates will be incurred to correct the *Work* until the *Work* has been corrected to the satisfaction of the *Owner*. In the event that the *Contractor* fails to correct/complete the *Work* to the satisfaction of the *Owner* within 15 *Working Days* of receipt of written notice of the defective work, the *Owner* may proceed to correct/complete the *Work* and shall deduct its costs from the holdback provided for in this provision without further notice to the *Contractor*.

5.12.2 In the event that any insurance policy required to be maintained by the *Contractor* under the *Contract* has lapsed, or the *Owner* or the *Region* has received notice from the insurer of cancellation of coverage thereunder, the *Owner* may withhold payment until a current certificate of insurance has been provided in a form satisfactory to the *Owner* and the *Region*.

PART 6 CHANGES IN THE WORK

GC 6.1 OWNER'S RIGHT TO MAKE CHANGES

Delete in its entirety and replace it with the following:

GC 6.1 CHANGES IN THE WORK

6.1.1 The *Owner*, without invalidating the *Contract*, may make *Changes in the Work* by providing the *Contractor* with a *Change Order* or *Change Directive* ("***Changes in the Work***"). The *Contractor* shall provide an updated *Construction Schedule* in the event that the *Change Order* or *Change Directive* affects the progress of the *Work*.

6.1.2 The *Contractor* shall not proceed with any *Changes in the Work* until it has received a *Change Order* or *Change Directive*. No claims for any compensation on account of any actual or alleged Change in the *Work* or for any changes in the *Contract Price* or *Contract Time* shall be valid unless provided for by the *Owner* in a *Change Order* or a *Change Directive*.

6.1.3 The *Contractor* shall not be entitled to receive any additional compensation of any kind whatsoever arising out of or in respect of *Changes in the Work* other than the amounts to which it is entitled under GC 6.2 – CHANGE ORDER, or as provided in GC 6.3 – CHANGE DIRECTIVE. Without limiting the foregoing, in no event shall the *Contractor* be entitled to claims for loss of profit, loss of productivity, loss of opportunity or any other such losses based on the quantity, scope or cumulative value or impact of *Changes in the Work* whether resulting from one or more *Change Orders* or *Change Directives*.

6.1.4 If any *Change in the Work* is made which results in a reduction in the amount of Work to be done, including reductions in any or all of the quantities specified in *Contract Documents* or the deletion of any items in the *Bid*, or if all or any component of the *Work* is deleted from the scope of *Work*, the *Contractor's* compensation shall be limited to the direct costs that it can demonstrate to the *Owner's* satisfaction (by way of backup documentation) had already been incurred by the *Contractor*, acting reasonably, in connection with the reduced or deleted *Work*. Save and except for these direct costs, the *Contractor* shall not be entitled to any compensation of any kind whatsoever on account of any reduced or deleted *Work* including any amounts on account of loss of anticipated profits, loss of opportunity or any such losses. Any credits to be applied to the *Contract Price* shall be reflected in the *Change Order.*

6.1.5 The *Contractor* shall include the value of *Work* performed under a *Change Order* or *Change Directive* during a *Payment Period* in the *Proper Invoice* that the *Contractor* submits pursuant to GC 5.2 – APPLICATIONS FOR PAYMENT, inclusive, in respect of that *Payment Period*.

6.1.6 Any mark-ups payable under the *Contract* for *Changes in the Work* carried out by way of *Change Order* or *Change Directive* shall be in accordance with the following:

.1 on work performed by the *Contractor*, the *Contractor* may charge a maximum mark-up of 5% as a combined percentage fee applied to the total actual cost of the items listed in GC 6.3 – CHANGE DIRECTIVE, paragraph 6.3.5 performed by the *Contractor*; and

.2 on work performed by *Subcontractors*, the *Subcontractors* may charge a maximum mark-up of 5% as a combined percentage fee and the *Contractor* may charge a maximum mark-up of 5% as a combined percentage fee applied to the total actual cost of the items listed in GC 6.3 – CHANGE DIRECTIVE, paragraph 6.3.5 performed by all *Subcontractors* (but, for clarity, the *Contractor's* mark-up shall not be charged on the

Subcontractors' mark-up or on any *Contractor* mark-up charged pursuant to paragraph 6.1.6.1):

No further mark-ups will be paid regardless of the number of times the work has been assigned or sublet and no mark-up will be paid to any associate or affiliate as defined by the *Securities Act*, RSO 1990, c S.5, or in respect of any compensation for rented equipment.

Any mark-ups payable under this paragraph 6.1.6 shall be deemed to include the cost of, and be considered full compensation for all of the following: profit, general expenses, indirect costs and overhead costs incurred by the *Contractor* in relation to the change including but not limited to head office and head office personnel costs, estimating, supervision, coordination, administration, general clean-up, small tools, *As-Built Drawings*, job safety, warranty, and additional insurance and bonding costs.

6.1.7 The *Contractor* shall promptly submit, at the request of the *Owner*, any information and documentation the *Owner* considers necessary to assess any amounts being claimed on account of a *Change Order* or *Change Directive*.

6.1.8 If the *Owner* and the *Contractor* do not agree on the proposed adjustment to the *Contract Time* attributable to a change in the *Work*, or the method of determining it, the adjustment shall be deemed a "dispute" under PART 8 – Dispute Resolution.

6.1.9 The *Contractor* acknowledges that the total *Contract Time* includes a built in float of approximately 10% of the *Contract Time* to account for schedule delays resulting from *Changes in the Work* which would normally be expected to arise on projects of a similar scope, size and complexity and as contemplated by GC 6.1 – CHANGES IN THE WORK. As a result, subject to paragraphs 6.1.10 and 6.1.11, no extensions of the *Contract Time* or compensation for schedule delays, shall be granted by the *Owner* to the *Contractor* for any *Changes in the Work* reflected in *Change Orders* or *Change Directives* issued under GC 6.2 – CHANGE ORDER or GC 6.3 - CHANGE DIRECTIVE respectively, until the cumulative value of all *Change Orders* and *Change Directives* under the *Contract* exceeds 10% of the original *Contract Price*. If and only once the total cumulative value of all *Change Orders* and *Change Directives* exceeds 10% of the original *Contract Price* (excluding those related to "substantial changes" as defined in paragraph 6.1.10), shall the *Contractor* be entitled to any extensions of *Contract Time* or compensation for schedule delays, in relation to any subsequent change in the *Work*, as reflected as part of any *Change Orders* or *Change Directives* issued thereafter, and provided that such change in the *Work* adversely affects the critical path schedule.

6.1.10 Paragraph 6.1.9 shall not apply when an extension of the *Contract Time* is made necessary due to a "*Substantial Change*" in the *Work*. A *Substantial Change* means a *Change in the Work* under GC 6.1 – CHANGES IN THE WORK which results in either:

.1 actual direct additional costs to the *Contractor* equal to, or greater than, $500,000; or

.2 a delay to the critical path of the *Construction Schedule* for the *Project* of greater than 10 *Working Days*;

or both.

6.1.11 Should a *Substantial Change* arise, the *Contractor* shall be entitled to an extension of *Contract Time* in accordance with the *Contract*, and the value of any *Change Order* or *Change Directive* issued in relation to the *Substantial Change* shall be excluded from the 10% calculation referred to in paragraph 6.1.9.

GC 6.2 CHANGE ORDER

Delete in its entirety and replace it with the following:

GC 6.2 CHANGE ORDER

6.2.1 When a change in the *Work* is proposed or requested, the *Consultant* will prepare a *Contemplated Change Order* (*CCO)* describing the proposed change(s) and submit the *CCO* to the *Contractor* for consideration.

6.2.2 The *Contractor* shall submit, within 5 *Business Days* of receipt of the *CCO* or such other time agreed to between the *Contractor* and the *Owner*, a detailed and itemized quotation which includes its proposed method and amount of adjustment to the *Contract Price* (in accordance with paragraph 6.2.3), if any, and the proposed adjustment to the *Contract Time*, if any, for the work included in the *CCO*, together with any supporting documentation which may be required by the *Owner*. If the change in the *Work* will require an adjustment in the *Contract Time* or otherwise affect the critical path of the current *Construction Schedule*, the *Contractor* shall also include with its quotation an updated *Construction Schedule* for the *Owner's* review.

6.2.3 The adjustment to the *Contract Price* for a *Change in the Work* carried out pursuant to a *Change Order* shall be determined in accordance with the following:

.1 If the *Change in the Work* is the type of work for which unit prices were provided in the Schedule of Prices in the *Bid* or schedule of values, then the adjustment to the *Contract Price* shall be based on those unit prices, plus the applicable mark-ups in GC 6.1 – CHANGES IN THE WORK, paragraph 6.1.6.

.2 If the *Change in the Work* is the type of work for which unit prices were not provided in the Schedule of Prices in the *Bid* or schedule of values, then the adjustment in the *Contract Price* shall be based on the actual costs of the change in the *Work*, determined in accordance with GC 6.3 – CHANGE DIRECTIVE, paragraph 6.3.5, plus the applicable mark-ups in GC 6.1 – CHANGES IN THE WORK, paragraph 6.1.6.

The *Owner*, in consultation with the *Consultant*, will assess the merits of the proposed adjustments to the *Contract Price* or the *Contract Time* or both. If the *Owner* and the *Contractor* agree to the adjustments in the *Contract Price* or the *Contract Time*, or the method to be used to determine the adjustments, such agreement shall be effective immediately and shall be recorded in a *Change Order* which shall be issued by the *Owner* and signed by both parties.

GC 6.3 CHANGE DIRECTIVE

Delete in its entirety and replace it with the following:

GC 6.3 CHANGE DIRECTIVE

6.3.1 If the *Owner* requires the *Contractor* to proceed with a *Change in the Work* prior to the *Owner* and the *Contractor* agreeing upon the adjustments to the *Contract Price* or the *Contract Time* or both, the *Owner* or the *Consultant* shall issue a *Change Directive*. Upon receipt of the *Change Directive*, the *Contractor* shall promptly proceed to execute the *Work* described in the *Change Directive*.

6.3.2 The adjustment in the *Contract Price* for a change carried out by way of a *Change Directive* shall be determined on the basis of the actual costs of expenditures and savings, in accordance with paragraph 6.3.5 to perform the *Change in the Work*, plus mark-up as specified in GC 6.1 – CHANGES IN THE WORK, paragraph 6.1.6.

6.3.3 The *Contractor* shall, within five (5) *Business Days* of the issuance of the *Change Directive* or such other time agreed to by the *Contractor* and the *Owner*, present to the *Owner*, for approval, a detailed itemized estimate of the actual costs of the items listed in paragraph 6.3.5 of the *Contractor* and the involved *Subcontractors*, plus the applicable mark-ups pursuant to GC 6.1 – CHANGES IN THE WORK, paragraph 6.1.6. The mark-ups pursuant to GC 6.1 – CHANGES IN THE WORK, paragraph 6.1.6, including mark-ups related to each of the involved *Subcontractors*, shall all be shown separately. If the *Change in the Work* will require an adjustment in the *Contract Time* or otherwise affect the critical path of the current *Construction Schedule*, the *Contractor* shall also include with its detailed itemized estimate of costs an updated *Construction Schedule* for the *Owner's* review.

6.3.4 The *Contractor* shall keep and present, in such form as the *Owner* may require, an itemized accounting of the actual cost of expenditures and savings, together with supporting data, and any other pertinent documents related to the cost of performing a change in the *Work* attributable to a *Change Directive*. The cost of performing the work attributable to the *Change Directive* shall be limited to the actual cost of the items contained in paragraph 6.3.5.

6.3.5 The cost of performing a *Change in the Work* attributable to the *Change Directive*, and the costs of performing a *Change in the Work* under a *Change Order* pursuant to GC 6.2 – CHANGE ORDER, paragraph 6.2.3.2 shall be limited to the actual cost of the following:

.1 salaries, wages and benefits paid to personnel in the direct employ of the *Contractor* under a salary or wage schedule agreed upon by the *Owner* and the *Contractor*, or in the absence of such a schedule, actual salaries, wages and benefits paid under applicable bargaining agreement, and in the absence of a salary or wage schedule and bargaining agreement, actual salaries, wages and benefits paid by the *Contractor*, for personnel:

(1) carrying out the work, including necessary supervisory services;

(2) engaged in the preparation of *Shop Drawings*, fabrication *Drawings*, coordination *Drawings* and *As-Built Drawings*; or

(3) engaged in the processing of *Changes in the Work*.

.2 contributions, assessments or taxes incurred for such items as employment insurance, provincial or territorial health insurance, workers' compensation, and Canada or Quebec Pension Plan, insofar as such cost is based on wages, salaries or other remuneration paid to employees of the *Contractor* and included in the cost of the *Work* as provided in paragraph 6.3.5.1;

.3 travel and subsistence expenses of the *Contractor's* personnel described in paragraph 6.3.5.1;

.4 all *Products* including cost of transportation thereof;

.5 materials, supplies, *Construction Equipment*, *Temporary Work*, and hand tools not owned by the workers, including transportation and maintenance thereof, which are consumed in the performance of the *Work*; and cost less salvage value on such items used but not consumed, which remain the property of the *Contractor*;

.6 all tools and *Construction Equipment*, exclusive of hand tools used in the performance of the *Work*, whether rented from or provided by the

Contractor or others, including installation, minor repairs and replacements, dismantling, removal, transportation, and delivery cost thereof;

.7 all equipment and services required for the *Contractor's* field office;

.8 the amounts of all subcontracts;

.9 quality assurance such as independent inspection and testing services;

.10 charges levied by *Authorities Having Jurisdiction* at the *Place of the Work*;

.11 royalties, patent licence fees and damages for infringement of patents and cost of defending suits therefor subject always to the *Contractor's* obligations to indemnify the *Owner* and the *Region* as provided in GC 10.3 - PATENT FEES;

.12 any adjustment in premiums for all bonds and insurance which the *Contractor* is required, by the *Contract Documents*, to purchase and maintain;

.13 any adjustment in taxes, other than Harmonized Sales Taxes, and duties for which the *Contractor* is liable;

.14 charges for long distance telephone and facsimile communications, courier services, expressage, and petty cash items incurred in relation to the performance of the *Work*;

.15 removal and disposal of waste products and debris; and

.16 any additional safety measures and requirements.

6.3.6 The cost of any item referred to in paragraph 6.3.5 shall not include any costs or liabilities attributable to any failure on the part of the *Contractor* to exercise reasonable care and diligence in the *Contractor's* attention to the *Work*. Any such costs shall be borne by the *Contractor*.

6.3.7 Pending determination of the final amount of a *Change Directive*, the *Contractor* shall include the undisputed value of the work performed under a *Change Directive* during a *Payment Period* in the *Proper Invoice* that the *Contractor* submits pursuant to GC 5.2 – APPLICATIONS FOR PAYMENT in respect of that *Payment Period*, plus the applicable mark-ups described in GC 6.1 – CHANGES IN THE WORK, paragraph 6.1.6.

6.3.8 If the *Owner* includes in a *Change Directive* that it issues to the *Contractor* a reference to an estimated or budgeted amount for the *Change Directive* work (the "***Estimate***"), the Contractor shall notify the Owner in writing when 75% of the *Estimate* has been expended. The *Contractor* shall immediately halt performance of the *Change Directive* work once the accumulated cost of performing such work

is equivalent to the *Estimate*, advise the *Owner* in writing that the *Estimate* has been reached, and not proceed with the balance of the *Change Directive* work until it receives instructions to do so from the *Owner* or *Consultant*. Failure to comply with the foregoing shall constitute a waiver of the *Contractor's* entitlement to any compensation on account of the *Change Directive* work in excess of the *Estimate*.

GC 6.4 CONCEALED OR UNKNOWN CONDITIONS

Paragraph 6.4.1

Subparagraph .1

Add the words "or the Reports" after the words "Contract Documents".

Subparagraph .2

Add the words "or the *Reports"* after the words "*Contract Documents*".

Paragraph 6.4.2

Delete in its entirety and replace with the following:

6.4.2 Having regard to and subject to the liabilities and responsibilities assumed by the *Contractor* pursuant to GC 3.11 – OPERATIONAL RISKS, the *Consultant* will promptly investigate such conditions and make a finding. Having regard to and subject to the liabilities and responsibilities assumed by the *Contractor* pursuant to GC 3.11 – OPERATIONAL RISKS, if the finding is that the conditions differ materially and this would cause an increase or decrease in the *Contractor's* cost or time to perform the *Work*, the *Consultant*, with the *Owner's* approval, will issue appropriate instructions for a *Change in the Work* as provided in GC 6.2 – CHANGE ORDER or GC 6.3 - CHANGE DIRECTIVE.

New Paragraphs

Add the following new paragraphs to GC 6.4:

6.4.5 The *Contractor* confirms that it carefully reviewed the *Contract Documents*, as well as the *Reports* and that it has satisfied itself as to the nature and extent of the *Work*, the *Contract Documents* and the *Contract* and as to the facilities and difficulties in attending and completing the execution of the *Work*. The *Contractor* confirms that it has applied to its review the degree of care and skill required by GC 3.9 – PERFORMANCE BY CONTRACTOR, paragraph 3.9.1. In those circumstances, notwithstanding the provisions of paragraph 6.4.2, the *Contractor* is not entitled to an adjustment to the *Contract Price* or to an extension of the *Contract Time* for conditions which could reasonably have been ascertained by the *Contractor* by such careful review, or which could have

been reasonably inferred from the material provided with the *Contract Documents* or *Reports*. In those circumstances, should a claim arise, the *Contractor* will have the burden of establishing that it could not have discovered the materially different conditions from a careful review of the *Contract Documents* or the *Reports*.

6.4.6 To the extent the *Contractor* has not reviewed the *Contract Documents* or *Reports* as referenced in paragraph 6.4.5, the *Contractor* willingly assumes responsibility for all losses, damages, costs, expenses (including all legal costs on a full indemnity basis), liabilities, claims, actions, and demands, whether arising under statute, contract or at common law, which such review might have avoided or reduced and shall indemnify, save harmless and defend the *Owner* and the *Region* from all risk which might make it more onerous and more expensive to fulfill or perform the *Work* than was contemplated or known when the *Contract* was signed, and for any and all liability, responsibility and obligations which the *Owner* or the *Region* may have to any third parties resulting from any failure to review.

6.4.7 If the finding made pursuant to paragraph 6.4.2 is that the subsurface or otherwise concealed physical conditions differ materially and this would cause an increase or decrease in the *Contractor's* cost or time to perform the *Work*, and if the said conditions were otherwise discoverable by the *Contractor* in the proper performance of its duties and obligations under the *Contract*, all costs and expenses resulting from any delay (excluding, for clarity, the direct cost of remediating the said conditions) in the completion of the *Work* that is caused, or contributed to, as a result of the said conditions, will be borne by the *Contractor*.

6.4.8 Without limiting the generality of any other provision in the *Contract Documents*, during the performance of the *Work*, the *Contractor* shall, as a part of the *Contract Price* and *Work*, perform any additional geotechnical and subsurface and other investigations, tests and studies beyond those being provided by the *Owner*, which a reasonable and prudent contractor would conduct to ascertain the nature and extent of subsurface or otherwise concealed physical conditions at the *Place of the Work*.

GC 6.5 DELAYS

Delete in its entirety and replace with the following:

GC 6.5 DELAYS

6.5.1 If the *Contractor* is delayed in the performance of a critical path activity on the *Construction Schedule* by an act or omission of the *Owner*, *Consultant* or anyone

employed or engaged by them directly or indirectly, contrary to the provisions of the *Contract Documents*, then the *Contract Time* shall be extended for such reasonable time as the *Consultant* may recommend in consultation with the *Contractor*. The *Contractor* shall also be reimbursed by the *Owner* for only the actual additional costs incurred as a result of the delay, excluding any mark-ups or payments to staff not employed full time at the *Site*.

6.5.2 If the *Contractor* is delayed in the performance of a critical path activity on the *Construction Schedule* by a stop work order issued by a court or other public authority and provided that such order was not issued as a result of an act or fault of the *Contractor* or any person employed or engaged by the *Contractor* directly or indirectly and provided that such order was issued as a result of an act or omission of the *Owner* contrary to the *Contract Documents* , resulting in the failure of the *Contractor* to attain *Substantial Performance of the Contract* or *Total Performance of the Contract* by the dates stipulated in Article A-1 of the Agreement – THE WORK, then the *Contract Time* shall be extended for such reasonable time as the *Consultant* may recommend. The *Contractor* shall also be reimbursed by the *Owner* for only the actual additional costs incurred as a result of the delay, excluding any mark-ups or payments to staff not employed full time at the *Site*.

6.5.3 If the *Contractor* is delayed in the performance of a critical path activity on the *Construction Schedule* by:

.1 any labour disputes, strikes or lock-outs affecting the *Work* or the *Project*,

.2 fire or unusual delay by common carriers,

.3 abnormally adverse weather conditions, or

.4 any other cause which could not be reasonably anticipated to occur during the course of a construction project, which the *Owner* deems to be beyond the *Contractor's* (including any *Subcontractor's*) reasonable control (other than financial incapacity) other than one resulting from a default or breach of *Contract* by the *Contractor*. For the purpose of this provision, delays in the *Supply* or delivery of materials, *Products* and/or equipment, or arising from the breakdown of equipment, do not constitute causes which are beyond the *Contractor's* control.

then the *Contract Time* shall be extended for such reasonable time as the *Consultant* may recommend in consultation with the *Contractor*. The extension of time shall not be less than the time lost as the result of the event causing the delay, unless the *Contractor* agrees to a shorter extension. The *Contractor* shall not be entitled to payment for costs incurred by such delays, unless such delays result from the actions of the *Owner*, *Consultant* or anyone employed or engaged

by them directly. Notwithstanding the foregoing, the *Contractor* shall use its best efforts to minimize the impact of such event upon the performance of the *Work* and *Contract Time*.

For the purposes of this GC 6.5 - DELAYS, a delay caused by abnormal inclement weather occurs when, in the *Owner's* sole opinion, the *Contractor* is prevented by inclement weather or other related conditions, for a period of at least six hours in a *Working Day*, from proceeding with at least 60% of the normal labour and equipment force engaged on any component of the *Work* which, if delayed, will delay the completion of the *Work*.

6.5.4 No compensation for delay shall be paid to the *Contractor*, and no extension shall be made for delay unless *Notice in Writing* of the cause of delay is given to the *Consultant* and *Owner* not later than 5 *Working Days* after the commencement of the delay. In the case of a continuing cause of delay only one *Notice in Writing* shall be necessary. Without limiting the generality of the foregoing, the following shall also apply to the event of delay dealt with by paragraphs 6.5.1, 6.5.2 or 6.5.3:

.1 the notice provided by the *Contractor* as set out in this paragraph 6.5.4 shall include, without limitation, sufficient and adequate information and documentation to allow the *Consultant* and *Owner* to properly consider the claim of the *Contractor*.

.2 the *Contractor* shall take all reasonable steps to minimize the impact of the delay event upon the performance of the *Work*, the *Contract Time* and the *Contract Price*, resume performance of all its obligations under the *Contract* affected by the delay as soon as practicable and use all reasonable endeavours to remedy any failure to perform.

Failure to adhere strictly to these notice provisions shall constitute a waiver and release of any obligation of the *Owner* to extend the *Contract Time* as a result of such delay and of any claim by the *Contractor* for costs as a result of such delay.

6.5.5 If no schedule is made under paragraph 2.2.12 of GC 2.2 – ROLE OF THE CONSULTANT, then no request for extension shall be made because of failure of the *Consultant* to furnish instructions until 10 *Working Days* after demand for such instructions has been made.

6.5.6 If the *Contractor* is delayed in the performance of the *Work* by an act or omission of the *Contractor*, any *Subcontractor* or *Supplier*, or anyone employed or engaged by them, directly or indirectly, or by any cause within the *Contractor's* control, the *Contractor* shall devote such additional resources and take all steps necessary, all at the *Contractor's* own cost and expense, to ensure that the dates for attaining *Substantial Performance of the Contract* and *Total Performance of the Contract*

under the *Contract* as may have been amended in accordance with the provisions of PART 6 – CHANGES IN THE WORK, are met. If the *Contractor* fails to attain *Substantial Performance of the Contract* or *Total Performance of the Contract* as aforesaid, the *Owner* shall be entitled to assess liquidated damages in accordance with Article A-12 of the Agreement – LIQUIDATED DAMAGES.

6.5.7 The parties acknowledge that in March 2020 the World Health Organization declared a global pandemic of the virus leading to COVID-19. The Government of Canada, the Province of Ontario, the *Region* and other municipal authorities responded to the pandemic with legislative amendments, controls, orders, requests of the public, and requests and requirements to the parties to change their activities in various ways (collectively, the "***Governmental Response***"). It is uncertain how long the pandemic, and the related *Governmental Response*, will continue, and it is unknown whether there may be a resurgence of the virus leading to COVID-19 or any mutation thereof (collectively, the "***Virus***") and resulting or supplementary renewed Government Response. Notwithstanding any other provision in the *Contract Documents*, if the *Contractor* is delayed in the performance of the *Work* by the continued spread of the *Virus* or the continuation of or a new *Governmental Response* to control the spread of the *Virus* (which was not reasonably foreseeable at the time of entering into the *Contract*), the parties agree it shall constitute a delay pursuant to paragraph 6.5.3. The *Contractor* shall not be entitled to any payment for costs incurred by such delays, save and except as provided for in paragraph 6.5.8. Nothing in this paragraph 6.5.7 shall excuse the *Contractor* from complying with any notification requirements in the *Contract* including, without limitation, those contained in paragraph 6.5.4.

6.5.8 In the event of a delay to the *Contractor's* performance of the *Work* pursuant to paragraph 6.5.7, the *Contractor* shall be entitled to payment of the direct costs it reasonably incurs, without any mark-up, as a result of having to comply with new legislative amendments, controls, and orders that are implemented by the Government of Canada, the Province of Ontario, the *Region* or other municipal authority after the bid submission deadline in response to the *Virus* associated with the following:

.1 the *Contractor* being required to use additional tools or equipment, including PPE equipment, in its performance of the *Work*;

.2 the *Contractor* being required to purchase, use or *Provide* additional safety-related supplies in connection with its performance of the *Work*; or

.3 the *Contractor* being required to *Install* temporary facilities or structures, including hand washing stations.

6.5.9 Notwithstanding any other provision in the *Contract*, the *Owner* and the *Region* shall not be liable or deemed to be in breach of the *Contract* for any failure or delay in performance of its obligations under the *Contract* arising out of:

.1 the *Virus*;

.2 *Governmental Response*; or

.3 any impacts to the *Owner's* operations and performance of its obligations that are beyond its reasonable control and are caused by, relate to or arise out of the *Virus* or the *Governmental Response* (including, without limitation, any delays in obtaining possession or access to the *Place of the Work*, or in obtaining permits from permitting offices or approvals from *Authorities Having Jurisdiction*).

GC 6.6 CLAIMS FOR A CHANGE IN CONTRACT PRICE

Paragraph 6.6.1

Delete the word "timely".

Add the words "within *5 Working Days* upon commencement of the event(s) giving rise to a claim*"* after the word *"Consultant"*.

Paragraph 6.6.3

Delete the words "within a reasonable time".

Add the words "no later than 20 *Working Days* after completion of the work which is the subject of the claim" after the words "the claim is based".

NEW GENERAL CONDITION

Add the following new General Condition to PART 6 – CHANGES IN THE WORK

GC 6.7 NO CLAIMS FOR CHANGE IN SCOPE OF WORK

6.7.1 If any change, deviation or omission from the *Work* is made by which the amount of *Work* to be done is decreased, including any of the quantities specified in *Contract Documents*, or if the whole or any portion of the *Work* is deleted from the scope of *Work* or otherwise dispensed with, no compensation shall be claimed by the *Contractor* (other than demonstrable direct costs already incurred by the *Contractor* in accordance with GC 6.1.4) or any *Subcontractors* for any such changes including any claims for loss of anticipated profits.

PART 7 DEFAULT NOTICE

GC 7.1 OWNER'S RIGHT TO PERFORM THE WORK, TERMINATE THE CONTRACTOR'S RIGHT TO CONTINUE WITH THE WORK OR TERMINATE THE CONTRACT

Delete in its entirety and replace with the following:

GC 7.1 OWNER'S RIGHT TO PERFORM THE WORK OR STOP THE WORK OR TERMINATE THE CONTRACT

7.1.1 If circumstances arise such that the *Owner* considers it necessary or advisable, the *Owner* may suspend the *Contract* and the performance of the *Work*. In the event the *Owner* exercises its right of suspension pursuant to this paragraph 7.1.1, the *Contractor* shall, subject to the directions in the notice of suspension:

.1 take all necessary steps to ensure the *Place of the Work* and all *Work* in place is left in a safe and clean state and is protected from the elements for the duration of the suspension; and

.2 take all necessary steps to ensure the *Work* is appropriately preserved and cared for in accordance with good industry practice and any occupational, use or safety requirements or standards of the *Authorities Having Jurisdiction* or stipulated in the *Contract Documents* for the duration of the suspension.

7.1.2 If the *Contract* and the performance of the *Work* is suspended pursuant to paragraph 7.1.1, the *Contract Time* shall be extended by the length of the suspension and the *Owner* shall pay the *Contractor* the direct costs the *Contractor* reasonably incurs that are a direct result of any demobilization, remobilization and *Site* security and preservation that is required as a result of the suspension. All such costs shall be substantiated with sufficient and appropriate supporting documentation.

7.1.3 If:

.1 the *Contractor* should become bankrupt or insolvent or make a general assignment for the benefit of creditors because of its insolvency; or

.2 a receiver is appointed because of its insolvency; or

.3 the *Contractor* commits a criminal act; or

.4 the *Contractor* transfers, assigns or otherwise disposes of its interest in the *Contract* or any part thereof without the written authority of the *Owner*; or

.5 the *Contractor* ceases the *Work* for a period of 30 Days or more (other than for delays for which an extension of *Contract Time* is granted by the *Owner* pursuant to GC 6.5 -DELAYS); or

.6 the *Owner* deems, in its sole discretion, acting reasonably, that the progress of the *Work* has fallen behind schedule to such an extent that the *Contractor* will not be able to meet one or more of the *Interim Milestone* dates specified in the *Contract* or complete the *Work* within the *Contract Time*, provided that the *Contractor* has first been given the opportunity to rectify this breach pursuant to the process outlined in paragraphs 7.1.4 and 7.1.5; or

.7 the *Contractor* fails to maintain adequate insurance as stipulated in GC 11.2 – INSURANCE; or

.8 the *Contractor* fails to comply immediately with a direction of the *Owner* under the *Contract* including, but not limited to, any directions under GC 9.4 – CONSTRUCTION SAFETY; or

.9 the *Contractor* fails to comply immediately with a stop work order issued by the *Owner* or the *Consultant* under the *Contract*; or

.10 the *Contractor* fails to comply with a written direction from the *Owner* under PART 8 – DISPUTE RESOLUTION; or

.11 the *Contractor* breaches the Supplier Code of Conduct included as Schedule 2 to the *Region's* Procurement Bylaw No. 2021-103; or

.12 the *Contractor* fails to comply with the *Owner's* and the *Region's* policies, protocols and procedures as required in GC 9.4 – CONSTRUCTION SAFETY, paragraph 9.4.10; or

.13 the *Contractor* fails to maintain its COR™ certification or COR™ equivalency, or have a valid Letter of Reciprocity issued by the Infrastructure Health and Safety Association (IHSA) indicating that they are in the process of obtaining COR™ equivalency, as stipulated in GC 9.8 - CERTIFICATE OF RECOGNITION (COR™) SAFETY PROGRAM; or

.14 the *Contractor* breaches Article A-10 of the Agreement – CONFLICT OF INTEREST; or

.15 the *Contractor* commits any other breach of *Contract* which the *Owner* deems material;

the *Owner*, without prejudice to any other right or remedy it may have, may by giving the *Contractor* or receiver or trustee in bankruptcy written notice to:

(a) terminate the *Contract*; or

(b) take all or any part of the *Work* out of the *Contractor's* hands and may employ such means as it may see fit to complete the *Work* and may deduct the costs thereof from any payment due to the *Contractor* and, in the event

the costs thereof exceed the sum payable to the *Contractor* had the *Contractor* completed that part of the *Work*, the *Contractor* shall pay such excess amount to the *Owner* forthwith upon notice from the *Owner*; or

(c) issue a stop work order on the *Contract*.

7.1.4 If the *Contractor* should neglect to perform the *Work* in compliance with the requirements of the *Contract Documents*, of which the *Owner* shall be the sole judge, the *Owner* may notify the *Contractor* in writing that it is in default of its contractual obligations and instruct it to correct the default in the 5 *Working Days* immediately following the receipt of such notice or, where immediate action is required, in such lesser time as specified in the notice.

7.1.5 If the correction of the default cannot be completed in the 5 *Working Days* specified, or the lesser time specified where immediate action is required, the *Contractor* shall be in compliance with the *Owner's* instructions if it:

.1 commences the correction of the default within the specified time; and

.2 provides the *Owner* with a schedule acceptable to the *Owner* for such correction; and

.3 completes the correction in accordance with such schedule.

7.1.6 If the *Contractor* fails to correct the default within the time specified, the *Owner* may, without prejudice to any other right or remedy it may have:

.1 correct such default and charge the cost thereof to the *Contractor*; or

.2 terminate the *Contractor's* right to continue with the *Work* in whole or in part; or

.3 terminate the *Contract*.

7.1.7 If the *Owner* terminates the *Contractor's* right to continue with the *Work* or terminates the *Contract* pursuant to paragraph 7.1.3 or paragraph 7.1.6, the *Owner* shall be entitled to:

.1 take possession of the premises and *Products*, utilize the construction machinery and equipment and finish the *Work* by whatever method it may see fit; and

.2 receive an assignment or transfer forthwith from the *Contractor* of any permit or approval obtained by the *Contractor* for the performance of the *Work*; and

.3 receive an assignment or transfer forthwith from the *Contractor* of any contract between the *Contractor* and a *Subcontractor* or a *Supplier* for the performance of the *Work* if required by the *Owner*; and

.4 withhold further payments to the *Contractor* until the *Work* is finished; and

.5 deduct the following costs from the unpaid balance of the *Contract Price*:

(1) the full cost of finishing the *Work*, as certified by the *Consultant*; and

(2) any additional compensation payable to the *Consultant* for additional services; and

(3) a reasonable allowance, as determined by the *Consultant*, to cover the cost of corrections to work performed by the Contractor as may be required under GC 12.3 – WARRANTY; and

.6 upon expiry of the *Warranty Period*, charge the *Contractor* the amount by which the cost of corrections to its work under GC 12.3 - WARRANTY exceeds the allowance provided for such corrections.

If the costs referred to in paragraphs 7.1.7.5 and 7.1.7.6 are less than the unpaid balance of the *Contract Price*, the *Owner* shall pay the *Contractor* the difference.

7.1.8 The *Contractor* acknowledges that the performance of the *Work* may require the following:

.1 approval of the local conservation authority or other applicable government agencies in respect of watercourses, wetlands, floodplain, and hazard lands;

.2 approval of the Ministry of Natural Resources and Forestry, the Department of Fisheries and Oceans or the local conservation authority in respect of its authority under the Fisheries Act, RSC 1985, c F-14;

.3 approval of the Ministry of the Environment, Conservation and Parks, the local conservation authority or other applicable government agencies in respect of any water taking;

.4 approval of the Ministry of the Environment, Conservation and Parks in respect of any discharge, emission, waste, waste disposal site, waste management system, water works, sewage works, storm water works or drinking water systems;

.5 approval of the Ministry of Natural Resources and Forestry, the Department of Fisheries and Oceans or Environment Canada in respect of the protection of any species at risk or the respective habitat of any species at risk;

.6 approval of Transport Canada in respect of navigable waterbodies;

.7 approval of the Ministry of Labour and Ministry of the Environment, Conservation and Parks, as applicable, in respect of any new equipment specified by the *Owner*;

.8 approval of the *Board,* Regional Committee/Council or other governmental or municipal authorities or utilities; and

.9 land acquisitions, easements or utility relocations.

If at any time any one or more of these requirements have not been satisfied, the *Owner* may terminate the *Contract* by providing a *Notice in Writing* to the *Contractor* to such effect and the *Contractor* shall be entitled to be paid for the *Work* performed up to and including the date of service of the notice terminating the *Contract*, as determined by the *Consultant* and the *Owner*. In no event will the *Contractor* be entitled to claim any amount for profit or loss sustained or any other damages as a result of the termination of the *Contract*.

7.1.9 If at any time during the course of the *Contract*, the *Owner* exhausts or exceeds the allocated budget for the *Contract*, or if the allocated budget for the *Contract* is withdrawn, reduced or cancelled by the *Board* or Regional Council for any reason whatsoever, the *Owner* may terminate the *Contract* by providing a Notice in Writing to the *Contractor* to such effect and the *Contractor* shall be entitled to be paid for the *Work* performed up to and including the date of service of the notice terminating the *Contract*, as determined by the *Consultant*. In no event will the *Contractor* be entitled to claim any amount for profit or loss sustained or any other damages as a result of the termination of the *Contract*.

7.1.10 The *Contractor's* obligation under the *Contract* as to quality, correction and warranty of the *Work* performed by it up to the time of termination shall continue in force after such termination.

7.1.11 If the *Work* is suspended or otherwise delayed for a period of 60 consecutive *Working Days* or more under an order of a court or other public authority and providing that the issuance of such order was not the direct result of an act or omission of the *Owner* or *Consultant* contrary to the provisions of the *Contract Documents*, the *Owner* may, at its sole option and discretion and without penalty, terminate the *Contract* for convenience upon providing seven (7) Days' Notice in Writing to the *Contractor*. Upon receiving the notice of termination in accordance with this paragraph 7.1.11, the *Contractor* shall cease or cause the cessation of all operations except for the following:

.1 The *Contractor* shall take all steps necessary to:

(1) ensure and preserve the safety of personnel (including, without limitation, construction personnel, building guests and building staff); and

(2) ensure the *Work* is appropriately preserved and cared for in accordance with good industry practice and any occupational, use or safety

requirements or standards of *Authorities Having Jurisdiction* or those stipulated in the *Contract Documents*.

.2 Subject to any directions in the notice of termination, the *Contractor* shall:

(1) take all necessary steps to ensure the *Place of the Work* and all *Work* in place is left in a safe and clean state and is protected from the elements; and

(2) discontinue or cause to be discontinued the ordering of *Products*, material, equipment and supplies and shall make reasonable efforts to cancel existing orders on the best terms available.

If the *Contract* is terminated for convenience pursuant to this paragraph 7.1.11, the *Contractor* shall not be entitled to any costs, expenses, damages, losses or reimbursement of any kind whatsoever (and the *Contractor* waives any claim against the *Owner* related to or arising from the termination), save and except for the amounts expressly contemplated in paragraph 7.1.12.

7.1.12 If the *Contract* is terminated pursuant to paragraph 7.1.11, the *Owner* shall pay the *Contractor* the cost of the *Work* incurred to the effective termination date and the reasonable costs the *Contractor* incurs in complying with its obligations under paragraph 7.1.11.

7.1.13 Notwithstanding any other provision in the *Contract*, the *Owner* shall not be liable to the *Contractor* for any actual or alleged damages of any kind whatsoever (including without limitation indirect, incidental, special, consequential or other damages, including loss of profits) on account of the publication of a notice of termination pursuant to the *Construction Act* and the *Contractor* waives any and all claims against the *Owner* related to or arising from the publication. This paragraph 7.1.13 shall survive termination of the *Contract*.

GC 7.2 CONTRACTOR'S RIGHT TO SUSPEND THE WORK OR TERMINATE THE CONTRACT

Paragraph 7.2.2

Delete the words "20 Working Days" and replace them with "60 consecutive Working Days".

Delete the words "engaged by the Contractor, the Contractor may" and replace them with "engaged by the Contractor, and provided that such order was issued as a result of an act or omission of the Owner contrary to the Contract Documents, the Contractor may".

Paragraph 7.2.3

Delete in its entirety and replace with the following:

7.2.3 The *Contractor* may give *Notice in Writing* to the *Owner*, with a copy to the *Consultant*, that the *Owner* is in default of the *Owner*'s contractual obligations and instruct the *Owner* to correct the default in the 20 *Working Days* immediately following the receipt of such notice if the *Owner* fails to comply with the requirements of the *Contract* to a substantial degree and the *Consultant* gives a written statement to the *Owner* and the *Contractor* that provides detail of such failure to comply with the requirements of the *Contract* to a substantial degree.

Paragraph 7.2.4

Delete in its entirety and replace with the following:

7.2.4 If the default cannot be corrected in the 20 *Working Days* specified, the *Owner* shall be in compliance with the *Contractor's* instructions if the *Owner*:

.1 commences the correction of the default within the specified time; and

.2 provides the *Contractor* with an acceptable schedule for such correction; and

.3 corrects the default in accordance with such schedule.

Paragraph 7.2.5

Delete in its entirety and replace with the following:

7.2.5 If the *Owner* fails to correct the default in the time specified or subsequently agreed upon, without prejudice to any other right or remedy the *Contractor* may have, the *Contractor* may suspend the *Work* until the default has been corrected or terminate the *Contract*.

New Paragraphs

Add the following new paragraphs to GC 7.2:

7.2.6 If the *Contractor* terminates the *Contract* under the conditions set out above, the *Contractor* shall be entitled to be paid for all work performed to the date of termination. The *Contractor* shall also be entitled to recover the direct costs associated with termination, including the costs of demobilization, and losses sustained on *Products* and *Construction Equipment*. The *Contractor* shall not be entitled to any additional reimbursement on account of any such termination including, without limitation, indirect, incidental, special, consequential or other damages, including loss of profits, notwithstanding any other provision of the *Contract Documents*.

7.2.7 The *Owner's* withholding of a progress payment, holdback payment or final payment due to the *Contractor's* failure to pay a *Subcontractor* or *Supplier*, to

protect the *Owner's* and the *Region's* interest in the event of the preservation of a lien or receipt of notice of lien, or otherwise pursuant to the terms of the *Contract*, shall not constitute a default under paragraph 7.2.3 which would permit the *Contractor* to stop the *Work* or terminate the *Contract*. In such circumstances, the *Contractor* shall continue with the *Work*.

7.2.8 If the *Contractor* stops the *Work* or terminates the *Contract* as provided in this GC 7.2 – CONTRACTOR'S RIGHT TO SUSPEND THE WORK OR TERMINATE THE CONTRACT, it shall ensure that the *Place of the Work* is left in a secure and safe condition as required by all *Authorities Having Jurisdiction* and the *Contract Documents*.

PART 8 DISPUTE RESOLUTION

GC 8.1 AUTHORITY OF THE CONSULTANT

Delete in its entirety and replace with the following:

GC 8.1 DISPUTES

8.1.1 Subject to GC 8.2 – ADJUDICATION, differences between the parties to the *Contract* as to the interpretation, application or administration of the *Contract* or any failure to agree where agreement between the parties is called for, other than a failure to agree on the method of valuation, measurement and change of the *Contract Price*, herein collectively called disputes, which are not resolved in the first instance by interpretation and the findings of the *Consultant* as provided in GC 2.2 - ROLE OF THE CONSULTANT, shall be settled in accordance with the requirements of PART 8 - DISPUTE RESOLUTION.

8.1.2 The *Contractor* shall give oral notice of any dispute to the *Owner* immediately becoming aware of the situation giving rise to such dispute.

8.1.3 The *Contractor* shall provide *Notice in Writing* of any dispute within 5 *Business Days* after the commencement of the work giving rise to the dispute to the *Owner*. Such *Notice in Writing* shall include particulars of the matter in dispute, the extent and value of the claim and the relevant provisions of the *Contract Documents*.

8.1.4 If the matter in dispute is not resolved promptly, the *Consultant* will give such instructions as, in its opinion, are necessary for the proper performance of the *Work* and to minimize delays pending settlement of the dispute. The parties shall act immediately according to such instructions, it being understood that by so doing neither party will jeopardize any claim it may have.

8.1.5 As time is of the essence, if so directed by the *Owner*, the *Contractor* shall continue to perform the *Work* in accordance with the instructions of the *Owner*,

notwithstanding any such dispute. Accordingly, in the event of a dispute, any work stoppage by the *Contractor* will constitute a breach of the *Contract* entitling the *Owner* to claim damages on account of any delay affecting the as-planned schedule of the *Work*.

8.1.6 The *Contractor* shall submit to the *Owner* a detailed statement of its claims not later than 20 *Business Days* after completion of the *Work* which is the subject of the dispute, identifying the item or items in respect of which the dispute has arisen, the grounds upon which a claim is made and all records substantiating such claim.

8.1.7 The *Contractor* shall promptly submit, at the request of the *Owner*, such further and other information and documentation as the *Owner* or the *Consultant* considers necessary to assess the claim.

8.1.8 If the *Contractor* fails to comply with the provisions for notices and claims within the times stipulated in respect of any dispute, the *Contractor* will not be entitled to proceed with any claim in respect of such dispute and this provision shall act as a bar to any such claims.

8.1.9 If the *Contractor* has complied with all of the provisions of this General Condition and the *Owner* and the *Contractor* cannot resolve the dispute, and if both parties do not agree to settle the dispute in accordance with GC 8.3 - NEGOTIATION, MEDIATION AND ARBITRATION, then either party may refer the dispute to a court of competent jurisdiction.

8.1.10 If a dispute arises under the *Contract* in respect of a matter in which the *Consultant* has no authority under the *Contract* to make a finding, the procedures set out in paragraphs 8.1.4, 8.1.5 and 8.3.3 to 8.3.11 shall apply to that dispute with the necessary changes to detail as may be required.

GC 8.2 ADJUDICATION

Delete in its entirety and replace with the following:

GC 8.2 ADJUDICATION

8.2.1 Notwithstanding anything else in PART 8 – DISPUTE RESOLUTION, the *Owner* and the *Contractor* shall engage in adjudication as required by, and in accordance with, the *Construction Act*.

8.2.2 If the *Contractor* fails to comply with the time limits set out in PART 8 – DISPUTE RESOLUTION in respect of any claim or dispute, the *Contractor* shall have no entitlement whatsoever (including to an increase in the *Contract* Price, or an extension of *Contract Time*) in the context of an adjudication under the *Construction Act*, and waives the right to make any such claims or disputes in an

adjudication. This paragraph 8.2.2 shall operate conclusively as an estoppel and bar in the event such claims or disputes are brought in an adjudication and the *Owner* may rely on this paragraph 8.2.2 as a complete defence to any such claims or disputes.

8.2.3 The following procedures shall apply to any adjudication the *Owner* and the *Contractor* engage in under the *Construction Act*:

.1 any hearings shall be held at a venue within the jurisdiction of the *Place of the Work* or such other venue as the *Owner* and the *Contractor* may agree and which is acceptable to the adjudicator;

.2 the adjudication shall be conducted in English;

.3 the *Owner* and the *Contractor* may be represented by counsel throughout an adjudication;

.4 there shall not be any oral communications with respect to issues in dispute that are the subject of an adjudication between a party and the adjudicator unless it is made in the presence of both parties or their legal representatives; and

.5 a copy of all written communication between the adjudicator and a party shall be given to the other party at the same time.

8.2.4 Any documents or information disclosed by the parties during an adjudication are confidential and the parties shall not use such documents or information for any purpose other than the adjudication in which they are disclosed and shall not disclose such documents and information to any third party, unless otherwise required by law, save and except for the adjudicator.

8.2.5 Notwithstanding any adjudication between the parties, there shall be no interruption of the *Work* pending settlement or resolution of such dispute or disagreement.

8.2.6 The parties agree that any dispute with respect to or that arises after termination or abandonment of the *Contract* shall not be referred to or resolved by adjudication.

GC 8.3 NEGOTIATION, MEDIATION AND ARBITRATION

Paragraph 8.3.1

Add the words "(the "***Rules***"), subject to amendments, if any, required by virtue of the applicability of the *Municipal Arbitrations Act*, RSO 1990, c M.48," after the words "CCDC 40".

Subparagraph .2

Delete the words “either party by Notice in Writing requests” and replace with “both parties agree”.

Paragraph 8.3.4

Delete the words “CCDC 40” and replace them with “the *Rules* subject to any amendments to the *Rules* made as described in paragraph 8.3.1”.

Paragraph 8.3.6

Delete in its entirety and replace with the following:

8.3.6 By giving *Notice in Writing* to the other party, not later than 20 *Working Days* after the date of termination of the mediated negotiations under paragraph 8.3.5, either party may refer the dispute to be finally resolved by arbitration under the latest edition of the *Rules*, subject to any amendments to the *Rules* made as described in paragraph 8.3.1 (the “***Notice of Arbitration***”). The arbitration shall be conducted pursuant to the *Municipal Arbitrations Act*, RSO 1990, c M.48, as amended. Unless either party gives the notice contemplated by this paragraph 8.3.6, there shall be no arbitration of any such dispute.

Paragraph 8.3.7

Delete the words “10 Working Days” and replace them with “20 Working Days”.

Paragraph 8.3.8

Subparagraph .1(1)

Delete the words “Ready for Takeover” and replace them with “Substantial Performance of the Contract”.

Subparagraph .2

Delete the words “paragraph 8.3.6” and replace them with “paragraph 8.3.1”.

New Paragraphs

Add the following new paragraphs to GC 8.3:

8.3.9 For purposes of the Rules for Mediation and Arbitration of Construction Disputes CCDC 40, the term “neutral appointing authority”, as used in the Rules for Mediation and Arbitration of Construction Disputes shall mean the head of the construction section of the ADR Institute of Ontario, Inc. presiding at the time notice of the dispute is given pursuant to the *Contract*.

8.3.10 Notwithstanding any other provision of this *Contract*, the provisions set out in paragraphs 8.3.1 and 8.3.3 to 8.3.9 shall only apply if the parties agree in

writing to submit a dispute to all, or any part of, those alternate dispute resolution procedures. If the parties do not agree as aforesaid, the Courts shall have exclusive jurisdiction to determine any dispute relating to the *Work* or to the *Contract*.

8.3.11 The *Contractor* agrees that the *Owner* may require the *Contractor* to join into an arbitration involving a dispute between the *Owner* and a third party in which the *Owner* wishes the *Contractor* to be bound by the results of the arbitration, and the *Contractor* hereby consents to such joinder. The *Contractor* agrees that should the *Owner* wish to join a third party into an arbitration involving a dispute between the *Owner* and the *Contractor*, the *Contractor* shall and does hereby consent to such joinder.

GC 8.4 RETENTION OF RIGHTS

Delete in its entirety.

PART 9 PROTECTION OF PERSONS AND PROPERTY

GC 9.1 PROTECTION OF WORK AND PROPERTY

Delete in its entirety and replace with the following:

GC 9.1 PROTECTION OF WORK AND PROPERTY

9.1.1 The *Contractor* shall protect the *Work* and the *Owner's* property and property adjacent to, in the vicinity of, or proximate to, the *Place of the Work* from damage and shall be responsible for damage which may arise as the result of its performance or failure to perform under the *Contract*.

9.1.2 Should the performance or non-performance by the *Contractor* under the *Contract* result in damage to the *Work*, the *Owner's* property or property adjacent to, in the vicinity of, or proximate to, the *Place of the Work*, the *Contractor* shall be responsible for the *Making Good* of such damage at its expense.

9.1.3 Before commencing any *Work*, the *Contractor* shall determine the location of all underground utilities and structures indicated in or reasonably inferable from the *Contract Documents* and the *Reports* by a contractor exercising the degree of care and skill described in GC 3.9 – PERFORMANCE BY CONTRACTOR, paragraph 3.9.1.

9.1.4 Should damage occur to the *Work* or *Owner's* property for which the *Contractor* is not responsible, as provided in paragraph 9.1.1, the *Contractor* shall *Make Good* such damage to the *Work* and, if the *Owner* so directs, to the *Owner's* property. The *Contract Price* and *Contract Time* shall be adjusted as provided in GC 6.1 – CHANGES IN THE WORK, GC 6.2 - CHANGE ORDER and GC 6.3 - CHANGE DIRECTIVE.

9.1.5 With respect to any damage to which paragraph 9.1.4 applies, the *Contractor* shall neither undertake to repair or replace any damage whatsoever to the work of Other Contractors, or to adjoining property, nor acknowledge that the same was caused or occasioned by the *Contractor*, without first consulting the *Owner* and receiving written instructions as to the course of action to be followed from either the *Owner* or the *Consultant*.

9.1.6 The *Contractor* shall be responsible for securing the *Place of the Work* at all times and shall take all reasonable precautions necessary to protect the *Place of the Work*, its contents, materials (including *Owner*-supplied materials) and the public from loss or damage during and after working hours.

GC 9.2 TOXIC AND HAZARDOUS SUBSTANCES

Paragraph 9.2.4

Delete in its entirety and replace with the following:

9.2.4 Unless the *Contract Documents* expressly provide otherwise, the *Contractor* shall be responsible for taking all necessary steps in accordance with legal requirements and the *Contract Documents* to dispose of, store or otherwise render harmless, toxic or hazardous substances or materials encountered at the *Place of the Work* in the course of the execution of the Work.

Paragraph 9.2.5

Delete the words "or which were disclosed but have not been dealt with as required under paragraph 9.2.4".

New Subparagraph

Add the following new subparagraph to paragraph 9.2.5:

.5 take all reasonable steps to mitigate the impact on *Contract Time* and *Contract Price* and any further steps it deems necessary to mitigate or stabilize any conditions resulting from encountering toxic or hazardous substances or materials.

Paragraph 9.2.7

Delete the words "the Owner shall promptly" and replace them with "the Owner will promptly".

Subparagraph .1

Delete in its entirety and replace with the following:

.1 take all necessary steps in accordance with legal requirements and the *Contract Documents* to dispose of, store or otherwise render harmless, toxic or hazardous

substances or materials encountered at the *Place of the Work* in the course of the execution of the *Work* ;

Subparagraph .2

Add the word "and" at the end of the subparagraph.

Subparagraph .4

Delete in its entirety.

Paragraph 9.2.8

Subparagraph .2

Delete the words "property adjacent to" and replace them with "property adjacent, in the vicinity of, or proximate to,"

Delete the words "paragraph 9.1.3" and replace with "paragraph 9.1.2".

Subparagraph .3

Add the words "and as a result of the delay" after the words "paragraph 9.2.6".

Subparagraph .4

Delete the words "GC 13.1 – INDEMNIFICATION" and replace them with "GC 13.1 – INDEMNIFICATION, CLAIMS HANDLING AND WAIVER OF CLAIMS".

New Paragraphs

Add the following new paragraphs to GC 9.2:

9.2.10 If the *Contractor* causes or permits

.1 any toxic or hazardous substances or materials to be brought by the *Contractor*, its *Subcontractors*, *Suppliers* or anyone else for whom the *Contractor* is responsible at law, to the *Place of the Work*, or

.2 any toxic or hazardous substances or materials which were already at the *Place of the Work* (but which were then harmless or stored, contained or otherwise dealt with in accordance with legal and regulatory requirements), to be dealt with in a manner which does not comply with legal and regulatory requirements or which threatens human health and safety or the environment or causes material damage to the property of the *Owner* or others,

the *Contractor* shall

.3 take all reasonable steps, including stopping the Work, to ensure that no person suffers injury, sickness or death and that no property is injured or

destroyed as a result of exposure to or the presence of the substances or materials, and

.4 immediately report the circumstances to the *Consultant* and the *Owner* by telephone, confirmed in writing.

9.2.11 In the case of any circumstances contemplated in paragraph 9.2.10, the *Contractor* shall be responsible, at the *Contractor's* sole expense, for cleaning up, removing, containing, storing, or otherwise dealing with the toxic or hazardous substances or materials and any damage caused thereby in a manner which the *Authorities Having Jurisdiction* determine will:

.1 meet all applicable legal and regulatory requirements and ensure compliance with any applicable permits or other authorizations,

.2 remove any threat to human health and safety or the environment, and

.3 rectify all material damage to the property of the *Owner* and others.

9.2.12 For the purposes of this GC 9.2 – TOXIC AND HAZARDOUS SUBSTANCES, the term "toxic and hazardous substances" shall be taken to mean, and shall be limited to, substances as currently defined by applicable statutory and regulatory requirements.

GC 9.4 CONSTRUCTION SAFETY

Delete in its entirety and replace with the following:

GC 9.4 CONSTRUCTION SAFETY

9.4.1 The *Contractor* acknowledges that it is aware of the provisions of the *Occupational Health and Safety Act*, RSO 1990, c O.1 (the "***OHSA***") and the regulations, policies and guidelines thereunder. The *Contractor* agrees to comply with, and cause to be complied with, the provisions thereof as such statutes, regulations, policies and guidelines may be amended or replaced from time to time including, without limiting the generality of the foregoing, all of the obligations of the *Constructor* and employer under the *OHSA* and regulations, as applicable, in respect of the Work.

9.4.2 The *Contractor* shall execute all required documents under the *Region's* Health and Safety Guide for Construction Contractors at the pre-construction meeting.

9.4.3 The *Contractor* shall do, cause to be done, or refrain from doing any act or thing as directed by the *Owner* or the *Consultant*, including stopping the Work if, at any time, the *Owner* or the *Consultant* considers that any situation or condition is unsafe or contrary to the provisions of the *OHSA*, or any other applicable *Laws*

and Regulations. If the *Contractor* fails to comply with such direction, the *Owner* may:

.1 take action to remedy the situation or condition and the cost thereof shall be payable by the *Contractor* on demand and, failing payment thereof, the *Owner* may deduct the costs from monies which are due or may become due to the *Contractor*; or

.2 terminate the *Contract* pursuant to GC 7.1 – OWNER'S RIGHT TO PERFORM THE WORK OR STOP THE WORK OR TERMINATE THE CONTRACT, paragraph 7.1.3.

9.4.4 Notwithstanding the foregoing, any act or failure to act by the *Owner* shall not in any way derogate from the responsibility of the *Contractor* under the *Contract* including its obligations under GC 9.4 – CONSTRUCTION SAFETY.

9.4.5 The *Contractor* shall indemnify, hold harmless and defend the *Owner*, the *Region*, the *Consultant*, the *Municipalities*, and their respective directors, officers, council members, board members, partners, agents and employees from and against all claims, demands, losses, costs including legal costs, damages, actions, suits and proceedings (including by any government agency) arising as a result of any violation or alleged violation of the *OHSA* or the regulations, policies and guidelines thereunder, as such statutes, regulations, policies and guidelines may be amended or replaced from time to time.

9.4.6 The *Contractor* acknowledges that the *Owner* may employ the services of an occupational health and safety auditor for the purpose of conducting inspections of the *Place of the Work*. The *Contractor* shall grant the auditor full and unimpeded access to the *Site*, at all times, and shall immediately comply with any direction issued by the auditor to stop work. The parties acknowledge that the authority of the auditor to stop work is limited to circumstances where there is an immediate threat to the health and safety of the *Owner's* staff or to members of the public.

9.4.7 This *Contract* is deemed to be an individual project for the purposes of the *OHSA* and the regulations made thereunder and the *Contractor* acknowledges that it is the "*Constructor*" as defined in the *OHSA* on this *Project* and that it shall carry out all of the obligations, and shall bear all of the responsibilities, of the *Constructor* as set out in the *OHSA* and regulations including, but not limited to, the following:

.1 ensuring that the measures and procedures prescribed by the *OHSA* are carried out;

.2 ensuring that every employer and every worker performing work on the *Project* complies with the said *OHSA* and regulations; and

.3 ensuring that the health and safety of workers on the *Project* is protected.

9.4.8 If the *Owner* or the *Region* is designated as the "*Constructor*" as a result of the *Contractor's* actions, all of the increases in costs to the *Owner* to carry out the duties and obligations of the "*Constructor*" shall be borne by the *Contractor*.

9.4.9 All *OHSA* Regulations for construction projects shall be strictly adhered to.

9.4.10 Without limiting the other provisions of GC 9.4 – CONSTRUCTION SAFETY or the *Contractor's* obligations for occupational health and safety, the *Contractor* shall, at no additional cost to the *Owner*, comply with, and cause its *Subcontractors* and any other persons present at the *Place of the Work* to comply with:

.1 all legislative amendments, controls, regulations, requirements and orders that were or are issued by the Government of Canada, the Province of Ontario, the *Region* or other municipal authority in response to the *Virus*, and

.2 the *Owner's* and the *Region's* policies, protocols and procedures implemented for the protection of the health of its staff, its residents and the community. Where they are subject to change, the *Contractor* must comply with the *Owner's* and the *Region's* new requirements.

GC 9.5 MOULD

Paragraph 9.5.2

Subparagraph .2

Delete the words "property adjacent to the Place of the Work" and replace them with "property adjacent to, in the vicinity of, or proximate to, the *Place of the Work".*

Delete the words "paragraph 9.1.3" and replace them with "paragraph 9.1.2".

Subparagraph .3

Add the words "and as a result of the delay" after the words "paragraph 9.5.1.3".

Subparagraph .4

Delete the words "GC 13.1 – INDEMNIFICATION" and replace them with "GC 13.1 – INDEMNIFICATION AND CLAIMS HANDLING".

Paragraph 9.5.3

Subparagraph .2

Add the word "and" at the end of the paragraph.

Subparagraph .4

Delete in its entirety.

NEW GENERAL CONDITIONS

Add the following new General Conditions to PART 9 – PROTECTION OF PERSONS AND PROPERTY

GC 9.6 COMPLIANCE WITH ENVIRONMENTAL LEGISLATION

9.6.1 The *Contractor* acknowledges that it is aware of the provisions of federal and provincial legislation applicable to the Work and the environment including, but not limited to:

- the *Canadian Navigable Waters Act*, R.S.C., 1985, c N-22
- the *Clean Water Act, 2006*, S.O. 2006, c 22;
- the *Conservation Authorities Act*, R.S.O. 1990, c C.27;
- the *Dangerous Goods Transportation Act*, R.S.O. 1990, c D.1;
- the *Endangered Species Act, 2007*, S.O. 2007, c 6;
- the *Environmental Protection Act*, R.S.O. 1990, c E.19;
- the *Fisheries Act*, R.S.C., 1985, c F-14;
- the *Ontario Water Resources Act*, R.S.O. 1990, c O.40;
- the *Safe Drinking Water Act, 2002*, S.O. 2002, c 32;
- the *Species at Risk Act*, S.C. 2002, c 29;
- the *Technical Standards and Safety Act, 2000*, S.O. 2000, c 16; and
- the *Transportation of Dangerous Goods Act, 1992*, S.C. 1992, c 34

and the regulations, permits, approvals, orders, directions, policies and guidelines issued thereunder. The *Contractor* agrees to comply with, and cause to be complied with, the provisions thereof as such statutes, regulations, permits, approvals, orders, directions, policies and guidelines may be amended or replaced from time to time including, without limiting the generality of the foregoing, any obligation to obtain, and any terms and conditions of, any approval, permit or other instrument required under the applicable acts, regulations, policies and guidelines thereunder in respect of the *Work* and further agrees to discharge, release, handle, transport, manage, store and dispose of all materials in accordance with such legislation.

9.6.2 The *Contractor* shall do, cause to be done, or refrain from doing any act or thing as directed by the *Owner* or the *Consultant*, including stopping the Work if, at any time, the *Owner* or the *Consultant* considers that any situation or condition is unsafe, damaging to the environment or contrary to the provisions of the applicable acts, regulations, policies or guidelines thereunder, or any term or condition of a permit, approval order, directive or other instrument issued thereunder. If the *Contractor* fails to comply with such direction, the *Owner* may:

.1 take action to remedy the situation or condition and the cost thereof shall be payable by the *Contractor* on demand and, failing payment thereof, the *Owner* may deduct the costs from monies which are due or may become due to the *Contractor*; or

.2 terminate the *Contract* pursuant to GC 7.1 – OWNER'S RIGHT TO PERFORM THE WORK OR STOP THE WORK OR TERMIANTE THE CONTRACT.

9.6.3 Notwithstanding the foregoing, any act or failure to act by the *Owner* shall not in any way derogate from the responsibility of the *Contractor* under the *Contract* including its obligations under paragraph 9.6.1.

9.6.4 The *Contractor* shall indemnify, hold harmless and defend the *Owner*, the *Region*, the *Consultant*, the *Municipalities*, and their respective directors, officers, council members, board members, partners, agents, employees and authorized representatives from and against all claims, demands, losses, expenses, costs including legal and professional costs, damages, actions, suits or proceedings (including by any government agency) arising as a result of the *Contractor's* violation of any applicable *Laws and Regulations* and the common law relating to the environment issued thereunder as such may be amended, replaced or superseded from time to time as it relates to the *Contractor's* performance of the *Work*.

9.6.5 The *Contractor* acknowledges that the *Owner* may employ the services of an environmental inspector for the purpose of conducting inspections of the *Place of the Work*. The *Contractor* shall grant the environmental inspector full and unimpeded access to the *Site*, at all times, and shall immediately comply with any direction issued by the Environmental Inspector, the *Consultant*, or the *Owner*, including any direction to stop Work.

GC 9.7 SPILLS REPORTING

9.7.1 Prior to commencing construction, the *Contractor* shall:

.1 submit to the *Owner* and The Ministry of the Environment, Conservation and Parks - Spill Action Plan in a form acceptable to the *Owner*, which outlines procedures for the reporting, interception, rapid clean-up, restoration of the

affected area, treatment and disposal of the pollutant or substance spilled or discharged and impacted materials including without limitation, soil, groundwater and vegetation; and

.2 post at the *Place of the Work*, in a clearly visible and accessible location, a notice containing the following information:

(1) the names and the telephone numbers of the representatives of the *Owner* and *Municipalities* to be notified in the event of a spill or discharge;

(2) the telephone number of the Spills Action Centre 1-800-268-6060;

(3) the names and the telephone numbers of the representatives of the fire, police and health and public works departments of the *Municipalities* to be notified in the event of a spill or discharge;

(4) the names and the telephone numbers of companies experienced in the control and clean-up of hazardous and non-hazardous materials and substances that would be called upon by the *Contractor* in the event of a spill or discharge; and

(5) the name and the telephone number of the *Contractor's* representative responsible for preparing, implementing, directing and supervising the clean-up of a spill or discharge.

9.7.2 In the event of a spill or discharge into the natural environment, the *Contractor* must comply, at all times, with the requirements of the Classification and Exemption of Spills and Reporting of Discharges, O. Reg. 675/98, under the *Environmental Protection Act*.

9.7.3 In the event of a spill or other discharge of a pollutant into the natural environment, every person responsible for the emission, or who causes or permits it, must forthwith notify all relevant parties of the spill or discharge. Information reported to the Ministry of the Environment, Conservation and Parks Spills Action Centre must comply with the reporting requirements stated within Classification and Exemption of Spills and Reporting of Discharges, O. Reg. 675/98, and may include the nature of the spill or discharge, the circumstances surrounding the spill or discharge, and the action taken or intended to be taken with respect to the spill or discharge.

Relevant parties to be notified in the event of a spill or discharge may include, but are not limited to:

- the Ministry of the Environment, Conservation and Parks Spills Action Centre – tel: 1-800-268-6060;

- the *Region*;
- the *Municipalities*;
- the owner of the pollutant or substance, if known;
- the person having control of the pollutant or substance, if known;
- the *Owner*; and
- the *Consultant*

GC 9.8 CERTIFICATE OF RECOGNITION (COR™) SAFETY PROGRAM

9.8.1 The Certificate of Recognition (COR™) safety program, endorsed by IHSA, has been implemented by the *Owner* as a requirement for this *Contract*.

9.8.2 The *Contractor* shall:

.1 maintain its COR™ certification;

.2 maintain its COR™ equivalency, in the form of a Letter of COR™ Equivalency issued by the IHSA; or

.3 have a valid Letter of Reciprocity issued by the IHSA, indicating that they are in the process of obtaining COR™ equivalency

for the duration of the *Contract*.

9.8.3 If, at any time during the *Contract*, the *Contractor's* COR™ certification, Letter of COR™ Equivalency or Letter of Reciprocity expires, the *Owner* may terminate the *Contract* pursuant to GC 7.1 – OWNER'S RIGHT TO PERFORM THE WORK OR STOP THE WORK OR TERMINATE THE CONTRACT, paragraph 7.1.3.

9.8.4 At any time during the term of the *Contract*, when requested by the *Owner*, the *Contractor* shall provide such evidence of compliance with the COR™ certification requirements set out in paragraph 9.8.2.

PART 10 GOVERNING REGULATIONS

GC 10.1 TAXES AND DUTIES

New Paragraphs

Add the following new paragraphs to GC 10.1:

10.1.3 Where the *Owner* is entitled to an exemption or a recovery of sales taxes, customs duties, excise taxes or *Value Added Taxes* applicable to the *Contract*, the *Contractor* shall, at the request of the *Owner*, assist with application for any exemption, recovery or refund of all such taxes and duties and all amounts recovered or exemptions obtained shall be for the sole benefit of the *Owner*. The *Contractor* agrees to endorse over to the *Owner* any cheques received from

the federal or provincial governments, or any other taxing authority, as may be required to give effect to this paragraph.

10.1.4 The *Contractor* shall maintain accurate records tabulating equipment, material and component costs reflecting the taxes, customs duties, excise taxes and *Value Added Taxes* paid.

10.1.5 Any refund of taxes, including without limitation, any government sales tax, customs duty, excise tax or *Value Added Tax*, whether or not paid, which is found to be inapplicable or for which exemption may be obtained, is the sole and exclusive property of the *Owner*.

10.1.6 The *Contractor* agrees to cooperate with the *Owner* and to obtain from all *Subcontractors* and *Suppliers* cooperation with the *Owner* in the application for any rebates, incentives or refund or exemption of any taxes, which cooperation shall include, but not be limited to, making or concurring in the making of an application for any such rebates, incentives, refund or exemption and providing to the *Owner* copies, or where required, originals of records, invoices, purchase orders and other documentation necessary to support such applications. All such rebates, incentives or refunds shall either be paid to the *Owner*, or shall be a credit to the *Owner* against the *Contract Price*, in the *Owner's* discretion.

10.1.7 Customs duties, penalties, or any other penalty, fine or assessment levied against the *Contractor* shall not be treated as a tax or customs duty for purposes of this GC 10.1 – TAXES AND DUTIES.

GC 10.2 LAWS, NOTICES, PERMITS, AND FEES

Paragraph 10.2.2

Delete in its entirety and replace with the following:

10.2.2. The *Owner* shall obtain and pay for development approvals, building permit, site plan approval and environmental approvals. Without limiting the generality of any other provision in the *Contract*, the *Contractor* shall obtain and pay for, at its sole expense and cost, all other permits, approvals, licences, certificates, charges and refundable deposits, including, without limitation, water and sanitary sewer permits, water and sewer connection charges, site alteration permits, curb cut and road cut permits, sign permits, hydro approvals, and occupancy permit necessary for the performance of the *Work* and the use and occupation of the *Work* by the *Owner* in accordance with the *Contract Documents*, the cost of which shall all be included in the *Contract Price*.

Paragraph 10.2.3

Delete in its entirety and replace with the following:

10.2.3 The *Contractor* shall comply, and shall require its employees, agents, *Subcontractors*, *Suppliers* and anyone for whom they are responsible to comply, with all *Laws and Regulations* and all of the *Owner's* policies and procedures which are or become in force and are applicable to the performance of the *Work* including, without limitation, all those relating to the preservation of the public health, occupational health and safety and to construction safety.

Paragraph 10.2.4

Delete in its entirety and replace with the following:

10.2.4 The *Contractor* shall give the required notices and comply with the *Laws and Regulations*, and industry best practices and guidelines which are or become in force during the performance of the *Work* and which relate to the *Work*, to the environment, to the preservation of public health and to construction safety. The *Contractor* shall provide the *Owner* with copies of all such required notices and related health and safety documents. The *Contractor* shall notify the Chief Building Official or the registered code agency, where applicable, of the readiness, substantial completion, and completion of the stages of construction set out in the *Ontario Building Code Act*, 1992, S.O. 1992, c.23. The *Contractor* shall be present at each *Site* inspection by an inspector or registered code agency. If any laws, ordinances, rules, regulations, or codes conflict, the more stringent shall govern.

Paragraph 10.2.5

Delete in its entirety and replace with the following:

10.2.5 Subject to GC 1.8 – DOCUMENT REVIEW BY THE CONTRACTOR, paragraph 1.8.1, the *Contractor* shall not be responsible for verifying that the *Contract Documents* are in compliance with the applicable *Laws and Regulations* relating to the Work. If the *Contract Documents* are at variance therewith, or if, subsequent to the time of bid closing, changes are made to the applicable *Laws and Regulations* which require modification to the *Contract Documents*, the *Contractor* shall advise the *Consultant* in writing requesting direction immediately upon such variance or change becoming known and no further work on the affected components of the *Contract* shall proceed until these changes to the *Contract Documents* have been obtained by the *Contractor* from the *Consultant*. The *Consultant* will make the changes required to the *Contract Documents* as provided in GC 6.1 – CHANGES IN THE WORK, GC 6.2 - CHANGE ORDER and GC 6.3 - CHANGE DIRECTIVE.

Paragraph 10.2.6

Delete in its entirety and replace with the following:

10.2.6 If the *Contractor* fails to provide the *Owner* and the *Consultant* with a *Notice in Writing*, fails to obtain direction as required in paragraph 10.2.5, or performs work that it knows or ought to have known that contravenes any *Laws and Regulations*, the *Contractor* shall be responsible for and shall correct the violations thereof, and shall bear the costs, expenses, and damages attributable to the failure to comply with the provisions of such *Laws and Regulations*

Paragraph 10.2.7

Delete in its entirety and replace with the following:

10.2.7 If, subsequent to the time of bid submission deadline, changes are made to applicable *Laws and Regulations* of *Authorities Having Jurisdiction* which were not anticipated at the time of bid closing and which affect the cost of the *Work*, either party may submit a claim in accordance with the requirements of GC 6.6 – CLAIMS FOR A CHANGE IN CONTRACT PRICE.

New Paragraphs

Add the following new paragraphs to GC 10.2:

10.2.8 Without limiting the generality of any other provision in the Contract Documents, the Contractor shall cause all certificates to be furnished that are required or given by the appropriate governmental or quasi-governmental Authorities as evidence that the Work as installed conforms with the *Laws and Regulations* of *Authorities Having Jurisdiction*, including, without limitation, certificates of compliance for the Owner's occupancy or partial occupancy. The certificates are to be final certificates giving complete clearance of the Work, in the event that such governmental or quasi-governmental Authorities furnish such certificates.

GC 10.3 PATENT FEES

Paragraph 10.3.1

Delete the words "The Contractor shall hold the Owner harmless" and replace them with "The Contractor shall indemnify, hold harmless and defend the Owner".

Delete the words "suits, or proceedings" and replace them with "suits and proceedings".

Paragraph 10.3.2

Delete the words "The Owner shall" and replace them with "The Owner will".

Delete the words “supplied to the Contractor as part of the Contract” and replace them with “supplied to the Contractor by the Owner as part of the Contract”.

GC 10.4 WORKERS’ COMPENSATION

Paragraph 10.4.1

Delete in its entirety and replace with the following:

10.4.1 Upon execution and delivery of the *Contract*, prior to commencing the *Work*, with each application for payment, at *Substantial Performance of the Contract*, and at the issuance of the final certificate for payment, the *Contractor* shall provide evidence of compliance with workers’ compensation legislation at the *Place of the Work*, including payments due thereunder.

New Paragraphs

Add the following new paragraphs to GC 10.4:

10.4.2 The *Contractor* shall ensure that each *Subcontractor* complies with the workers' compensation legislation at the *Place of the Work*. At any time during the term of the *Contract*, when requested by the *Owner*, the *Contractor* shall provide such evidence of compliance by the *Contractor* and *Subcontractors*.

10.4.3 Where a *Subcontractor* is not required to participate in the insurance plan provided for under the workers’ compensation legislation, the *Contractor* shall require the *Subcontractor* to provide a sworn declaration of its exemption as a condition of the *Subcontractor’s* admission to the *Place of Work*. When requested by the *Owner*, the *Contractor* shall require the *Subcontractor* to provide a letter of exemption under the workers’ compensation legislation.

10.4.4 If the *Contractor* at any time fails to pay any assessment or compensation required to be paid with respect to workplace safety and insurance, the *Owner* may pay such assessment or compensation and deduct the cost thereof from monies due or that may become due to the *Contractor*.

PART 11 INSURANCE

Delete in its entirety and replace with the following:

PART 11 INSURANCE AND CONTRACT SECURITY

GC 11.1 BONDS

11.1.1 On or before the execution and delivery of the *Contract*, the *Contractor* shall provide to the *Owner*:

.1 a performance bond in the amount of 100% of the *Contract Price* and conforming to Form 32 – Performance Bond under Section 85.1 of the *Construction Act*; and

.2 a labour and material payment bond in the amount of 50% of the *Contract Price* and conforming to Form 31 – Labour and Material Payment Bond under section 85.1 of the *Construction Act.*

11.1.2 Such bonds shall be issued by a surety company licensed under the *Insurance Act*, RSO 1990, c. I.8, as amended, and approved by the *Owner*, and shall be maintained in good standing until the fulfillment of the *Contract*.

GC 11.2 INSURANCE

11.2.1 Without restricting the generality of GC 13.1 – INDEMNIFICATION AND CLAIMS HANDLING, the *Contractor* shall obtain, maintain, pay the premium(s) and any deductibles for, and provide evidence of, insurance coverage as listed in Appendix D to the Request for Tender. The insurance shall be taken out with insurance companies licensed to transact business in the Province of Ontario and who are not otherwise excluded by the *Region's* Risk Manager.

11.2.2 The forms of the insurance policies shall in all respects be satisfactory to the Owner and the *Region's* Risk Manager and shall be maintained continuously from the commencement of the *Work* until the *Work* has been completed to the satisfaction of the *Owner*.

11.2.3 The policies shall be endorsed to provide the *Owner* and the *Region* with not less than 30 Days' *Notice in Writing* in advance of any cancellation, change or amendment which restricts coverage such that the *Contract* requirements are no longer met.

11.2.4 The *Contractor* shall provide the *Owner* and the *Region* with proof of insurance, by submitting an original Certificate of Insurance on the *Region's* standard "Certificate of Insurance" form, upon execution and delivery of the *Contract*, prior to commencement of the *Work* and thereafter upon request by the *Owner* or the *Region*. In lieu of an original Certificate of Insurance, the *Owner* and the *Region* may accept an electronic copy provided it is e-mailed or faxed by the *Contractor's* insurance broker directly to the *Owner* and the *Region*.

11.2.5 If the *Contractor* fails to provide or maintain insurance as required in this General Condition or elsewhere in the *Contract*, then the *Owner* and the *Region* shall have the right to provide and maintain such insurance and give evidence thereof to the *Contractor*, the *Consultant* and the *Municipalities*, as applicable, and all such costs, including administration costs, shall be payable by the *Contractor* to the *Owner* and the *Region* on demand.

PART 12 OWNER TAKEOVER

GC 12.1 READY-FOR-TAKEOVER

Delete in its entirety.

GC 12.2 EARLY OCCUPANCY BY THE OWNER

Delete in its entirety and replace with the following:

GC 12.2 EARLY OCCUPANCY BY THE OWNER

12.2.1 Upon the *Owner's* request, the *Owner* shall, at any time or times, have the right of occupying or using any part or parts of the *Work* (including, without limitation, for the purposes of installing and testing fittings and equipment), whether partially performed or entirely complete, whether completed on schedule or not, before *Substantial Performance of the Contract* has been attained, or before the completion of the *Work*.

12.2.2 In the event the *Owner* desires to exercise the privilege of occupancy or use of the *Work* as provided above, the *Contractor* shall co-operate with the *Owner* throughout in making available for the *Owner's* use such building services as heating, ventilation, cooling, water, lighting and telephone for the space or spaces to be occupied or used, and if the equipment required to furnish such services is not entirely completed at the time the *Owner* desires to occupy or use the aforesaid space or spaces, the *Contractor* shall make every reasonable effort to complete same as soon as possible to the extent that the necessary equipment can be put into operation and use and any extra cost beyond that originally required to complete the *Work* arising from such early occupancy or use shall be borne by the *Owner*.

12.2.3 In the event that the *Owner* exercises the privilege of occupancy or use of the *Work* as provided above, it agrees to do so, so as not to materially interfere with the respective work of the *Contractor*, *Subcontractors* or *Suppliers* and under the understanding that the *Owner* will be occupying premises within a construction site which will require compliance with all normal construction site requirements including, without limitation, health and safety requirements.

12.2.4 It shall be understood, however, that the *Owner's* occupancy or use of such space or spaces of the *Work* shall not constitute the *Owner's* acceptance of any *Work*, materials or equipment which are not in accordance with the requirements of the *Contract Documents*, nor affect the *Warranty Period* under the *Contract*, nor relieve the *Contractor* from its obligations, duties, responsibilities, and liabilities to complete the *Work*, nor for responsibility for loss or damage due to or arising out of defects in, or malfunctioning of, any

Work, material or equipment, nor from any other unfulfilled duties, liabilities, obligations or responsibilities under the *Contract* nor from any other duty, liability, obligation or responsibility under the *Contract* including, without limitation, the *Contractor's* warranty obligations. If, however, damage results from any act by the *Owner*, the *Owner* shall assume its share of the responsibility for such damage.

GC 12.3 WARRANTY

Paragraph 12.3.1

Delete in its entirety and replace with the following:

12.3.1 The *Contractor* agrees to remedy, at its costs, any defects in materials and workmanship which are identified by the *Owner* within the warranty period specified in Article A-13 of the Agreement – WARRANTY PERIOD, or such longer periods as may be specified for certain *Products* or *Work* or as agreed to by the *Owner* and the *Contractor* (the *"**Warranty Period***"). This warranty shall cover labour and material, including, without limitation, the costs of removal and replacement of covering materials. This warranty shall not limit extended warranties on any items of equipment or material called for elsewhere in the *Specifications* or otherwise provided by any manufacturer of such equipment or material.

Paragraph 12.3.2

Delete the word "The" at the beginning of the sentence and replace it with "Subject to GC 1.8 – DOCUMENT REVIEW BY THE CONTRACTOR, paragraph 1.8.1, the".

Paragraph 12.3.3

Delete the words "one year Warranty Period" and replace them with "*Warranty Period*".

Paragraph 12.3.4

Delete the words "one year Warranty Period" and replace them with "*Warranty Period*".

Paragraph 12.3.6

Delete the words "one year Warranty Period" and replace them with "*Warranty Period*".

New Paragraphs

Add the following new paragraphs to GC 12.3:

12.3.7 The *Contractor* shall commence to correct any deficiency within 5 *Working Days* after receiving a *Notice in Writing* from the *Owner* or the *Consultant*, and shall complete the correction as expeditiously as possible, except that in case the deficiency would prevent maintaining security or keeping basic systems

essential to the ongoing business of the *Owner* or the *Owner's* tenants, operational as designed, all necessary corrections or installation of temporary replacements shall be carried out immediately as an emergency service. Should the *Contractor* fail to attend to the service request on *Site* within four (4) hours and provide this emergency service within 24 hours of a request made in writing during the normal business hours of the *Contractor*, the *Owner* is authorized to carry out all necessary repairs or replacements at the *Contractor's* expense.

12.3.8 The carrying out of replacement work and *Making Good* of defects shall be executed at times convenient to the *Owner* and this may require work outside of normal working hours at the *Contractor's* expense.

12.3.9 Any material or equipment requiring excessive servicing during the *Warranty Period* (or free maintenance period, if applicable) shall be considered defective and the warranty (or free maintenance period) shall be deemed to take effect from the time that the defect has been corrected so as to cause excessive servicing to terminate.

12.3.10 The *Contractor* shall assign to the *Owner* all warranties, guarantees or other obligations for work, services or materials performed or supplied by any *Subcontractor*, *Supplier* or other person in or about the *Work*, with the consent of the other party thereto where required by law or by the terms of the *Contract* or engagement. Such assignment shall be in addition to, and without detracting from, the warranty rights of the *Owner* under the provisions of the *Contract Documents* for the duration of the *Warranty Period*, with the exception of any extended warranties beyond the periods specified in Article A-13 of the Agreement – WARRANTY PERIOD which are subject to paragraph 12.3.6.

12.3.11 Any specified *Warranty Period* shall not be construed as limiting the provisions of GC 13.1 - INDEMNIFICATION AND CLAIMS HANDLING.

12.3.12 The remedies of the *Owner* set forth above shall not deprive the *Owner* of any action, right or remedy otherwise available to it for breach of any provisions of the *Contract Documents* and the periods referred to above, or such longer time as may be specified elsewhere, shall not be construed as a limitation on the time in which the *Owner* may pursue such other action or remedy.

PART 13 INDEMNIFICATION AND WAIVER

Delete in its entirety and replace with the following:

PART 13 INDEMNIFICATION AND WAIVER

GC 13.1 INDEMNIFICATION, CLAIMS HANDLING AND WAIVER OF CLAIMS

13.1.1 The *Contractor* shall indemnify, hold harmless and defend the *Owner*, the *Region*, the *Consultant*, the *Municipalities*, and their respective directors, officers, council members, board members, partners, agents and employees from and against all claims, demands, losses, costs (including all legal costs), damages, actions, suits and proceedings that arise directly or indirectly out of, or are attributable to, the *Contractor's* performance of, or failure to perform, the *Work* or out of the condition of the *Work*, the *Place of the Work*, adjoining lands or highways used in connection with the performance of the *Work*, including any act or omission of the *Contractor* or its agents, any *Subcontractors*, employees, workers or other persons for whom the *Contractor* is in law responsible provided that such claims are caused by the negligent acts or omissions of the *Contractor* or its agents, any *Subcontractors*, employees, workers or other persons for whom the *Contractor* is in law responsible. This indemnification shall include any legal costs incurred by the *Owner* or the *Region* on a substantial indemnity basis, including those incurred to defend any criminal or quasi-criminal prosecutions against the *Owner* or the *Region* resulting from the actions of the *Contractor* or other persons for whom the *Contractor* is in law responsible.

13.1.2 The indemnification obligations in GC 13.1 – INDEMNIFICATION, CLAIMS HANDLING AND WAIVER OF CLAIMS shall apply provided that such claims are made by *Notice in Writing* within a period of two years from the date of *Total Performance of the Contract*, or within such longer period of time as may be prescribed by any limitation statute of the province or territory of the *Place of the Work*.

13.1.3 The *Contractor* shall respond to, and deal with, all third-party claims in a prompt, courteous and efficient manner. The *Contractor* shall contact all third-party claimants and acknowledge receipt of all third-party claims within 1 *Business Day* and in writing within 3 *Business Days* upon being notified in writing of the third-party claim. The *Contractor* shall immediately, upon receipt of any third-party claim, provide the *Region's* Controllership Office with notice of the third-party claim. The *Contractor* shall also provide the *Region's* Controllership Office with copies of all correspondence between the *Contractor* or its agents and the third-party claimant.

13.1.4 The *Contractor* shall not advise the third-party claimant that the *Owner* or the *Region* is responsible for their claim.

13.1.5 If, in the sole discretion of the *Region's* Controllership Office, acting reasonably, a claim is not being dealt with in a manner consistent with the provisions of this *Contract*, which includes, without limiting the generality of the foregoing:

.1 failure of the *Contractor* to acknowledge receipt of the third-party claim in the manner set out in paragraph 13.1.3; and

.2 failure to resolve the third-party claim to the satisfaction of *Region's* Controllership Office within 90 Days of the receipt of the third-party claim;

the *Region's* Controllership Office may appoint an insurance adjuster or other person to settle any third-party claims arising from this *Contract*. Any money paid by the *Owner* or the *Region* in satisfaction of any third-party claim determined to be the *Contractor's* responsibility, plus all associated costs incurred by the *Owner* or the *Region*, shall be deducted from monies owing to the *Contractor* by the *Owner*.

13.1.6 Notwithstanding paragraph 13.1.5 the *Owner* may withhold funds in the amount of any third-party claim received plus the greater of $1,000.00 or 25% of the amount claimed, from monies owing to the *Contractor* by the *Owner* under this *Contract* or, in the event the *Contractor* becomes insolvent, any other contract between the *Owner* and the *Contractor*.

GC 13.2 WAIVER OF CLAIMS

13.2.1 Subject to any rights or remedies provided by the *Construction Act*, as of the date of the final certificate for payment, the *Contractor* expressly waives and releases the *Owner* and the *Region* from all claims against the *Owner* and the *Region* including, without limitation, those that might arise from the negligence or breach of contract by the *Owner* except:

.1 those made in writing in compliance with the *Contract Documents* prior to the *Contractor's* application for final payment and still unsettled; and

.2 those arising from the provisions of GC 9.2 – TOXIC AND HAZARDOUS SUBSTANCES or GC 10.3 PATENT FEES.

GC 13.3 DAMAGES AND MUTUAL RESPONSIBILITY

13.3.1 If the *Owner* suffers damage in any manner because of any wrongful act or negligent act or omission of the *Contractor* or of anyone for whom the Contractor is responsible in law, then the *Owner* shall be reimbursed by the *Contractor* for such damage.

13.3.2 Claims for damage under paragraph 13.3.1 shall be made by the *Owner* by providing a Notice in Writing within reasonable time after the first observance of

such damage and if undisputed shall be confirmed by *Change Order*. Disputed claims shall be resolved as set out in PART 8 – DISPUTE RESOLUTION.

13.3.3 If the *Contractor* has caused damage to the work of an *Other Contractor* on the *Project*, the *Contractor* agrees upon receipt of a *Notice in Writing* to settle with the *Other Contractor* by negotiation or arbitration. If the *Other Contractor* makes a claim against the *Owner* or the *Region* on account of damage alleged to have been so sustained, the *Owner* shall notify the *Contractor* and may require the *Contractor* to defend the action at the *Contractor's* expense. The *Contractor* shall satisfy a final order or judgement against the *Owner* or the *Region* and pay the costs incurred by the *Owner* and the *Region* arising from such action.

NEW PARTS

Add the following new Parts to the General Conditions:

PART 14 AUDIT

GC 14.1 AUDIT

14.1.1 The *Owner*, the *Region* and the Ministry of Labour shall have the right to audit all books and records (in whatever form they may be kept, whether written, electronic or other) relating or pertaining to any work performed under the *Contract* (including any and all documents and other materials, in whatever form they may be kept, which support or underlie those books and records), kept by or under the control of the *Contractor*, including, but not limited to those kept by the *Contractor*, its employees, agents, assigns, successors and *Subcontractors*. The *Contractor* shall maintain and preserve all original books and records, together with such supporting or underlying documents and materials, for the duration of this *Contract* and for at least 2 years following the completion of this *Contract*, including any and all renewals thereof. The books and records, together with the supporting or underlying documents and materials shall be made available, upon request, to the *Owner* and the *Region*, through its employees, agents, representatives, contractors or other designees, during normal business hours at the *Contractor's* office or place of business, and the *Contractor* shall supply certified copies of payrolls and any other records required by the *Owner* or the *Region* as and when called for. In the event that no such location is available, then the books and records, together with the supporting or underlying documents and records, shall be made available for audit at a time and location in the Region of York, Ontario, which is convenient for the *Owner* and the *Region*.

14.1.2 Paragraph 14.1.1 shall not be construed to limit, revoke, or abridge any other rights, powers, or obligations relating to audit which the *Owner* and the *Region* may have by

Federal, Provincial, or Municipal statute, ordinance, regulation, or agreement, whether those rights, powers, or obligations are express or implied.

PART 15 SOFTWARE

GC 15.1 SOFTWARE

15.1.1 Without limiting the generality of any other provision in the *Contract*, the *Contractor*, as a part of the *Work*, shall *Supply* and *Install* all software required by the *Contract Documents* or included with any systems required by the *Contract Documents* ("***Software***"). The *Contractor* shall grant or obtain a perpetual, irrevocable non-exclusive royalty-free license to use the Software sufficient for the *Owner's* purposes.

FORMS

Form 1 Preliminary Estimate for Payment

Form 2 Proper Invoice

Form 3 Declaration to be provided in connection with GC 5.4.7.4, GC 5.5.2.6 and GC 5.6.5.4

Form 4 Release to be provided in connection with GC 5.4.7.3

Form 5 Release to be provided in connection with GC 5.6.5.3

Form 6 Statutory Declaration to be provided in connection with GC 5.5.2.4

Form 7 Release to be provided in connection with GC 5.5.2.5

Form 1

CONTACT NO. [*Contract No.*] / PURCHASE ORDER NO. [*Purchase Order #*]

[*Brief Description of Contract*]

CONTRACTOR: [*Contractor Name*] **WORK PERIOD:** [*start date*] to [*end date*]

[*Division / Part Reference*]

Item #	Spec. Reference	Item Description	Unit	Unit Price	Tender Quantity	Tender Amount	Previous Quantity	Current Quantity	Quantity to Date	Previous Amount	Current Amount	Amount to Date	% Complete	Projected Final Quantity	Projected Final Cost	Cost Over/Under
1				$		$				$	$	$	%		$	$
2				$		$				$	$	$	%		$	$
3				$		$				$	$	$	%		$	$
4				$		$				$	$	$	%		$	$
5				$		$				$	$	$	%		$	$
6				$		$				$	$	$	%		$	$
7				$		$				$	$	$	%		$	$
8				$		$				$	$	$	%		$	$
9				$		$				$	$	$	%		$	$
10				$		$				$	$	$	%		$	$
11				$		$				$	$	$	%		$	$
12				$		$				$	$	$	%		$	$
13				$		$				$	$	$	%		$	$
14				$		$				$	$	$	%		$	$
								Total		**$**	**$**	**$**			**$**	**$**

Form 2

CONTACT NO. [*Contract No.*] / PURCHASE ORDER NO. [*Purchase Order #*]

[*Brief Description of Contract*]

CONTRACTOR: [*Contractor Name*]
[*Contractor Address*]
BILLING CONTACT INFORMATION: [*Name, Title*]
[*Phone Number Fax Number, Email Address*]
[*Mailing Address*]
GST/HST REGISTRATION #: [*Contractor Name*]

INVOICE NO. [*Invoice Number*]
INVOICE DATE: [*Invoice Date*]
WORK PERIOD: [*start date*] to [*end date*]

Division / Part	Tender Amount	Current Amount	Amount Paid	Amount to Date	% Complete
Division 1 – General Requirements	$	$	$	$	
Part E - Electrical	$	$	$	$	
Cash Allowances	$	$	$	$	
Change Orders	$	$	$	$	
Credits (e.g. asphalt payment adjustment)	$	$	$	$	
Deductions (e.g. asphalt payment adjustment)	$	$	$	$	
SUBTOTAL	$	$	$	$	
HST (13%)	$	$	$	$	
TOTAL CONTRACT	$	$	$	$	

Total value of work completed to end of Work Period	$	$	$
Less 10% Statutory Holdback	$	$	$
Less Maintenance Security (if applicable)	$	$	$
Less Lien Holdback	$	$	$
Subtotal	$	$	$
Plus HST	$	$	$
Total Amount to be paid to Contractor	**$**		

By submitting this invoice, the Contractor declares that:

1. all assessment and levies under the Employment Standards Act, the Workplace Safety and Insurance Act or other social or labour legislation in respect of this Contract have been duly paid and the work is free of all liens and encumbrances;
2. all claims for damage to property or injury to persons in respect of this Contract for which the Contractor has received notice have been fully paid or settled; and

3. all accounts for labour, subcontracts, products, construction machinery and equipment and other indebtedness which may have been incurred by the Contractor in the performance of the work under this Contract, and for which the Region might in any way be held responsible, have been fully paid except for statutory and contractual holdback monies properly retained, payments deferred by agreement, or payment withheld by reason of legitimate dispute which has been identified to the party or parties from whom payment has been withheld.

CONTACT NO. [*Contract No.*] / PURCHASE ORDER NO. [*Purchase Order #*]

[*Brief Description of Contract*]

CONTRACTOR: [*Contractor Name*] **WORK PERIOD:** [*start date*] to [*end date*]

[*Division / Part Reference*]

Item #	Spec. Reference	Item Description	Unit	Unit Price	Tender Quantity	Tender Amount	Previous Quantity	Current Quantity	Quantity to Date	Previous Amount	Current Amount	Amount to Date	% Complete	Projected Final Quantity	Projected Final Cost	Cost Over/Under
1				$		$				$	$	$	%		$	$
2				$		$				$	$	$	%		$	$
3				$		$				$	$	$	%		$	$
4				$		$				$	$	$	%		$	$
5				$		$				$	$	$	%		$	$
6				$		$				$	$	$	%		$	$
7				$		$				$	$	$	%		$	$
8				$		$				$	$	$	%		$	$
9				$		$				$	$	$	%		$	$
10				$		$				$	$	$	%		$	$
11				$		$				$	$	$	%		$	$
12				$		$				$	$	$	%		$	$
13				$		$				$	$	$	%		$	$
14				$		$				$	$	$	%		$	$
								Total		**$**	**$**	**$**			**$**	**$**

Form 3

DECLARATION OF KNOWN ADJUDICATIONS

I, _____ of _____ declare that:
(name of declarant) *(name of contractor)*

1. I am the _____ of _____
(title or position of declarant) *(name of contractor)*
and as such have knowledge of the facts herein declared.

2. That _____ entered into Contract No. _____
(name of contractor) *(contract number)*
with The Regional Municipality of York Police Service Board for:

_____
(description of contract)

3. That _____ is not engaged in any adjudication with
(name of contractor)
respect to Contract No. _____ except for those adjudications
(contract number)
identified in Schedule A – Known Adjudications.

4. That _____ is not aware of any adjudication in which any
(name of contractor)
subcontractors or suppliers are engaged in with respect to Contract No. _____
(contract number)
except for those adjudications identified in Schedule A – Know Adjudications, and has made reasonable enquiries to confirm this.

_____ _____
Date Signature of Declarant

Schedule A - Known Adjudications

ODACC File No.	Claimant	Respondent	Date Adjudicator Received Documents pursuant to section 13.11 of the *Construction Act*

Form 4

RELEASE

IN THE MATTER OF a contract for ....., known as Contract No. ....., entered into between The Regional Municipality of York Police Service Board (the "**Board**") and ..... (the "**Contractor**").

KNOW ALL MEN BY THESE PRESENTS THAT the Contractor, on its own behalf and on behalf of its Subcontractors, and their respective heirs, executors, administrators, successors and assigns, as the case may be (the "**Releasor**"), for and in consideration of the payment or promise to pay the statutory holdback under the above-mentioned contract, and for other good and valuable consideration, hereby remises, releases and forever discharges the Board, The Regional Municipality of York, and their directors, officers, council members, board members, partners, employees, agents, assigns and successors (the "**Releasees**"), of and from all manner of actions, causes of action, suits, debts, dues, sums of money, claims and demands whatsoever at law or in equity which the Releasor ever had, now has, or may have by reason of the above-mentioned contract, save and except any claim which the Releasor has arising out of:

1. Claims pursuant to PART 8 – DISPUTE RESOLUTION made prior to Substantial Performance of the Contract and still unsettled, as listed in the attached "Schedule of Outstanding Claims"
2. The retention by the Board of the maintenance security, if applicable
3. Pending/Unresolved Change Orders as listed in the attached "Schedule of Pending/Unresolved Change Orders"
4. Quantities which have not been finalized

With respect to item 1 above, the Contractor acknowledges and agrees that none of the claims listed in the attached "Schedule of Outstanding Claims" have been admitted, acknowledged or accepted by the Board as valid claims. The Contractor further acknowledges that nothing in this Release prevents or estops the Board from disputing the validity, timeliness and quantum of the claims listed therein.

Dated this ..... day of ....., 20..... .

WITNESSED BY	SIGNED, SEALED AND DELIVERED
_____	_____ (Seal)
_____	_____ (Seal)

Schedule of Outstanding Claims

Description of Dispute	Value of Dispute

Schedule of Pending / Unresolved Change Orders

CO #	Description of Change Order	Value of Change Order

Form 5

RELEASE

IN THE MATTER OF a contract for ....., known as Contract No. ....., entered into between The Regional Municipality of York Police Service Board (the "**Board**") and ..... (the "**Contractor**").

KNOW ALL MEN BY THESE PRESENTS THAT the Contractor, on its own behalf and on behalf of its Subcontractors, and their respective heirs, executors, administrators, successors and assigns, as the case may be (the "**Releasor**"), for and in consideration of the payment or promise to pay the statutory holdback under the above-mentioned contract, and for other good and valuable consideration, hereby remises, releases and forever discharges the Board, The Regional Municipality of York, and their directors, officers, council members, board members, partners, employees, agents, assigns and successors (the "**Releasees**"), of and from all manner of actions, causes of action, suits, debts, dues, sums of money, claims and demands whatsoever at law or in equity which the Releasor ever had, now has, or may have by reason of the above-mentioned contract, save and except any claim which the Releasor has arising out of:

1. Claims pursuant to PART 8 – DISPUTE RESOLUTION made prior to Total Performance of the Contract and still unsettled, as listed in the attached "Schedule of Outstanding Claims"
2. The retention by the Board of the maintenance security, if applicable
3. Pending/Unresolved Change Orders as listed in the attached "Schedule of Pending/Unresolved Change Orders"
4. Quantities which have not been finalized

With respect to item 1 above, the Contractor acknowledges and agrees that none of the claims listed in the attached "Schedule of Outstanding Claims" have been admitted, acknowledged or accepted by the Board as valid claims. The Contractor further acknowledges that nothing in this Release prevents or estops the Board from disputing the validity, timeliness and quantum of the claims listed therein.

Dated this ..... day of ....., 20..... .

WITNESSED BY	SIGNED, SEALED AND DELIVERED
_____	_____ (Seal)
_____	_____ (Seal)

Schedule of Outstanding Claims

Description of Dispute	Value of Dispute

Schedule of Pending / Unresolved Change Orders

CO #	Description of Change Order	Value of Change Order

Form 6

DECLARATION OF COMPLETION OF SUBCONTRACT AND PAYMENT OF ACCOUNTS

I, ... of .....
(name) *(name of subcontractor)*

declare that:

1. I am the ..... of .....
(title or position) *(name of subcontractor)*
and as such have knowledge of the facts herein declared.

2. ..... entered into a subcontract with
(name of subcontractor)
..... for the supply of the following services and/or
(name of contractor)
materials: .....
(description of work)
for Contract No. ..... located at .....
(contract number) *(contract location)*
.....

3. The supply of all services and materials required to be furnished under the subcontract have been completed in an acceptable manner.

4. All assessments and levies under the Employment Standards Act, the Workplace Safety and Insurance Act or other social or labour legislation in respect of the subcontract have been duly paid, and the work is free of all liens and encumbrances.

5. All claims for damage to property or injury to persons in respect of the subcontract, and of which the above named subcontractor has received notice, have been fully paid or settled.

6. All accounts for labour, subcontracts, Projects, construction machinery and equipment and other indebtedness which may have been incurred by the subcontractor in the performance of the work under the subcontract, and for which The Regional Municipality of York Police Service Board might in any way be held responsible, have been duly paid except for statutory and contractual holdback monies properly retained.

7. The above named subcontractor is not engaged in, nor aware of, any adjudication with respect to the above-mentioned subcontract or Contract and has made reasonable enquires to confirm this.

Declared before me in .....
City/Town
in the Province of ..... _____
(Province) *Signature of Declarant*
on the ..... day of ....., 20.....

_____
A Commissioner, etc.

Form 7

RELEASE

IN THE MATTER OF a subcontract for .....,
entered into between ..... (the "**Contractor**") and
..... (the "**Subcontractor**") in relation to Contract No. .....
....., entered into between The Regional Municipality of York Police Service Board (the "**Board**") and the Contractor, which subcontract has been completed for the price of
..... (exclusive of tax).

KNOW ALL MEN BY THESE PRESENTS THAT the Contractor and Subcontractor, on their own behalf and on behalf of their respective Subcontractors, heirs, executors, administrators, successors and assigns, as the case may be (the "**Releasors**"), for and in consideration of the payment or promise to pay the statutory holdback under the above-mentioned subcontract, and for other good and valuable consideration, hereby remise, release and forever discharge the Board, The Regional Municipality of York, and their directors, officers, council members, board members, partners, employees, agents, assigns and successors (the "**Releasees**"), of and from all manner of actions, causes of action, suits, debts, dues, sums of money, claims and demands whatsoever at law or in equity which the Releasors ever had, now have, or may have by reason of the above-mentioned subcontract, save and except any claim which the Releasors have arising out of:

1. Claims pursuant to PART 8 – DISPUTE RESOLUTION made prior to the date of completion of the subcontract and still unsettled, as listed in the attached "Schedule of Outstanding Claims"
2. The retention by the Board of the maintenance security, if applicable

With respect to item 1 above, the Contractor and Subcontractor acknowledge and agree that none of the claims listed in the attached "Schedule of Outstanding Claims" have been admitted, acknowledged or accepted by the Region as valid claims. The Contractor and Subcontractor further acknowledges that nothing in this Release prevents or estops the Board from disputing the validity, timeliness and quantum of the claims listed therein.

Dated this ..... day of ....., 20.....

WITNESSED BY	SIGNED, SEALED AND DELIVERED
	CONTRACTOR
_____	_____ (Seal)
	SUBCONTRACTOR
_____	_____ (Seal)

Schedule of Outstanding Claims

Description of Dispute	Value of Dispute

T-24-33
APPENDIX D
INSURANCE REQUIREMENTS

Contractor's Insurance

The Contractor shall obtain, maintain, pay the premium(s) and any deductibles for, and provide evidence of the following insurance coverage, taken out with insurance companies licensed to transact business in the Province of Ontario and who are not otherwise excluded by the Region's Insurance and Risk Manager.

Commercial General Liability Insurance

Commercial General Liability ("**CGL**") insurance with limits of not less than $5,000,000.00 inclusive per occurrence for bodily and personal injury, death, and damage to property including loss of use thereof. The CGL insurance shall include Cross Liability and Severability of Interest clauses, Products and Completed Operations coverage (minimum 24 months), Owner's and Contractor's Protective and a Standard Non-Owned Automobile endorsement including standard contractual liability coverage.

The following parties shall be included as Additional Insured parties on the CGL policy:

- the Owner
- YRP
- the Region
- the Consultant
- the Municipalities

Automobile Liability Insurance

Automobile liability insurance in respect of licensed vehicles shall have limits of not less than $5,000,000.00 inclusive per occurrence for bodily injury, death, and damage to property. Coverage shall be in the form of a standard owner's form automobile policy providing third party liability and accident benefits insurance and covering licensed vehicles owned and/or leased or operated by or on behalf of the Contractor.

Contractors' Equipment Insurance

All Risks Contractors' Equipment coverage, insuring the full amount of the Contractor's equipment, including all owned, non-owned and mobile equipment.

Property and Boiler & Machinery Insurance

(i) All Risks Builder's Risk insurance insuring not less than the sum of the amount of the Estimated Contract Price and the full value of Products that are specified to be provided by the Owner, YRP or the Region for incorporation into the Work. The Contractor, the Owner, YRP and the Region shall be Named Insureds on the policy. This policy shall be maintained from the commencement of the Work until Substantial Performance of the Contract has been attained, as set out in the Certificate of Substantial Performance.

(ii) Standard Comprehensive Boiler & Machinery insurance insuring the interests of the Contractor, the Owner, YRP and the Region for not less than the replacement value of boiler and pressure vessels forming part of the Work. Should testing be required as part of the Contract, the policy shall be extended to cover such testing. If production machinery is involved in the

performance of the Work, the policy shall be extended to cover such machinery. The policy shall contain a Joint Loss Agreement clause and shall be maintained from the commencement of the Work until Substantial Performance of the Contract has been attained, as set out in the Certificate of Substantial Performance.

The policies shall provide that, in the event of a loss or damage, payment shall be made to the Owner, YRP, the Region and the Contractor as their respective interests may appear. The Contractor shall act on behalf of the Owner, YRP, the Region and itself for the purpose of adjusting the amount of such loss or damage payment with the insurers. When the extent of the loss or damage is determined, the Contractor shall proceed to restore the Work. Loss or damage shall not affect the rights and obligations of either party under the Contract except that the Contractor shall be entitled to such reasonable extension of Contract Time relative to the extent of the loss or damage as the Owner may decide in accordance with the General Conditions of the Contract.

The Contractor shall be entitled to receive from the Owner, in addition to the amount due under the Contract in respect of Work performed prior to the date of the occurrence of the loss or damage, the amount at which the Owner's interest in restoration of the Work has been appraised to the extent paid by the insurer, such amount to be paid as the restoration of the Work proceeds and in accordance with the requirements of the General Conditions of the Contract.

Contractor's Pollution Liability Insurance

Contractor's Pollution Liability insurance is required with limits of not less than $2,000,000.00 with the Owner, YRP and the Region added as Additional Insureds. This policy shall be maintained from the commencement of the Work until Substantial Performance of the Contract has been attained, as set out in the Certificate of Substantial Performance.

The form of Contractor's Pollution Liability may be an occurrence or claims-made form. Should the policy be on a claims-made form, the Contractor must provide a two-year extended reporting period.

The Owner will accept in place of the above-mentioned insurance coverage, a combination of primary liability limits and umbrella insurance or excess liability limits which meet the CGL, General Aggregate and Automobile Liability limits noted above.

T-24-33
APPENDIX E
BID BOND

BID BOND

BOND NO. _____ 10% of the Bid Price

KNOW THEREFORE ALL MEN BY THESE PRESENTS that _____ (hereinafter called the "Principal") and _____ a corporation created and existing under the laws of _____ and duly authorized to transact the business of Suretyship in _____, (hereinafter called the "Surety") are held and firmly bound unto The Regional Municipality of York Police Service Board (hereinafter called the "Obligee"), in the amount of 10% of the Bid Price, lawful money of Canada, for the payment of which sum, well and truly to be made, the Principal and the Surety bind themselves and their respective heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS the Principal has submitted a written tender or proposal to the Obligee for Contract No. T-24-33 for the construction of a helicopter hangar and related interior and exterior spaces in the Town of East Gwillimbury, Ontario.

NOW THEREFORE, the condition of the foregoing obligation is such that, if the Principal shall have the tender or proposal accepted within the period of irrevocability of the tender, as may be amended by addenda issued by the Obligee, the said Principal will, within the time required, enter into a formal contract with the Obligee in a form satisfactory to the Obligee, (hereinafter called the "Contract"), and give the specified security to secure the performance of the terms and conditions of the Contract, then this obligation shall be void; otherwise the Principal and the Surety will pay unto the Obligee the difference in money between the amount of the bid of the said Principal and the amount for which the Obligee legally contracts with another party to perform the work if the latter amount be in excess of the former.

The Surety shall not be liable for a greater sum than the specified penalty of this Bond. Any suit under this Bond must be instituted before the expiration of six months from the date of this Bond.

IN WITNESS WHEREOF, the Principal and the Surety have hereunto affixed their corporate seals and caused their presents to be signed by their duly authorized officers.

DATED THIS _____ day of _____, _____.

_____

Name – Surety

_____

Signature of Authorized Person Signing for Surety
I have authority to bind the Corporation

(Place Surety corporate seal above)

_____

Name – Principal

_____

Signature of Authorized Person Signing for Principal
I have authority to bind the Corporation

(Place Principal corporate seal above)

T-24-33
APPENDIX F
UNDERTAKING TO BOND

UNDERTAKING TO BOND

CONTRACT NO. T-24-33

TO: THE REGIONAL MUNICIPALITY OF YORK POLICE SERVICE BOARD (the "Board")

AND TO: _____ (the "Contractor")

We, the undersigned, hereby undertake and agree to become bound as Surety for the Contractor in:

(a) a Performance Bond in an amount equal to 100% of the Bid Price and conforming to Form 32 - Performance Bond under Section 85.1 of the *Construction Act*; and

(b) a Labour and Material Payment Bond in an amount equal to 50% of the Bid Price and conforming to Form 31 - Labour and Material Payment Bond under Section 85.1 of the *Construction Act*,

if the bid for the construction of a helicopter hangar and related interior and exterior spaces in the Town of East Gwillimbury, Ontario is accepted by the Board.

If the above-mentioned bid is accepted, the undersigned will execute the bonds within 8 business days of notification of acceptance of the bid.

DATED this _____ day of _____, _____.

_____

Name - Surety

(Place Surety corporate seal above)

_____

Signature of Authorized Person Signing for Surety

I have authority to bind the Corporation

No Appendix G

T-24-33
APPENDIX H
AODA TRAINING FORM

AODA TRAINING CERTIFICATE

TO: THE REGIONAL MUNICIPALITY OF YORK POLICE SERVICE BOARD (the "Board")

RE: Agreement dated_____ between [CONTRACTOR NAME] and the Board (the "Agreement")

Pursuant to Section 7 and Section 80.49 of *Ontario Regulation 191/11, Integrated Accessibility Standards* (the "**Regulations**"), made under the AODA, the Vendor shall ensure that all of its employees, agents, volunteers, or others engaged by the Vendor in the delivery of goods, services and/or facilities under this Contract receive training in connection with the provision of these goods, services and/or facilities to persons with disabilities. Such training shall be provided in accordance with the Regulations and shall include, without limitation, a review of the purposes of the AODA, the requirements of the Regulations and the *Human Rights Code* as it pertains to persons with disabilities.

The Vendor represents and certifies to the Board that:

1. the AODA training provided by the Vendor includes the following:
    a. A review of the purposes of the AODA, the requirements of the Regulations and the *Human Rights Code*;
    b. How to interact and communicate with persons with various types of disability including persons with disabilities who use assistive devices or require the assistance of a guide animal, or a support person.
    c. How to use equipment or devices that are available on the premises that may assist in the provision of goods and services to a person with a disability.
    d. What to do if a person with a particular type of disability is having difficulty accessing the Vendor's goods or services.
2. the Vendor, its employees, agents, volunteers, and other persons engaged by the Vendor in the provision of goods, services and/or facilities under this Contract have received the required AODA training;
3. the required AODA training is delivered on an ongoing basis, including new employees, agents, volunteers and other persons engaged by the Vendor;
4. the Vendor keeps a record of the training provided and the number of individuals who have received AODA training;
5. under this Contract the AODA training is required by the following number of individuals: _____; and
6. the following number of individuals have received AODA training as of the date of this Certificate: _____

The source of the AODA training provided by the Vendor is:

- ☐ York Region Accessible Customer Service Training
- ☐ Integrated Accessibility Standards Training
- ☐ Alternate training program that meets the requirements listed above

Signature: _____ **Vendor Name: _____**

Name: _____ **Date: _____**

Rev. (01/18)

THE REGIONAL MUNICIPALITY OF YORK

POLICE SERVICE BOARD

REQUEST FOR TENDER

T-24-33

GENERAL CONTRACTOR FOR THE CONSTRUCTION OF A HELICOPTER HANGAR AND RELATED INTERIOR AND EXTERIOR SPACES IN THE TOWN OF EAST GWILLIMBURY, ONTARIO

CLOSING TIME: ELECTRONIC BID SUBMISSIONS must be received by the Bidding System, prior to: 2:00:00 p.m. (14:00:00 Hours) local time, on Tuesday, October 1, 2024.

Bidders who, due to a disability, require an accommodation in order to participate in the procurement process should contact the Procurement Analyst as specified on the Bidding System.

York Regional Police, Purchasing Unit, 47 Don Hillock Drive, Aurora, ON, L4G 0S7.
yrp.bidsandtenders.ca

Table of Contents

PART 1 INVITATION AND SUBMISSION INSTRUCTIONS

1.1 Invitation to Bidders

This Request for Tenders (the "**RFT**") is an invitation by The Regional Municipality of York Police Service Board (the "**Board**") to prospective bidders to submit bids for the construction of a helicopter hangar and related interior and exterior spaces in the Town of East Gwillimbury, Ontario, as further described in Section A of the RFT Particulars (Appendix A) (the "**Deliverables**").

The following is a list of prequalified bidders that have been approved to submit bids in response to this RFT under Request for Prequalification No. PQ-24-07:

- Area Construction Inc.
- BLT Construction Services
- Buttcon Limited
- Corebuild Construction Ltd.
- DNN Contracting Inc.
- Ledcor Construction Limited
- M.J. Dixon Construction Limited
- Matheson Constructors Limited
- Maystar General Contractors Inc.
- Walsh Canada

Any bids received from bidders not listed above shall be rejected from further consideration.

1.2 Communications with the Board, the Region and YRP

To contact the Board in relation to this RFT, bidders must register for this bid opportunity in the Board's bidding system at https://yrp.bidsandtenders.ca (the "**Bidding System**") and initiate communication electronically using the 'Submit a Question' function. The Board will not accept communications from bidders by any other means except as specifically stated in the RFT.

Bidders and their representatives are not permitted to contact any employees, officers, agents, consultants, elected or appointed officials or other representatives of the Board, the Regional Municipality of York (the "Region") or York Regional Police ("YRP") in connection with this RFT, other than the Board's Procurement Analyst identified in the Bidding System. Bidders should only contact the Procurement Analyst where specifically

instructed to in this RFT. Failure to adhere to this rule may result in the disqualification of the bidder and the rejection of their bid.

1.3 RFT Timetable

Refer to the Bidding System for a list of key dates in this RFT process. The dates may be changed by the Board at any time, in its sole discretion.

1.4 Mandatory Bidders' Meeting

Bidders are required to attend a mandatory Bidders' meeting to be held on the date, time on the Bidding System. The meeting will be held online through Microsoft Teams. No other meeting will be scheduled. It is the responsibility of Bidders to understand all aspects of this RFT prior to submitting their Bid.

Bidders have been contacted through email by YRP's Procurement Analyst. As Bidders' respond back to YRP's Procurement Analyst, they are emailed a meeting invite which includes the Microsoft Teams link for the meeting.

Bidders are encouraged to submit any questions to the Board using the 'Submit a Question' feature on the Bidding System a minimum of 24 hours before the site visit / information meeting.

During the mandatory meeting, YRP's Procurement Analyst will take attendance of all Bidders' that are on the video conference. Bids will be accepted only from Bidders who have been documented as attending the mandatory meeting. Where a Bidder has not attended the mandatory meeting, that Bidder's Bid will be rejected.

Bidders are prohibited from the use of any technology, including without limitation artificial intelligence, to record the content of any site visit / information meeting without prior written authorization from the Procurement Analyst. Failure to adhere to this rule may result in the disqualification of the bidder and the rejection of their bid.

1.5 Electronic Submissions

Bids must be submitted electronically through the Bidding System. Any bids not received through the Bidding System will not be accepted by the Board and will be returned to the bidder unopened.

Bidders must have a bidding system vendor account and be registered as a plan taker for this procurement, which will enable them to download the RFT documents and addenda, receive notifications, and submit their bids electronically through the Bidding System.

1.6 Closing Time

Bids must be submitted, and received by the Board, on or before the bid closing date and time indicated on the Bidding System (the "**Closing Time**"), which will be determined by the Bidding System clock. Bidders are cautioned that the timing of their submission is based on when the bid is received in the Bidding System, not when it is submitted by the bidder.

As transmission can be delayed due to internet traffic, file transfer size, transmission speed or other technical factors, the Board recommends that bidders allow sufficient time to upload their bid and to resolve any issues that may arise.

Bidders will receive a confirmation email from the Bidding System once they have successfully submitted their bid. Bidders should not consider their bid to have been submitted until they have received the confirmation email.

The Board accepts no responsibility if the bidder is unable to submit its bid before the Closing Time, for any reason whatsoever, including computer system failures of either the bidder or the Board's service provider. The bidder agrees that the Board shall have no liability for delays caused by internet/network traffic, degraded operation or failure of any computer system element including, but not limited to, any computer system, power supply, telephone or data connection or system or software or browser of any type whatsoever.

1.7 Amendment of Bid

Bidders may amend their bids prior to the Closing Time.

To amend a bid after it has been submitted, the bidder must withdraw its bid from the Bidding System, make the necessary revisions, and resubmit its bid before the Closing Time.

The bidder is solely responsible for ensuring that the amended bid is received in the Bidding System by the Closing Time.

1.8 Withdrawal of Bid

Bidders may withdraw their bid at any time prior to the Closing Time.

To withdraw a bid prior to the Closing Time, the bidder must withdraw their bid through the Bidding System.

Bidders are not permitted to withdraw bids after the Closing Time.

1.9 Irrevocability Period

Bids shall be irrevocable for a period of sixty (60) days after the Closing Time.

1.10 Contact for Technical Issues

Bidders that encounter technical issues with the Bidding System should contact technical support at bids&tenders™ via email at support@bidsandtenders.ca and copy the Procurement Analyst.

[End of Part 1]

PART 2 EVALUATION AND SELECTION

The Board will conduct the evaluation of bids in the following stages:

2.1 Stage I – Mandatory Submission Requirements

Stage I will consist of a review to determine which bids comply with all of the mandatory submission requirements as set out in Section C of the RFT Particulars (Appendix A).

Other than inserting the information requested on the mandatory submission forms set out in the RFT, a bidder may not make any changes to any of the forms. Any bid containing any such changes, whether on the face of the form or elsewhere in the bid, may be disqualified at the Board's sole discretion.

2.2 Stage II – Evaluation

Stage II will consist of the following sub-stages:

2.2.1 Mandatory Technical Requirements

The Board will review the bids to determine whether the mandatory technical requirements as set out in Section D of the RFT Particulars (Appendix A) have been met. Questions or queries on the part of the Board as to whether a bid has met the mandatory technical requirements will be subject to the verification and clarification process set out in subsection 2.2.2.

Bids that do not meet all of the mandatory technical requirements will be rejected.

2.2.2 Verify, Clarify, and Supplement

The Board may, in its sole discretion, request further information from the bidder or third parties in order to verify, clarify, or supplement the information provided in the bid.

2.3 Stage III – Pricing

Stage III will consist of evaluating the submitted prices for each compliant bid in accordance with the evaluation method set out in Appendix B - Pricing. The evaluation of pricing will be undertaken after the evaluation of mandatory requirements has been completed.

2.4 Stage IV – Selection of Lowest Compliant Bidder

2.4.1 Selection of Lowest Compliant Bidder

Subject to the reserved rights of the Board, the compliant bidder with the lowest price will be selected to enter into a contract with the Board for the provision of the Deliverables. In the event of a tie the selected bidder will be determined in accordance with the Board's Tied Bid Procedure.

2.4.2 Notice of Selection

The Board will notify the selected bidder, in writing, that its bid has been accepted.

The selected bidder shall satisfy all of the pre-conditions of award specified in Section E of the RFT Particulars (Appendix A), within 10 business days of the Board's request. This provision is solely for the benefit of the Board and may be waived by the Board.

2.4.3 Failure to Satisfy Pre-Conditions of Award

If the selected bidder fails to satisfy any of the pre-conditions of award listed in Section E of the RFT Particulars (Appendix A) within 10 business days of the Board's request, the Board may, without incurring any liability, proceed with the selection of another bidder and pursue all other remedies available to the Board.

[End of Part 2]

PART 3 TERMS AND CONDITIONS OF THE RFT PROCESS

3.1 General Information and Instructions

3.1.1 RFT Incorporated into Bid

All provisions of the RFT are deemed to be accepted by the bidder and incorporated into its bid. A bidder who submits conditions, options, variations or contingent statements inconsistent with the terms set out in the RFT, including the terms of the contract attached as Appendix C, either as part of its bid or after receiving notice of selection, may be disqualified. If a bidder is not disqualified despite such changes or qualifications, the provisions of the RFT, including the contract attached as Appendix C, will prevail over any such changes or qualifications in the bid.

3.1.2 Bidders to Follow Instructions

Bidders should structure their bids in accordance with the instructions in the RFT. Where information is requested in the RFT, bids should reference the applicable section numbers of the RFT.

3.1.3 Bids in English

Bids shall be in English only.

3.1.4 No Incorporation by Reference

The entire content of a bid should be submitted in a fixed format, and the content of websites or other external documents referred to in a bid but not attached will not be considered to form part of the bid.

3.1.5 Past Performance

In the selection process, the Board may consider the bidder's past performance or conduct on previous contracts with the Board.

3.1.6 Information an Estimate

Any quantities shown or data contained in the RFT are estimates only, and are for the sole purpose of indicating the general scale and scope of the Deliverables. It is the bidder's responsibility to obtain all information necessary to prepare a bid in response to this RFT.

3.1.7 Errors and Omissions

The Board shall not be held liable for any errors or omissions in the RFT. While the Board has used reasonable efforts to ensure an accurate representation of information in the RFT, the information contained in the RFT is supplied solely as a guideline for bidders. The Board does not guarantee or warrant that the information is accurate, comprehensive or exhaustive. Nothing in the RFT is intended to relieve bidders from forming their own opinions and conclusions with respect to the matters addressed in the RFT.

3.1.8 Bidders to Bear Their Own Costs

Bidders shall bear all costs associated with or incurred in preparing and presenting their bid including, if applicable, costs incurred for interviews or demonstrations.

3.1.9 Bid to be Retained by the Board

The Board will not return the bid or any accompanying documentation submitted by a bidder.

3.1.10 No Guarantee of Volume of Work or Exclusivity of Contract

The Board makes no guarantee of the value or volume of Deliverables that may be required. Any contract entered into as a result of this RFT will not be an exclusive contract for the provision of the described Deliverables. The Board may contract with others for goods and services the same as or similar to the Deliverables or may obtain such goods and services internally.

3.1.11 Procurement Bylaws

Bids will be called, received, evaluated, accepted and processed in accordance with the Board's Purchasing Bylaw (the "Bylaw"). By submitting a bid, the bidder agrees to be bound by the terms and conditions of the Bylaw and any amendments from time to time, as fully as if they were incorporated herein. To view a copy of the Board's Purchasing Bylaw: https://www.yrp.ca/en/services/resources/Purchasing_Bylaw_10-17_-_Signed.pdf.

3.1.12 Suspended Suppliers

The Board may not open bids received from bidders that are suspended pursuant to the Board's supplier suspension protocol.

3.2 Blackout Period

Bidders shall not initiate communication with any Board, Region or YRP officials, consultants or employees with respect to this RFT from the Closing Time up to, and including, the date that the contract has been awarded (the "**Blackout Period**") or the RFT has been cancelled. Any communication initiated by a bidder during the Blackout Period to any Board, Region or YRP official, consultant or employee other than the Procurement Analyst may be grounds for disqualifying the offending bidder from consideration for the award of this or any future Board procurements.

3.3 Questions and Clarifications

If a bidder finds discrepancies or omissions in the RFT, or is in doubt as to its meaning, the bidder shall direct its questions, or seek additional information, in writing using the 'Submit a Question' function on the Bidding System on or before the question deadline indicated on the Bidding System (the "**Question Deadline**"). It is the responsibility of the bidder to seek clarification on any matter it considers to be unclear. The Board is not responsible for any misunderstanding on the part of the bidder concerning this RFT or its process.

The Board shall make reasonable efforts to provide bidders with written responses to questions that are submitted during the RFT process, subject to the provisions of this section.

Questions and answers will be distributed in the form of an addendum. The Board may, in its sole discretion:

- edit question(s) for clarity;
- exclude questions that are either unclear, irrelevant or inappropriate;
- answer similar questions from various bidders only once; and
- not answer questions received after the Question Deadline.

3.4 All New Information by Way of Addenda

All amendments, new information, and clarifications to the RFT will be posted to the Bidding System in the form of an addendum.

No employee or agent of the Board is authorized to amend or waive the requirements of this RFT in any way unless the amendment or waiver is issued in an addendum. Under no circumstances shall bidders rely upon any information or instructions from the Board, the Region or YRP, their employees, or their agents, unless the information or instructions are provided in writing in the form of an addendum.

The Board will notify bidders of the issuance of addenda via email. The onus remains with bidders to ensure that they have downloaded all addenda prior to submitting their bid. The Board will not be liable for misdirected notices of addenda resulting from a bidder's failure to update its contact information in the Bidding System or check for addenda prior to submitting its bid, or for any other reason.

Bidders shall acknowledge receipt of all addenda in the Bidding System prior to submitting their bid. Bids that do not contain evidence of receipt of all addenda will be deemed to be "incomplete" and will not be accepted in the Bidding System.

In the event that an addendum is issued after a bidder has submitted its bid, the Bidding System will change the status of their submission to "incomplete" and the bidder will be required to acknowledge the addendum and resubmit its bid prior to the Closing Time. The Board recommends that after submitting its bid, the bidder regularly checks for addenda up until the Closing Time.

3.5 Notification and Debriefing

3.5.1 Notification to Other Bidders

Once the selected bidder has satisfied all of the pre-conditions of award listed in Section E of the RFT Particulars (Appendix A) the other bidders will be notified by public posting of the outcome of the procurement process on the Bidding System.

3.5.2 Procurement Debriefing

Bidders may request a debriefing by contacting the Procurement Analyst.

3.5.3 Procurement Dispute Process

If a bidder wishes to challenge the procurement process, it should provide written notice to the Procurement Analyst.

3.6 Conflict of Interest and Prohibited Conduct

3.6.1 Conflict of Interest

For the purposes of this RFT, the term "**Conflict of Interest**" includes, but is not limited to, any situation or circumstance where:

(a) in relation to the procurement process, the bidder has an unfair advantage or engages in conduct, directly or indirectly, that may give it an unfair advantage, including but not limited to:

    (i) having, or having access to, confidential information of the Board or YRP that is not available to other bidders;

(ii) having been involved in the development of the RFT, including having provided advice or assistance in the development of the RFT;

(iii) receiving advice or assistance in the preparation of its bid from any individual or entity that was involved in the development of the RFT;

(iv) communicating with any person with a view to influencing preferred treatment in the procurement process (including but not limited to the lobbying of decision makers involved in the procurement process); or

(v) engaging in conduct that compromises, or could be seen to compromise, the integrity of the open and competitive procurement process or render that process non-competitive or unfair; or

(b) in relation to the performance of its contractual obligations under a contract for the Deliverables, the bidder's other commitments, relationships, or financial interests could, or could be seen to:

(i) exercise an improper influence over the objective, unbiased, and impartial exercise of its independent judgement; or

(ii) compromise, impair or be incompatible with the effective performance of its contractual obligations.

Bidders shall declare in their bid all Conflicts of Interest or any situation that may reasonably be perceived as a Conflict of Interest.

3.6.2 Disqualification for Conflict of Interest

The Board may disqualify a bidder for:

(a) any conduct, situation or circumstances determined by the Board, in its sole discretion, to constitute a Conflict of Interest or perceived Conflict of Interest; or

(b) failure to disclose a Conflict of Interest in its bid.

3.6.3 Bidders Not to Communicate with Media

Bidders must not at any time directly or indirectly communicate with the media in relation to this RFT or any contract entered into pursuant to this RFT without first obtaining the written permission of the Procurement Analyst.

3.6.4 No Lobbying

Bidders, including their subcontractors, consultants, agents, officials and employees, shall not engage in any form of political or other lobbying whatsoever with respect to influencing the outcome of this procurement process. This anti-lobbying clause extends to all members of the Board, YRP, Regional Council, and municipal councillors within the

Region, their respective staff members and their appointees, and members of the Board's consulting and RFT evaluation teams.

This anti-lobbying clause extends from the release date of this RFT until the date and time when a contract for the Deliverables has been awarded or alternatively, when the procurement process has been terminated.

This section shall not be construed as prohibiting any activity which is duly authorized as part of the procurement process, including meetings, interviews, tours of facilities or presentations, which activities may include the participation of the Board, YRP, Council members from the Region or its local area municipalities.

3.6.5 Illegal or Unethical Conduct

Bidders must not engage in any illegal business practices including, but not limited to, activities such as bid-rigging, price-fixing, bribery, fraud, coercion, or collusion. Bidders must not engage in any unethical conduct, including lobbying (as described above) or other inappropriate communications; offering gifts to any employees, officers, agents, elected or appointed officials, or other representatives of the Board, the Region or YRP; deceitfulness; submitting bids containing misrepresentations or other misleading or inaccurate information; or any other conduct that compromises or may be seen to compromise the competitive procurement process.

3.6.6 Past Performance or Past Conduct

The Board may prohibit a bidder from participating in this procurement process based on past performance or based on inappropriate conduct in a prior procurement process including, but not limited to, the following:

(a) illegal or unethical conduct as described above;

(b) its refusal to honour its submitted pricing or other commitments; or

(c) any conduct, situation or circumstance determined by the Board, in its sole discretion, to have constituted an undisclosed Conflict of Interest.

3.6.7 Misleading Information

Any bids which contain information which the Board deems, in its sole discretion, to be inaccurate or misleading, shall be rejected, whether or not the bidder intended to include the inaccurate or misleading information. This stipulation shall survive the termination of the procurement process and, should the Board determine, at a later date, that any information contained in a bid which is or was inaccurate or misleading, the Board reserves the right to disqualify any bidder from the process at any time, including at any time prior to award of the contract and in the event that a contract was awarded, may terminate the contract for cause. Such bidder shall not have any claims

against the Board for any disqualifications or terminations of contracts made pursuant to this provision.

3.6.8 Disqualification for Prohibited Conduct

The Board may disqualify a bidder, rescind a notice of selection, or terminate a contract subsequently entered into if the Board determines that the bidder has engaged in any conduct prohibited by this RFT.

3.7 Confidential Information

3.7.1 Confidential Information of the Board and YRP

All information provided by, or obtained from, the Board or YRP in any form in connection with this RFT, either before or after the issuance of this RFT:

(a) is the sole property of the Board or YRP or both and must be treated as confidential;

(b) must not be used for any purpose other than replying to this RFT and the performance of any subsequent contract for the Deliverables;

(c) must not be disclosed without prior written authorization from the Procurement Analyst; and

(d) must be returned by the bidder to the Board immediately upon the request of the Board.

3.7.2 Confidential Information of Bidder

Bids shall be submitted by the bidder on the understanding that the bid will become the property of the Board and may be made public by the Board with notice to the bidder involved.

A bidder should identify any information in its bid or any accompanying documentation which has been supplied in confidence for which confidentiality is to be maintained by the Board. The confidentiality of such information will be maintained by the Board, except as otherwise required by law or by order of a court or tribunal.

Bidders are advised that their bids will, as necessary, be disclosed, on a confidential basis, to advisers retained by the Board to advise or assist with the RFT process, including the evaluation of bids.

Bidders shall submit any questions about the collection and use of personal information pursuant to this RFT to the Procurement Analyst.

3.8 Reserved Rights and Limitation of Liability

3.8.1 The Board's Rights Under this RFT

The Board may, at any time during the procurement process:

(a) elect not to proceed with the RFT;

(b) alter the timetable, the procurement process or any other aspect of this RFT;

(c) elect not to proceed with the Deliverables in their entirety;

(d) decline to evaluate any bid that, in the Board's opinion, is incomplete, obscure or does not contain sufficient information to carry out a reasonable evaluation;

(e) retain for consideration any bid which fails to comply with this RFT in any manner, either in respect of the content of the bid submitted or the manner of its submission, and may select as the selected bidder a bidder submitting such a non-compliant bid;

(f) reject a bid that:

  (i) fails to comply, in a material way, with the technical requirements of the RFT, as identified in the RFT Particulars (Appendix A);

  (ii) is incomplete, conditional, or restricted or altered in a way that is not acceptable to the Board; or

  (iii) includes pricing which the Board deems, in its sole discretion, to be unbalanced;

(g) reject any or all of the bids, including without limitation, the bid with the lowest cost;

(h) accept any bid that the Board, in its sole discretion, deems appropriate; and/or

(i) if only one bid is received, elect to accept or reject it.

For the purposes of clause (f)(iii) of this subsection 3.8.1, "unbalanced" means the price submitted, whether it be the total price or a price for an item, part, section or division, does not reflect reasonable, anticipated costs for the required labour, equipment and materials, plus a reasonable proportionate share of the bidder's anticipated overhead and profit, or the bid creates a reasonable doubt that its acceptance will result in the lowest actual cost to the Board.

If the Board does not receive any bid satisfactory to the Board, in its sole discretion, the Board reserves the right to proceed in any manner it deems appropriate, including negotiating with any one or more persons whatsoever, including one or more of the bidders.

3.8.2 Limitation of Liability

By submitting a bid, the bidder:

(a) agrees that neither the Board nor any of its employees, officers, agents, elected or appointed officials, advisors, or representatives will be liable, under any circumstances, for any claim arising out of this RFT process including, but not limited to, the bidder's costs incurred in preparing its bid, loss of profits, loss of opportunity, or for any other claim; and

(b) waives any claim for compensation of any kind whatsoever, including claims for the bidder's costs incurred in preparing its bid, loss of profit or loss of opportunity by reason of the Board's decision to not accept a bid, to enter into an agreement with any other bidder, or to cancel this RFT process, and the bidder shall be deemed to have agreed to waive such right or claim.

3.9 Trade Agreements

Procurements falling within the scope of the Canada-European Union Comprehensive Economic and Trade Agreement, the Canada-UK Trade Continuity Agreement, the Canadian Free Trade Agreement or the Trade and Cooperation Agreement between Quebec and Ontario are subject to such agreements.

3.10 Governing Law and Interpretation

The terms and conditions of the RFT process:

(a) are intended to be interpreted broadly and independently (with no particular provision intended to limit the scope of any other provision);

(b) are non-exhaustive and shall not be construed as intending to limit the pre-existing rights of the Board; and

(c) are to be governed by and construed in accordance with the laws of the province of Ontario and the federal laws of Canada applicable therein.

[End of Part 3]

UPDATED GEOTECHNICAL INVESTIGATION
PROPOSED HELICOPTER HANGER
350 GARFIELD WRIGHT BOULEVARD
EAST GWILLIMBURY, ONTARIO

Prepared for:

PARKIN ARCHITECTS LIMITED

PATRIOT ENGINEERING LTD.
Consulting Engineers

Project 44148A
October 17, 2024

80 Nashdene Road, Unit 62
Toronto, Ontario
M1V 5E4
416-293-7716

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PATRIOT
ENGINEERING LTD.
Consulting Engineers

Project 44148A

October 17, 2024

Parkin Architects Limited
1 Valleybrook Drive
Toronto, Ontario
M3B 2S7

Attention: Mr. Lind Nyman
Principal

Updated Geotechnical Investigation
Proposed Helicopter Hangar
350 Garfield Wright Boulevard
East Gwillimbury, Ontario

1.0 INTRODUCTION

It is our understanding that the proposed development at the above site will consist of constructing a helicopter hangar and an attached one storey building without a basement. An above grade helicopter pad, an apron pad and a parking lot will also be constructed.

In light of this, Patriot Engineering Ltd., has carried out a geotechnical investigation to determine the subsurface soil and groundwater conditions in order to provide geotechnical recommendations for type of foundations, safe soil bearing pressures, earthquake design parameters, earth pressure coefficients, excavation and backfill procedures, slab-on-grade floor construction, plus pavement thicknesses. Authorization to proceed with this overall investigation was provided by Mr. Lind Nyman, from Parkin Architects Limited, on behalf of the Owner.

The site is located approximately 400m north and 840m west from the intersection of Warden Avenue and Davis Drive, in East Gwillimbury, Ontario. It is vacant and unoccupied. The terrain is relatively flat. The site is generally covered with vegetation consisting of grass, shrubs and a few trees.

2.0 BACKGROUND

Previously, we had carried out a goetechnical investigation at the above site for a helicopter hangar and an attached one storey building without a basement that included an above grade helicopter pad, an apron pad and a parking lot. Our geotechnical findings and recommendation were presented in our Report No. 44148, dated August 30, 2024.

On August 31, 2024, we were informed by our client Mr. Lind Nyman from Parkin Architects Limited that the proposed building location and footprint, plus the helicopter pad, the apron pad and a parking lot the parking layout have changed to a different configuration. However, the proposed building will still consist of having one storey and without a basement. For reference purposes, the footprints of the original development along with that of the new development are provided on Figure A1, in Appendix A.

In general, given the above mentioned alterations, to some extent, this will now affect the borehole layout and alter the intended purpose of some of the boreholes, as it relates to the transition from the original development to the new development. For example, some boreholes that were intended for the previous building will now fall at or very close the proposed apron pad (BH3 and BH6). Also, some boreholes will now fall outside of the footprint of their intended purposes (BH1, BH11 and BH12).

A considerable portion of the new building footprint is now situated at areas that has not been explored for the building recommendations. Therefore, it is our opinion, that the new building footprint would require proper borehole representation that is conducive to its layout. It was recommended that three (3) additional boreholes would be required to provide a suitable transition from the original building to the new building. In light of this, a supplementary geotechnical investigation was carried out on September 23, 2024, consisting of these three (3) boreholes (BH19, BH20 and BH21) to 8.1m each. In this regard, we have then provided an *updated final report* that combines the findings from our original investigation plus the findings from the supplementary investigation and have designated it as Report No. 44148A, dated October 17, 2024.

3.0 FIELDWORK

The fieldwork for this overall investigation took place in two phases, thus resulting in a combined total of twenty-one (21) boreholes. The first or initial phase was carried out on July 25, 26 and 29, 2024, and consisted of drilling a total of eighteen (18) boreholes (BH1 to BH18). The second phase was carried out on September 23, 2024, and consisted of drilling a total of three (3) boreholes (BH19, BH20 and BH21). All boreholes were drilled using solid stem augers. A summary of the boreholes, their designations and their depths for this investigation is shown below:

(a) <u>For the Helicopter Hangar and Attached One Storey Building</u>
Six (6) boreholes (BH3, BH4, BH5, BH19, BH20 and BH21) to a depth of 8.1m each

Although Borehole BH3 fell within the footprint of the apron pad, in our opinion, it is situated sufficiently close to the footprint of the building and may also be applicable to both the building and the apron pad.

(b) <u>For the Helicopter Pad and Apron Pad</u>
Seven (7) boreholes (BH2, BH3, BH6, BH7, BH8, BH9 and BH10) to depths ranging from 5.0m to 8.1m

As mentioned above, Borehole BH3 was used for both the apron pad and for the building.

Borehole BH8 in our opinion, is situated sufficiently close to the footprint of the apron pad and is considered suitable for use for the apron pad.

(c) For the Parking Lot and Driveways
Six (6) boreholes (BH13 to BH18) to a depth of 2.0m each

Boreholes BH13, BH15 and BH16 in our opinion, are situated sufficiently close to the footprint of the parking lot and driveway areas and are considered suitable for use for the parking lot and driveway areas.

Boreholes BH1, BH11 and BH12 fell a fair distance away from the footprint of their intended purposes. Although they were not used for the above mentioned specific footprints, these boreholes generally assisted in establishing consistency and uniformity of the subsurface conditions at the overall subject site, as well as providing increased assurance contributing towards developing our geotechnical recommendations.

All boreholes were backfilled in accordance with Regulation 903.

The approximate borehole locations along with their surface elevations at the time of our first face and second phase of our drilling activities are shown on the Partial Site Plan, Figure 1.

The boreholes were drilled by using continuous flight solid stem augurs by a specialist drilling contractor under the supervision of Patriot Engineering Ltd. field engineering staff. Samples were obtained at regular depth intervals using a 50mm diameter split spoon sampler that was driven into the soil with a 63.5 kg drop hammer falling 760mm, in accordance with Standard Penetration Test (SPT) procedures (ASTM D1586). During the fieldwork, our staff member also inspected the samples and logged them. The samples were then brought to our laboratory for detailed inspections and laboratory testing. Samples were generally tested for moisture contents and selected samples were tested for gradation analysis / hydrometers.

Groundwater level readings were obtained during our drilling activities. They were obtained upon the completion of drilling of each individual borehole.

Surveying of the ground surface elevations at the borehole locations were determined by our field engineering personnel and referenced at the following datum:

Top of manhole on Garfield Wright Boulevard, near the southeast corner of the property. The location of this manhole is also shown on Figure 1.

The elevation at this point is understood to be at Elev. 272.32m.

The scope of work for the geotechnical investigation for this project is as it is presented in this report, which is being provided on the assumption that the applicable codes and standards will be met. If there are any changes in the design features relevant to the geotechnical analysis, or if there are any apparent deviations of the report from relevant codes and standards, our office should be contacted to review the design.

4.0 SUBSURFACE CONDITIONS

The detailed subsurface stratigraphy encountered in the boreholes is presented on the Borehole Logs, Drawings 2 to 22.

In general, all boreholes were drilled from above grass covered regions at the site and initially advanced through a topsoil layer that ranged in thickness from approximately 50mm to 75mm.

Below the topsoil layer, earth fill material was encountered in all boreholes and consisted of brown, slightly moist to saturated, silt. This silt fill layer also contained traces to some sand, some clay, plus traces of gravel, topsoil, rootlets, wood pieces, brick fragments and plastic pieces. The "N" values (blows/foot) that were recorded within this fill material ranged from 6 to 55, revealing relative densities that were loose to very dense. The moisture contents varied from 4% to 21%. Some degree of dilation was noted in a few samples that were extracted from this layer. Figures 23 and 24 show the grain size distribution test results that were performed on two samples extracted from this silt fill layer. Local variations of the composition of the material can occur at the sampling locations. It is our understanding that the location of the proposed development was part of a large construction site in the past where the subgrade was raised. Our boreholes indicate that this material was used to raise the subgrade.

The depth of the fill layer inside the boreholes which were drilled for the proposed building ranged from approximately 1.4m to 4.1m below existing grade. The depth of the fill layer inside the boreholes which were drilled for the helicopter pad and adjacent apron slab varied from 1.4m to 3.4m below existing grade. Similarly, the depth of the fill layer inside the boreholes which were drilled for the parking lot / driveway areas varied from approximately 0.7m to 1.0m below existing grade.

Below the earth fill material, all boreholes next encountered native soil that was composed of brown and/or grey, slightly moist to saturated, silt. This material also contained traces to some sand, traces to some clay, plus traces of gravel and cobbles. The "N" values that were recorded within this layer ranged from 10 to well over 50, demonstrating relative densities that were compact to very dense. The moisture contents varied from 5% to 27%. Dilation was noted in several samples that were obtained from this layer. The results from our grain size distribution tests performed on three samples obtained from this native, silt layer are shown on Figures 25, 26 and 27. All boreholes with the exception of Boreholes BH1, BH4, BH19, BH20 and BH21 were terminated within this silt layer.

In Boreholes BH1, BH4, BH19, BH20 and BH21, beneath the silt layer, the soil that was encountered next consisted of grey, moist, sandy silt. Traces to some clay, plus traces of gravel were also present within this material. The "N" values that were obtained from this layer were well over 50, displaying relative densities that were very dense. The moisture contents varied from 8% to 12%.These boreholes were terminated in this sandy silt material.

Groundwater level readings were obtained upon the completion of drilling from each borehole. These short term groundwater levels that were recorded in each borehole are indicated below on Table 1.

All groundwater level readings are also shown on the individual borehole logs.

Some seasonal fluctuations and higher water levels should be anticipated.

The soil and groundwater conditions presented in this report have been deducted from soil sampling that was noncontinuous and therefore, should not be taken to represent exact planes of geological change. Furthermore, the geotechnical recommendations and comments provided in this report have been based on boreholes that were widely spaced. Therefore, the soil and groundwater conditions between the boreholes could vary significantly. The interpretation between boreholes and the recommendations in this report must therefore be checked through field inspections, provided by our office during the construction stages, to validate the information for use.

Table 1
Measured Short Term Groundwater Level Readings Obtained Upon Completion of Drilling of Each Borehole

Borehole No.	Depth of Borehole (m)	Borehole Surface Elevation (m)	Approximate Depth of Groundwater Level Below Existing Ground (m)	Approximate Groundwater Elevation (m)
BH1	8.1	273.5	5.0	268.5
BH2	8.1	273.5	5.3	268.2
BH3	8.1	273.4	5.3	268.1
BH4	8.1	273.6	4.3	269.3
BH5	8.1	273.8	5.3	268.5
BH6	8.1	273.8	4.7	269.1
BH7	5	273.9	DRY	-
BH8	5	273.9	DRY	-
BH9	5	273.7	DRY	-
BH10	5	273.8	DRY	-
BH11	2	273.7	DRY	-
BH12	2	273.5	DRY	-
BH13	2	273.9	DRY	-
BH14	2	274	DRY	-
BH15	2	272.9	DRY	-
BH16	2	273.2	DRY	-
BH17	2	273.7	DRY	-
BH18	2	273.3	DRY	-
BH19	8.1	273.8	5.0	268.8
BH20	8.1	274.2	5.4	268.8
BH21	8.1	273.9	5.4	268.5

5.0 GEOTECHNICAL RECOMMENDATIONS

The comments provided in this report are intended only for the guidance of design engineers. The amount of boreholes required to determine the localized underground conditions between boreholes that would affect construction costs, sequencing, equipment, scheduling construction techniques, and the like, would be much greater than that carried out for design purposes. Contractors and/or subcontractors bidding on or undertaking the work should, in this light, decide on their own interpretations of the factual borehole results, so that they may draw their own conclusions as to how the subsurface conditions may affect them and their scope of work.

5.1 Foundations: Conventional Spread Footings

It is our understanding that the elevation of the top surface of the ground floor slab has been established at Elev. 273.8m. The anticipated footings are expected to be founded approximately 1.5m below the ground floor slab, corresponding approximately to Elev. 272.3m.

As previously mentioned, we had been informed by Parkin Architects Limited that the location of the proposed development was part of a large construction site in the past where material was used to backfill the site and raise the subgrade. At the footprint of the building, the depth that the fill material that was used ranged from approximately 1.4m to 4.1m below existing grade. We have also been provided with documentation that is available that indicates that compaction testing was carried out on the material that was used to raise the subgrade and the results showed that specified compaction was achieved.

Our review of the soil samples show that the fill material appeared to be uniform in structure. The recorded "N" values (blow/foot) that were obtained within the fill layer, especially at or near the proposed footing founding elevation, demonstrated that the existing fill layer had undergone through compaction procedures and is generally yielding densities that are in the compact to very dense state. The available records indicate that the fill material was installed approximately 9 years ago. It is expected that it has self consolidated during the course of this time duration, and therefore, it should not induce above normal settlement. Therefore, it is our opinion that the existing fill layer is considered suitable for sustaining conventional spread footings.

Based on the subsurface information recorded at the borehole locations, conventional spread footings may be used for the proposed building and shall be founded below all topsoil, wet, deleterious materials and loosened soil, on the compact to very dense, silt fill material as indicated in Boreholes BH3, BH4, BH19, BH20 and BH21, and on the native, undisturbed, compact to very dense, silt as indicated in Borehole BH5. The following soil bearing pressures and specified founding depths as shown below on Table 2 are recommended:

Table 2
Soil Bearing Pressures for Spread Footings

Borehole No.	Serviceability Limit State (SLS) (kPa)	Factored Bearing Capacity at Ultimate Limit State (ULS) (kPa)	Approximate Founding Depth Below Existing Ground (m)	Approximate Founding Elevation (m)
BH3	75	115	Below 0.8	Below 272.6
BH4	75	115	Below 0.8	Below 272.8
BH5	75	115	Below 0.8	Below 273.0
BH19	75	115	Below 0.8	Below 273.0
BH20	75	115	Below 0.8	Below 273.4
BH21	75	115	Below 0.8	Below 273.1

Foundations designed using the soil pressures pertaining to the Serviceability Limit State (SLS) condition shown above, should not exceed the total and differential settlements of 25mm (1 inch) and 20mm (3/4 inch), respectively, provided that the foundation bases are not disturbed by excavation, surface water inflow, or freezing and thawing action.

Nominal reinforcement will be required in footings and foundation walls placed on the fill material. This is a precautionary measure to ensure that soft subgrade areas, if any, are adequately bridged with the reinforcement of foundations.

In general, fills are more susceptible to the effects of weather than are natural soils. Therefore, they must be protected from excessive wetting, drying and erosion.

Foundations exposed to freezing ground conditions must be protected against frost action with a minimum of 1.2m (4 ft.) of soil cover or equivalent.

Any footings constructed at different founding levels must be stepped along a line of 7 vertical to 10 drawn from the bottom of the lower footing.

All foundation bases should be inspected by a geotechnical engineer from our office prior to placing concrete to verify the bearing pressures, plus the consistency of the founding conditions that is suggested in this report.

It is recommended that the foundation drawings be reviewed by our office for general conformance with our geotechnical recommendations.

Higher bearing capacities are also available at deeper zones of our boreholes on native soils, if required. See Section 4.2 below.

5.2 Alternate Foundation Method Using Helical Pier Foundations

If higher bearing capacities are required, then an alternate foundation method for the soil conditions encountered at the site is deep foundations consisting of helical piers in combination with grade beams to support the building loads. The helical piers should be supplied by Chance, or equivalent.

The installation of the helical pier foundations will transfer the building loads beyond the fill layers plus beyond the relatively weak native soils and into much deeper zones towards the bottom of our boreholes, where the soil conditions appear to be more favourable for bearing purposes.

Helical piers may be founded below all topsoil, fill, soft, loosened and deleterious soils into the native, undisturbed, very dense, silt, and/or native undisturbed, very dense, sandy silt.

The design load sustained by the individual helical piers should be provided by the Structural Engineer.

Besides the soil conditions encountered, the capacity of a helical pier also depends on the type and size selected, plus the number of helices. Therefore, the specialist contractor/supplier will finalize the selection of the pier size which will achieve this design capacity that is specified by the structural engineer. The general specifications for the installation and testing will also be provided by the specialist contractor/supplier.

A compression load test is recommended to be carried out on a minimum of one helical pier, to verify its capacity.

All helical pier installation work should be inspected on a full-time basis by a geotechnical engineer from our office to ensure that they have been installed into the specified native layers at adequate depths and have achieved the designated torque requirements.

Excavations for any new grade beams and foundations must be stepped along a line of 7 vertical to 10 horizontal where founding grades are variable and must not interfere with adjacent foundation systems, underground services and the like.

Foundations / grade beams exposed to freezing ground conditions must be protected against frost action with a minimum of 1.2m (4 ft.) of soil cover or equivalent.

Provisions should be made by the contractor when advancing through the upper fill zones which could have obstacles, oversized concrete chunks, construction rubble, caving and the like, plus in the native soils as cobbles and boulders may be present.

It is recommended that the foundation drawings be reviewed by our office for general conformance with our geotechnical recommendations.

5.3 Earthquake Design Parameters

In accordance to the Ontario Building Code, the site's classification for Seismic Response would be Class C.

5.4 Earth Pressure Coefficients

For this site, the following parameters may be used to assess the earth pressure:

Soil	γ (kN/m^3)	ϕ degrees	K_a	K_o	K_p
Onsite Compacted Fill or Compacted Granular Fill - OPSS Granular B	21	32	0.31	0.47	3.25
Native Subsoil	21.5	33	0.3	0.46	3.39

Where γ = bulk unit weight of soil, kN/m^3

ϕ = internal angle of friction, degrees

K_a = coefficient of active earth pressure

K_o = coefficient of earth pressure at rest

K_p = coefficient of passive earth pressure

Also,

μ = Coefficient of Static Friction Between footings and Underlying Soil use 0.4

5.5 Excavation and Backfill

In general, based on the groundwater levels presented on Table 1, no significant groundwater issues are expected with excavations on this site. Any flow from surface water and any minor seepage from perched water levels should be controlled with properly filtered sumps with pumps. However, given the fluctuation of the groundwater, if excavations are to be carried out to depths close to or below the groundwater level, then high capacity pumps should then be installed inside the sumps to sufficiently draw down the groundwater. Depending on the season of construction, groundwater levels can increase significantly. If so, then a well point dewatering system may be required to be installed to control and effectively reduce the groundwater levels. It is recommended that a specialist dewatering contractor be contacted to provide their recommendations during the construction stages, if excavations encounter groundwater.

Provisions should be made by the contractor during the excavations for handling possible oversized concrete chunks, construction rubble and obstructions in the fill materials, plus cobbles and boulders in the underlying native soils.

All temporary shallow excavations may be cut at 1 vertical to 1 horizontal. If some sloughing occurs at the upper fill zones, or if wet conditions are encountered, then shallower slopes may be required in localized areas. All excavations must be made to conform to regulations set out in the Occupational Health and Safety Act. Using the classification system described in the Occupational Health and Safety Act, the fill soils on site can be classified as Type 3. The native soils can also be considered as Type 3. Any wet and saturated soils, or soils located below the groundwater level are classified as Type 4.

Excavations shall not be cut below an imaginary line drawn downward from existing foundations and/or underground services at 7 vertical to 10 horizontal. If this cannot be achieved then adequate temporary shoring and/or underpinning will be required.

The on site materials are not free draining and highly susceptible to frost. They should not be used for exterior foundation backfilling as this could potentially result to damage of the foundation walls from frost adhesion. Therefore, the exterior foundations should be backfilled with approved OPSS Granular B Type I (sand and gravel) material, placed in loose lifts with a maximum thickness of 300mm and compacted to a minimum of 95% Standard Proctor maximum dry density. The upper 1.2m (4 ft.) zone of backfill material should be compacted to a minimum of 98% Standard Proctor maximum dry density.

The underslab interior excavations should be backfilled with approved onsite soils and/or approved OPSS Granular B Type I (sand and gravel) material, placed in loose lifts with a maximum thickness of 300mm and compacted to a minimum of 98% Standard Proctor maximum dry density.

Backfilling of service trenches under proposed pavement areas may be carried out using approved onsite soils and/or approved OPSS Granular B Type I (sand and gravel) material placed in loose lifts with a maximum thickness of 300mm and compacted to a minimum of 95% Standard Proctor maximum dry density. The upper 1.2m (4 ft.) zone of backfill material should be compacted to a minimum of 98% Standard Proctor maximum dry density.

The silt materials onsite have the capacity to retain water, they are not free draining and may be too wet to be used for backfilling. In some cases, drying the material, if space restriction permit this, will assist in salvaging some portion of this material for reuse. In other cases, they may be found to be too wet and rendered unusable. In this regard, the suitability for reuse of the onsite material as backfill should be inspected and evaluated during the initial stages of construction. Materials that have been approved for reuse should be maintained within 2% of their optimum moisture content. Tarps may be required to cover and protect the approved material.

5.6 Slab-On-Grade Floor

From our boreholes that were drilled for the building, it is noted that fill material was present consisting of silt. The fill material extends to depths varying from approximately 1.4m to 4.1m below existing grade. This indicates that the exposed subgrade surface at the envelope of the proposed building is expected to be constructed within this fill layer. The fill material appeared to be uniform in structure. It is our opinion that the fill layer is considered suitable to remain as a subgrade. Therefore, the concrete floor may be constructed by conventional slab-on-grade techniques on an adequately prepared subgrade consisting of compact to very dense, silt fill, provided that the following items are complied with:

1. The exposed subgrade must be stripped of any topsoil, vegetation, loose, wet and deleterious materials.

2. Any weak spots encountered on the exposed subgrade must be excavated and removed.

3. The amount of organics appeared minor in the samples, however, during construction, if it becomes greater then localized areas of the fill containing excessive organics must be excavated and removed.

4. The exposed surface of the subgrade within the footprint of the proposed building must be heavily proofrolled under geotechnical supervision and compacted to a minimum of 98% Standard Proctor maximum dry density. It must be inspected and approved by a geotechnical engineer.

5. The grade must then be raised to the design subgrade level to fill any such voids as indicated on Items 2 and 3 above, and/or to fill any areas with relatively lower surface elevations with approved onsite soils and/or approved OPSS Granular B Type I (sand and gravel) material, placed in loose lifts with a maximum thickness of 300mm and compacted to a minimum of 98% Standard Proctor maximum dry density.

A basecourse / moisture barrier consisting of at least 200mm (8 inch) thick of 20mm (3/4 inch) of OPSS Granular A crusher run limestone must be provided under the proposed floor slab. It shall be compacted to at least 98% Standard Proctor maximum dry density.

The proposed concrete floor may then be constructed by conventional slab-on-grade techniques directly above the Granular A crusher run limestone basecourse.

A Modulus of Subgrade Reaction (k_S) of 30,000 kN/m^3 is suggested for designing the proposed floor slab.

The general requirements for the perimeter drainage, underfloor fill and backfill are provided on Figure 28.

6.0 GEOTECHNICAL RECOMMENDATIONS FOR PROPOSED HELICOPTER CONCRETE PAD AND APRON CONCRETE PAD

The on site silt materials retain water, they are not free draining and are highly susceptible to frost and heave action. They have the potential to cause the development of cracks on the overlying concrete pad surfaces from the oscillations and floating movement during the freezing and thawing cycles. Taking this into consideration, for the soil and groundwater conditions encountered at their respective locations, two options may be used to construct the above concrete pads. The first option involves constructing the pads with excavations extending to 1.2m below existing grade which is discussed in Section 5.1. While the second option involves constructing the pads on a basecourse layer in combination with insulation and this is discussed in Section 5.2. The selection between these two pad options will depend on factors, such as, economics, duration of activity, availability and scheduling.

6.1 Concrete Pads: Option 1 - Concrete Pads Constructed with Excavations Extending to 1.2m Below Existing Grade

Given the frost susceptible soil conditions that are present at the site, it is recommended that the following geotechnical recommendations be complied with for developing the proposed concrete pads for both the helicopter pad and apron pad:

1. It is recommended that excavations for the floating concrete pads to extend to a depth of 1.2m (4 ft.) below their proposed final grade. It is expected that the exposed subgrade to consist of compact to very dense, silt fill material. The exposed subgrade must be inspected and approved by a geotechnical engineer. Any weak spots, deleterious materials and organic materials detected at the exposed surface must be sub-excavated and removed. The exposed subgrade surface must be proofrolled and compacted to a minimum of 98% Standard Proctor maximum dry density.

2. It is recommended that excavations extend laterally outward for a minimum of 1.2m (4 ft.) from the edge of the pads at sides.

3. It is recommended that weeping tiles to be placed in parallel rows of 6m centres one way, above the excavated subgrade (at 1.2m depth) leading to a positive outlet, such as manholes or catch basins. The tiles should consist of a 100mm diameter PVC perforated weeping tile surrounded with a layer of 150mm thick of 20mm Clear Stone at the top and sides of the pipe and 50mm of stone at the base. The stone should be then be wrapped with an approved geotextile cloth, type Terrafix 270R, or equivalent. The subgrade should be shaped and crowned to allow drainage into these pipes.

4. The subgrade shall then be raised to the desired level using approved OPSS Granular B (Sand and Gravel) material placed in loose lifts with a maximum thickness of 300mm and compacted to a minimum of 100% Standard Proctor maximum dry density.

5. A provision shall be made to allow for a basecourse / moisture barrier, consisting of at least 300mm (12 inches) of 20mm (3/4 inch) approved OPSS Granular A crusher run limestone to be placed under the concrete slabs. The Granular A material must be compacted to at least 100% Standard Proctor maximum dry density. The proposed concrete slabs may then be constructed by conventional slab-on-grade techniques directly above the compacted Granular A basecourse.

A Modulus of Subgrade Reaction (k_s) of 30,000 kN/m^3 is suggested for designing the proposed concrete pads.

It is recommended that the concrete pad drawings be reviewed by our office for general conformance with our geotechnical recommendations.

6.2 Concrete Pads: Option 2 - Concrete Pads Constructed on Basecourse Layer in Combination with Insulation

Based on the frost susceptible soil conditions encountered at the borehole locations, the following procedure is recommended for constructing the concrete pads for both the helicopter pad and apron pad:

1. Figure 29 shows the general geotechnical guidelines for constructing the concrete pads. It is expected that the exposed subgrade to consist of compact to very dense, silt fill material. The exposed subgrade surface must be proofrolled and compacted to a minimum of 98% Standard Proctor maximum dry density. The exposed subgrade must be inspected and approved by a geotechnical engineer. Any weak spots, deleterious materials and organic materials detected at the exposed surface must be sub-excavated and removed. The grade can then be raised to the design subgrade level to fill any such voids using approved OPSS Granular B Type I (sand and gravel) material placed in loose lifts with a maximum thickness of 300mm and compacted to a minimum of 100% Standard Proctor maximum dry density.

2. It is recommended that excavations extend laterally outward for a minimum of 1.2m (4 ft.) from the edge of the pads at sides.

3. In order to minimize the amount of oscillations and floating movement during the freezing and thawing cycles, a layer of polystyrene board insulation (SM Blue), or equivalent, consisting of a minimum thickness of 50mm be placed below the entire area of the proposed pad and extend 1.2m laterally outwards. It should be placed above the approved subgrade. Insulation requirements should be in general conformance as shown in Figure 29 and the manufacturer's specifications.

4. A basecourse / moisture barrier, consisting of at least 300mm (12 inchs) of 20mm (3/4 inch) clear stone should be provided under the concrete pads. It should be compacted and vibrated for interlocking purposes.

5. The pads may then be constructed above the basecourse layer.

A Modulus of Subgrade Reaction (k_S) of 30,000 kN/m^3 is suggested for designing the proposed concrete pads.

It is recommended that the concrete pad drawings be reviewed by our office for general conformance with our geotechnical recommendations.

7.0 PAVEMENT STRUCTURES

It is our understanding that the proposed development will require the construction of flexible pavement areas with light duty and heavy duty applications.

The pavement areas may be constructed on an adequately prepared subgrade, inspected and approved by a geotechnical engineer. The subgrade may consist of compact, silt fill and/or compact to dense, native, silt. The exposed subgrade must be stripped of all topsoil, vegetation, loose, wet and deleterious materials. The exposed fill portion of the subgrade surface must be proofrolled and compacted to a minimum of 98% Standard Proctor maximum dry density. While the exposed native portion of the subgrade surface must be heavily proofrolled under geotechnical supervision. If any weak or soft areas are encountered at the exposed subgrade surface they must be further sub-excavated and removed. The grade must then be raised to the design subgrade level using approved onsite materials, and/or approved OPSS Granular B Type I (sand and gravel) material, placed in loose lifts with a maximum thickness of 300mm and compacted to a minimum of 98% Standard Proctor maximum dry density. Stringent construction control procedures must be maintained to ensure uniform subgrade moisture and density conditions are achieved.

Based on the subgrade conditions encountered and normal anticipated traffic loading, the pavement structures indicated below in Table 3 are recommended:

Table 3
Recommended Pavement Structures and Thicknesses

Material	Light Duty	Heavy Duty
HL 3 Surface Asphalt	40mm	40mm
HL 8 Binder Asphalt	40mm	100mm
Granular Basecourse OPSS Granular "A" Consisting of 20mm Crusher Run Limestone	150mm	150mm
Granular Subbase OPSS Granular "B" Type II 50mm Crusher Run Limestone	300mm	500mm
Total Combined Thickness	530mm	790mm
Granular Base Equivalents (GBE)	510mm	770mm

Grading of the final subgrade should be shaped and crowned to allow drainage to adequately spaced catch basins installed with subdrains leading to a positive outlet. Figure 30, shows a typical subdrain detail. We emphasize the need for adequate drainage. Catch basins must contain subdrains for drainage infiltration from the granular basecourse leading into these drainage structures. Subdrains may also be installed along the driveway areas plus be installed to extend between catch basins.

It is recommended that all granular components to be placed in loose lifts with a maximum thickness of 300mm and compacted to a minimum 98% Standard Proctor maximum dry density. The asphalt components to be placed and compacted to be within the acceptable compaction requirements of 92.0% to 96.5% Maximum Relative Density.

The completed pavement surface must not contain any depressions and must be adequately sloped to provide effective surface drainage toward the catch basins. Additionally, surface water shall not be allowed to accumulate adjacent to the outside edges of the pavement areas. Subdrains shall be installed to collect the excess subsurface moisture and prevent the subgrade from softening.

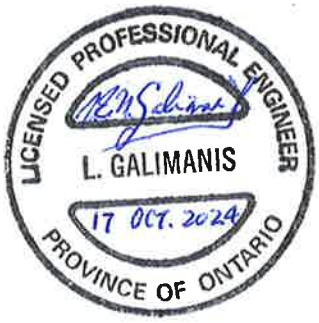
In order to minimize the adverse affects of settlement, it is recommended that the surface asphalt course be delayed for approximately one year after the binder asphalt course is placed, where practical.

Frost action can often result in differential movement taking place between the pavement and catch basins and/or manholes. As a result, it is recommended that these structures be backfilled with granular materials which are not as susceptible to frost, such as, approved OPSS Granular B Type I (sand and gravel), placed in loose lifts with a maximum thickness of 300mm and compacted to a minimum of 98% Standard Proctor maximum dry density. Hand controlled light compaction equipment shall be used when backfilling these structures to avoid damaging them.

The quality, performance and life expectancy of the finished product is highly dependent upon adequate subgrade preparation work, the quality and proper placement of the pavement components and the compaction level achieved. Therefore, it is important that geotechnical inspections be carried out during the construction period to ensure construction practice is in conformance with design requirements.

We trust that the information contained in this report will assist you with your proposed development. Should you have any questions, please do not hesitate to contact our office.

Yours truly,
PATRIOT ENGINEERING LTD.



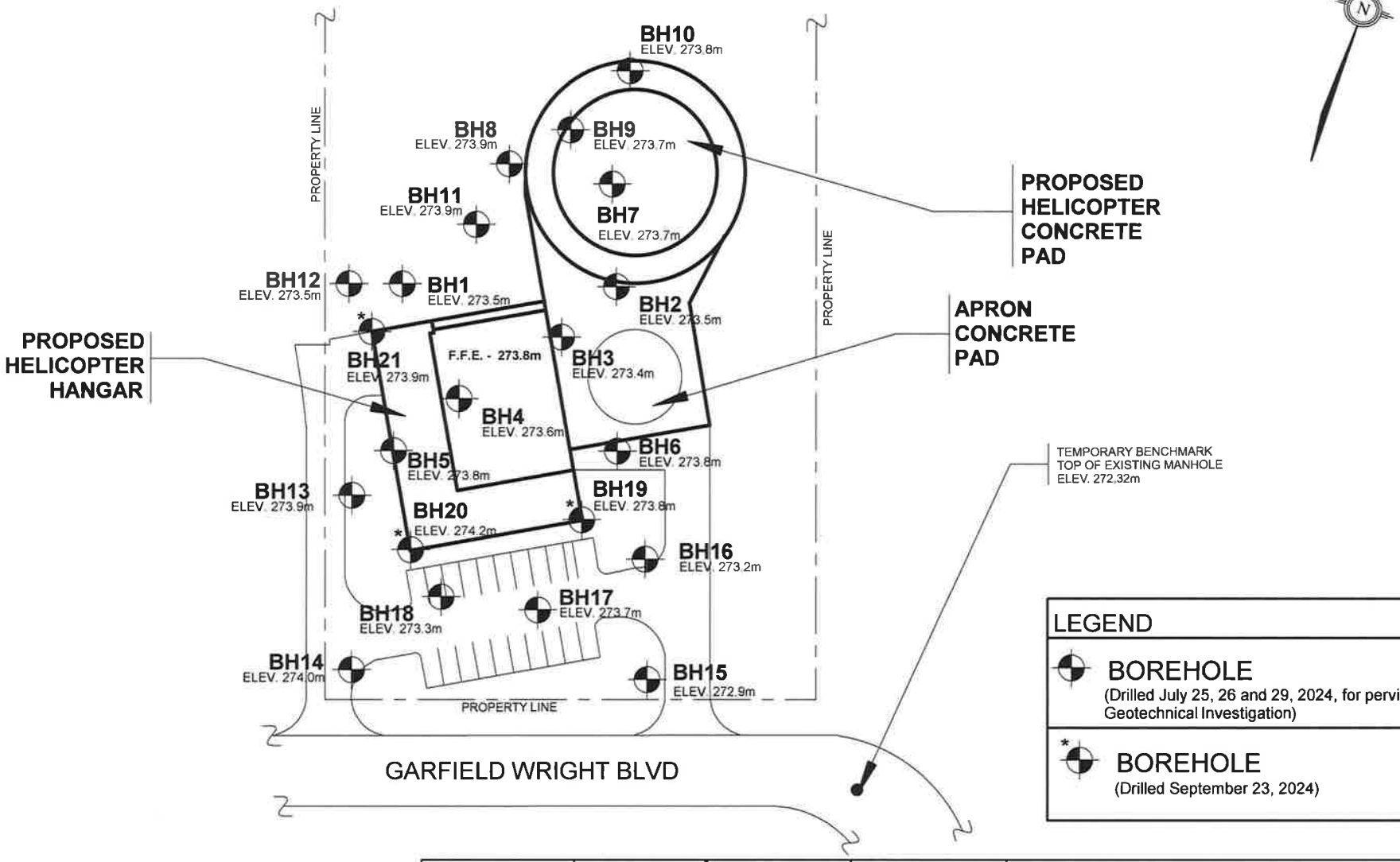
Larry Galimanis, P.Eng.
Principal / Consulting Engineer

Distribution: Mr. Lind Nyman, Parkin Architects Limited (4)

FIGURE 1: PARTIAL SITE PLAN SHOWING THE APPROXIMATE BOREHOLE LOCATIONS

PROPOSED HELICOPTER HANGAR

350 GARFIELD WRIGHT BOULEVARD, EAST GWILLIMBURY, ONTARIO



REFERENCE:

PARTIAL SITE PLAN INFORMATION ADAPTED FROM OVERALL SITE PLAN DRAWING NO. A-002, PREPARED BY PARKIN ARCHITECTS LIMITED, SUBMITTED TO US ON AUGUST 31, 2024.

	Name	Date
Drawn By	M.A.	Sept '24
Checked By	L.G.	Sept '24
Revisions		
Scale	Reduced From Original	

PATRIOT ENGINEERING LTD.
Consulting Engineers

Project: 44148A | Figure: 1

Project No: 44148A

Borehole #: BH1

Project: Proposed Helicopter Hanger

Borehole Location: See Figure 1

Location: 350 Garfield Wright Boulevard, East Gwillimbury, ON

Project Engineer: L.G.

Client: Parkin Architects Limited

Drawing No.: 2

SUBSURFACE PROFILE				SAMPLE						
Depth (m)	Symbol	Description	Elevation (m)	Type	N = Blows/300mm	Recovery (%)	U.Wt.(kN/m3)	- SPT Blows/300mm 20 40 60 80	▲ Penetrometer ▲ 50 100 150 200	Moisture x Moisture% x 10 20 30
		Ground Surface	273.5							
0		***TOPSOIL - 75mm***		SS1	16	80		○		×
		FILL - SILT compact to dense, brown, slightly moist to moist, some clay, some sand, trace gravel, trace topsoil, trace plastic pieces								
1				SS2	15	65		○		×
				SS3	37	75		○		×
2			271.4							
		SILT compact to very dense, brown becoming grey below 4.6m depth, moist to saturated, trace to some clay, trace gravel, trace cobbles, dilated at Samples SS6 and SS7		SS4	43	0*		○		
3				SS5	28	85		○		×
4										
				SS6	12	100		○		×
5										
6				SS7	22	100		○		×
7			266.4							
		SANDY SILT very dense, grey, moist, trace clay, trace gravel								
			265.4	SS8	69	100		○		×
8		***END OF BOREHOLE*** See next page for notes...								
9										
10										

Drill Method: S/S Auger

Drill Date: July 25 & 26, 2024

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Datum: Geodetic

Checked by: L.G.

Project No: 44148A

Borehole #: BH1

Project: Proposed Helicopter Hanger

Borehole Location: See Figure 1

Location: 350 Garfield Wright Boulevard, East Gwillimbury, ON

Project Engineer: L.G.

Client: Parkin Architects Limited

Drawing No.: 2

SUBSURFACE PROFILE				SAMPLE						
Depth (m)	Symbol	Description	Elevation (m)	Type	N = Blows/300mm	Recovery (%)	U.Wt.(kN/m3)	- SPT Blows/300mm 20 40 60 80	▲ Penetrometer ▲ 50 100 150 200	Moisture x Moisture% x 10 20 30
11		Notes: * There was no sample recovered in the spoon. The auger sample was not representative. 1. Boreholes advanced using solid stem augers to 8.1m depth on July 25 & 26, 2024. 2. Short term groundwater water level measured at 5.0m depth upon completion of drilling.								
12										
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Drill Method: S/S Auger

Drill Date: July 25 & 26, 2024

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Phone: (416) 293-7716 Fax: (416) 293-6722
e-mail: info@patrioteng.ca

Datum: Geodetic

Checked by: L.G.

Project No: 44148A

Project: Proposed Helicopter Hanger

Location: 350 Garfield Wright Boulevard, East Gwillimbury, ON

Client: Parkin Architects Limited

Borehole #: BH2

Borehole Location: See Figure 1

Project Engineer: L.G.

Drawing No.: 3

SUBSURFACE PROFILE				SAMPLE						
Depth (m)	Symbol	Description	Elevation (m)	Type	N = Blows/300mm	Recovery (%)	U.Wt.(kN/m3)	- SPT Blows/300mm 20 40 60 80	▲ Penetrometer ▲ 50 100 150 200	Moisture x Moisture% x 10 20 30
0		Ground Surface	273.5							
		TOPSOIL - 75mm		SS1	10	45		○		×
		FILL - SILT compact to dense, brown, slightly moist to moist, some clay, some sand, trace gravel, trace topsoil, trace rootlets		SS2	31	85		○		×
1			272.1							
		SILT compact to very dense, brown, moist to saturated, some clay, trace sand, trace gravel, isolated pockets of clay, oxidized, minor dilation at Samples SS5, SS6, SS7 and SS8		SS3	44	100		○		×
2				SS4	16	50		○		×
3				SS5	19	90		○		×
4										
5				SS6	19	80		○		×
6										
7				SS7	27	100		○		×
8			265.3							
				SS8	55	100		○		×
		END OF BOREHOLE								
9		Notes: 1. Boreholes advanced using solid stem augers to 8.1m depth on July 25, 2024. 2. Short term groundwater water level measured at 5.3m depth upon completion of drilling.								
10										

Drill Method: S/S Auger

Drill Date: July 25, 2024

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Datum: Geodetic

Checked by: L.G.

Project No: 44148A

Borehole #: BH3

Project: Proposed Helicopter Hanger

Borehole Location: See Figure 1

Location: 350 Garfield Wright Boulevard, East Gwillimbury, ON

Project Engineer: L.G.

Client: Parkin Architects Limited

Drawing No.: 4

SUBSURFACE PROFILE				SAMPLE						
Depth (m)	Symbol	Description	Elevation (m)	Type	N = Blows/300mm	Recovery (%)	U.Wt.(kN/m3)	- SPT Blows/300mm 20 40 60 80	▲ Penetrometer ▲ 50 100 150 200	Moisture x Moisture% x 10 20 30
0		Ground Surface	273.4							
		TOPSOIL - 75mm		SS1	10	65		○		×
		FILL - SILT compact to dense, brown, moist, some clay, some sand, trace gravel, trace topsoil, trace rootlets, minor dilation at Samples SS4 and SS5		SS2	43	60		○		×
				SS3	26	80		○		×
				SS4	12	75		○		×
			270.0	SS5	23	70		○		×
		SILT compact to very dense, brown becoming grey below 4.6m depth, moist to saturated, trace clay, some sand, trace gravel, isolated pockets of clay, oxidized, dilated at Samples SS6 and SS7		SS6	18	100		○		×
				SS7	42	100		○		×
			265.3	SS8	65	100		○		×
		END OF BOREHOLE Notes: 1. Borehole advanced using solid stem augers to 8.1m depth on July 25, 2024. 2. Short term groundwater level measured at 5.3m depth upon completion of drilling.								

Drill Method: S/S Auger

Drill Date: July 25, 2024

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Datum: Geodetic

Checked by: L.G.

Project No: 44148A

Borehole #: BH4

Project: Proposed Helicopter Hanger

Borehole Location: See Figure 1

Location: 350 Garfield Wright Boulevard, East Gwillimbury, ON

Project Engineer: L.G.

Client: Parkin Architects Limited

Drawing No.: 5

SUBSURFACE PROFILE				SAMPLE						
Depth (m)	Symbol	Description	Elevation (m)	Type	N = Blows/300mm	Recovery (%)	U.Wt.(kN/m3)	- SPT Blows/300mm 20 40 60 80	▲ Penetrometer ▲ 50 100 150 200	Moisture x Moisture% x 10 20 30
		Ground Surface	273.6							
0		***TOPSOIL - 55mm***		SS1	13	45				
		FILL - SILT compact to dense, brown, very moist to moist, some clay, some sand, trace gravel, trace topsoil, trace rootlets		SS2	35	85				
1										
				SS3	30	100				
2										
				SS4	19	50				
3										
			270.2	SS5	43	90				
		SILT compact to very dense, brown becoming grey below 4.6m depth, moist to saturated, some clay, some sand, trace gravel, isolated pockets of clay, oxidized, dilated at Sample SS6								
4										
				SS6	23	80				
5										
6				SS7	50	100		/140mm		
7			266.5							
		SANDY SILT very dense, grey, moist, trace clay, trace gravel								
			265.5	SS8	50	100		/140mm		
8		***END OF BOREHOLE*** Notes: 1. Boreholes advanced using solid stem augers to 8.1m depth on July 25, 2024. 2. Short term groundwater water level measured at 4.3m depth upon completion of drilling.								
9										
10										

Drill Method: S/S Auger

Drill Date: July 25, 2024

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Datum: Geodetic

Checked by: L.G.

Project No: 44148A

Borehole #: BH5

Project: Proposed Helicopter Hanger

Borehole Location: See Figure 1

Location: 350 Garfield Wright Boulevard, East Gwillimbury, ON

Project Engineer: L.G.

Client: Parkin Architects Limited

Drawing No.: 6

SUBSURFACE PROFILE				SAMPLE						
Depth (m)	Symbol	Description	Elevation (m)	Type	N = Blows/300mm	Recovery (%)	U.Wt (kN/m3)	○ - SPT Blows/300mm ○ 20 40 60 80	▲ Penetrometer ▲ 50 100 150 200	Moisture x Moisture% x 10 20 30
		Ground Surface	273.8							
0		***TOPSOIL - 75mm***		SS1	14	80		○		×
		FILL - SILT compact to very dense, brown, moist, some clay, some sand, trace gravel, trace topsoil, trace rootlets, trace wood peices		SS2	52	70		○		×
1			272.4							
		SILT compact to very dense, brown becoming grey below 6.2m depth, slightly moist to saturated, some sand, trace clay, trace gravel, isolated pockets of clay, oxidized, dilated in Samples SS6, SS7 and SS8		SS3	57	85		○		×
2				SS4	37	80		○		×
3				SS5	27	55		○		×
4										
				SS6	26	80		○		×
5										
6				SS7	42	100				×
7										
				SS8	50	85		○/50mm		×
8			265.7							
		END OF BOREHOLE Notes: 1. Boreholes advanced using solid stem augers to 8.1m depth on July 25, 2024. 2. Short term groundwater water level measured at 5.3m depth upon completion of drilling.								
9										
10										

Drill Method: S/S Auger

Drill Date: July 25, 2024

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Checked by: L.G.

Project No: 44148A

Borehole #: BH6

Project: Proposed Helicopter Hanger

Borehole Location: See Figure 1

Location: 350 Garfield Wright Boulevard, East Gwillimbury, ON

Project Engineer: L.G.

Client: Parkin Architects Limited

Drawing No.: 7

SUBSURFACE PROFILE				SAMPLE						
Depth (m)	Symbol	Description	Elevation (m)	Type	N = Blows/300mm	Recovery (%)	U.Wt.(kN/m3)	○ - SPT Blows/300mm 20 40 60 80	▲ Penetrometer ▲ 50 100 150 200	Moisture x Moisture% x 10 20 30
0		Ground Surface	273.8							
		TOPSOIL - 60mm		SS1	7	45		○		×
		FILL - SILT loose to very dense, brown, moist, some clay, some sand, trace gravel, trace topsoil, trace rootlets		SS2	38	95		○		×
1				SS3	55	100		○		×
2				SS4	51	10		○		×
3			270.4	SS5	31	100		○		×
		SILT compact to very dense, brown becoming grey below 4.6m depth, moist to saturated, some sand, trace clay, trace gravel, isolated pockets of clay, oxidized, dilated in Samples SS6, SS7 and SS8		SS6	13	100		○		×
4										
5										
6				SS7	66	100		○		×
7										
8			265.7	SS8	50	55		○/125mm		×
		END OF BOREHOLE Notes: 1. Boreholes advanced using solid stem augers to 8.1m depth on July 25, 2024. 2. Short term groundwater water level measured at 4.7m depth upon completion of drilling.								
9										
10										

Drill Method: S/S Auger

Drill Date: July 25, 2024

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Datum: Geodetic

Checked by: L.G.

Project No: 44148A

Borehole #: BH7

Project: Proposed Helicopter Hanger

Borehole Location: See Figure 1

Location: 350 Garfield Wright Boulevard, East Gwillimbury, ON

Project Engineer: L.G.

Client: Parkin Architects Limited

Drawing No.: 8

SUBSURFACE PROFILE				SAMPLE						
Depth (m)	Symbol	Description	Elevation (m)	Type	N = Blows/300mm	Recovery (%)	U.Wt.(kN/m3)	- SPT Blows/300mm 20 40 60 80	▲ Penetrometer ▲ 50 100 150 200	Moisture x Moisture% x 10 20 30
0		Ground Surface	273.9							
		TOPSOIL - 55mm		SS1	12	55		○		×
		FILL - SILT compact, brown, slightly moist to moist, some clay, some sand, trace gravel, trace topsoil, trace rootlets, isolated pockets of topsoil		SS2	10	90		○		×
1			272.5							
		SILT compact to very dense, brown, moist, some sand, trace clay, trace gravel		SS3	17	80		○		×
2				SS4	55	100		○		×
3				SS5	78	90		○		×
4										
			268.9	SS6	28	85		○		×
5		***END OF BOREHOLE***								
6		Notes: 1. Boreholes advanced using solid stem augers to 5.0m depth on July 26, 2024. 2. Borehole was found to be dry upon completion of drilling.								
7										
8										
9										
10										

Drill Method: S/S Auger

Drill Date: July 26, 2024

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Datum: Geodetic

Checked by: L.G.

Project No: 44148A

Borehole #: BH8

Project: Proposed Helicopter Hanger

Borehole Location: See Figure 1

Location: 350 Garfield Wright Boulevard, East Gwillimbury, ON

Project Engineer: L.G.

Client: Parkin Architects Limited

Drawing No.: 9

SUBSURFACE PROFILE				SAMPLE						
Depth (m)	Symbol	Description	Elevation (m)	Type	N = Blows/300mm	Recovery (%)	U Wt (kN/m3)	○ - SPT Blows/300mm ○ 20 40 60 80	▲ Penetrometer ▲ 50 100 150 200	Moisture x Moisture% x 10 20 30
0		Ground Surface	273.9							
		TOPSOIL - 75mm		SS1	10	45		○		×
		FILL - SILT compact, brown, slightly moist to moist, some clay, some sand, trace gravel, trace topsoil, trace rootlets, oxidized		SS2	13	80		○		×
1			272.2							
		SILT compact to dense, brown becoming grey below 4.6m, moist, some sand, trace clay, trace gravel, oxidized		SS3	28	90		○		×
2				SS4	39	70		○		×
3				SS5	29	100		○		×
4										
			268.9	SS6	30	80		○		×
5		***END OF BOREHOLE***								
6		Notes: 1. Boreholes advanced using solid stem augers to 5.0m depth on July 26, 2024. 2. Borehole was found to be dry upon completion of drilling.								
7										
8										
9										
10										

Drill Method: S/S Auger

Drill Date: July 26, 2024

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Datum: Geodetic

Checked by: L.G.

Project No: 44148A

Borehole #: BH9

Project: Proposed Helicopter Hanger

Borehole Location: See Figure 1

Location: 350 Garfield Wright Boulevard, East Gwillimbury, ON

Project Engineer: L.G.

Client: Parkin Architects Limited

Drawing No.: 10

SUBSURFACE PROFILE				SAMPLE						
Depth (m)	Symbol	Description	Elevation (m)	Type	N = Blows/300mm	Recovery (%)	U.Wt (kN/m3)	○ - SPT Blows/300mm ○ 20 40 60 80	▲ Penetrometer ▲ 50 100 150 200	Moisture x Moisture% x 10 20 30
0		Ground Surface	273.7							
		TOPSOIL - 75mm		SS1	9	55		○		×
		FILL - SILT loose to compact, brown, moist, some clay, som sand, trace gravel, trace topsoil, trace rootlets		SS2	23	80		○		×
1			272.0							
		SILT compact to dense, brown, moist, some sand, trace clay, trace gravel, oxidized, minor dilation in Sample SS4		SS3	24	95		○		×
2				SS4	20	100		○		
3				SS5	20	65		○		×
4										
			268.7	SS6	36	100		○		×
5		***END OF BOREHOLE***								
6		Notes: 1. Boreholes advanced using solid stem augers to 5.0m depth on July 26, 2024. 2. Borehole was found to be dry upon completion of drilling.								
7										
8										
9										
10										

Drill Method: S/S Auger

Drill Date: July 26, 2024

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Checked by: L.G.

Project No: 44148A

Borehole #: BH10

Project: Proposed Helicopter Hanger

Borehole Location: See Figure 1

Location: 350 Garfield Wright Boulevard, East Gwillimbury, ON

Project Engineer: L.G.

Client: Parkin Architects Limited

Drawing No.: 11

SUBSURFACE PROFILE				SAMPLE						
Depth (m)	Symbol	Description	Elevation (m)	Type	N = Blows/300mm	Recovery (%)	U.Wt (kN/m3)	- SPT Blows/300mm 20 40 60 80	▲ Penetrometer ▲ 50 100 150 200	Moisture x Moisture% x 10 20 30
0		Ground Surface	273.8							
		TOPSOIL - 50mm		SS1	14	85		○		×
		FILL - SILT compact to very dense, brown, moist, some clay, some sand, trace gravel, trace topsoil, trace rootlets, trace brick fragments		SS2	55	95		○		×
2			271.6	SS3	20	65		○		×
		SILT dense, brown, moist, some sand, trace clay, trace gravel, oxidized		SS4	32	65		○		×
3				SS5	37	55		○		×
5			268.7	SS6	33	100		○		×
		END OF BOREHOLE								

Notes:

1. Boreholes advanced using solid stem augers to 5.0m depth on July 26, 2024.

2. Borehole was found to be dry upon completion of drilling.

Drill Method: S/S Auger

Drill Date: July 26, 2024

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Datum: Geodetic

Checked by: L.G.

Project No: 44148A

Borehole #: BH11

Project: Proposed Helicopter Hanger

Borehole Location: See Figure 1

Location: 350 Garfield Wright Boulevard, East Gwillimbury, ON

Project Engineer: L.G.

Client: Parkin Architects Limited

Drawing No.: 12

SUBSURFACE PROFILE				SAMPLE						
Depth (m)	Symbol	Description	Elevation (m)	Type	N = Blows/300mm	Recovery (%)	U.Wt (kN/m3)	- SPT Blows/300mm 20 40 60 80	▲ Penetrometer ▲ 50 100 150 200	Moisture x Moisture% x 10 20 30
0		Ground Surface	273.7							
		TOPSOIL - 65mm								
		FILL - SILT compact, brown, slightly moist, some clay, some sand, trace gravel, trace topsoil, trace rootlets	273.0	SS1	10	60		○		×
1		***SILT*** very dense to dense, brown, slightly moist to moist, some sand, trace clay, trace gravel		SS2	59	95		○		×
			271.7	SS3	32	85		○		×
2		***END OF BOREHOLE***								
3		Notes: 1. Boreholes advanced using solid stem augers to 2.0m depth on July 29, 2024. 2. Borehole was found to be dry upon completion of drilling.								
4										
5										
6										

Drill Method: S/S Auger

Drill Date: July 29, 2024

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Checked by: L.G.

Project No: 44148A

Borehole #: BH12

Project: Proposed Helicopter Hanger

Borehole Location: See Figure 1

Location: 350 Garfield Wright Boulevard, East Gwillimbury, ON

Project Engineer: L.G.

Client: Parkin Architects Limited

Drawing No.: 13

SUBSURFACE PROFILE				SAMPLE						
Depth (m)	Symbol	Description	Elevation (m)	Type	N = Blows/300mm	Recovery (%)	U.Wt.(kN/m3)	- SPT Blows/300mm 20 40 60 80	▲ Penetrometer ▲ 50 100 150 200	Moisture x Moisture% x 10 20 30
0		Ground Surface	273.5							
		TOPSOIL - 50mm								
		FILL - SILT compact to loose, brown, moist to saturated, some clay, some sand, trace gravel, trace topsoil, trace rootlets, dilated at Sample SS2		SS1	13	65		○		×
1				SS2	6	80		○		×
			271.9							
		SILT dense, brown, moist, some sand, trace clay, trace gravel	271.5	SS3	30	70		○		×
2		***END OF BOREHOLE***								
		Notes: 1. Boreholes advanced using solid stem augers to 2.0m depth on July 29, 2024. 2. Borehole was found to be dry upon completion of drilling.								
3										
4										
5										
6										

Drill Method: S/S Auger

Drill Date: July 29, 2024

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Checked by: L.G.

Project No: 44148A

Borehole #: BH13

Project: Proposed Helicopter Hanger

Borehole Location: See Figure 1

Location: 350 Garfield Wright Boulevard, East Gwillimbury, ON

Project Engineer: L.G.

Client: Parkin Architects Limited

Drawing No.: 14

SUBSURFACE PROFILE				SAMPLE						
Depth (m)	Symbol	Description	Elevation (m)	Type	N = Blows/300mm	Recovery (%)	U.Wt (kN/m3)	○ - SPT Blows/300mm 20 40 60 80	▲ Penetrometer ▲ 50 100 150 200	Moisture x Moisture% x 10 20 30
0		Ground Surface	273.9							
		TOPSOIL - 50mm								
		FILL - SILT compact, brown, moist, some clay, some sand, trace gravel, trace topsoil, trace rootlets	273.2	SS1	11	45		○		×
1		***SILT*** compact, brown, moist, some sand, trace clay, trace gravel		SS2	22	90		○		×
				SS3	23	80		○		×
2			272.0							
		END OF BOREHOLE								
3		Notes: 1. Boreholes advanced using solid stem augers to 2.0m depth on July 29, 2024. 2. Borehole was found to be dry upon completion of drilling.								
4										
5										
6										

Drill Method: S/S Auger

Drill Date: July 29, 2024

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Datum: Geodetic

Checked by: L.G.

Project No: 44148A

Borehole #: BH14

Project: Proposed Helicopter Hanger

Borehole Location: See Figure 1

Location: 350 Garfield Wright Boulevard, East Gwillimbury, ON

Project Engineer: L.G.

Client: Parkin Architects Limited

Drawing No.: 15

SUBSURFACE PROFILE				SAMPLE						
Depth (m)	Symbol	Description	Elevation (m)	Type	N = Blows/300mm	Recovery (%)	U.Wt.(kN/m3)	○ - SPT Blows/300mm ○ 20 40 60 80	▲ Penetrometer ▲ 50 100 150 200	Moisture x Moisture% x 10 20 30
0		Ground Surface	274.0							
		TOPSOIL - 60mm								
		FILL - SILT compact, brown, moist, some clay, some sand, trace gravel, trace topsoil, trace rootlets	273.3	SS1	20	60				
1		***SILT*** compact, brown, moist to saturated, some sand, trace clay, trace gravel, minor dilation in Sample SS3		SS2	14	80				
			272.0	SS3	22	100				
2		***END OF BOREHOLE***								
		Notes: 1. Boreholes advanced using solid stem augers to 2.0m depth on July 29, 2024. 2. Borehole was found to be dry upon completion of drilling.								
3										
4										
5										
6										

Drill Method: S/S Auger

Drill Date: July 29, 2024

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Datum: Geodetic

Checked by: L.G.

Project No: 44148A

Borehole #: BH15

Project: Proposed Helicopter Hanger

Borehole Location: See Figure 1

Location: 350 Garfield Wright Boulevard, East Gwillimbury, ON

Project Engineer: L.G.

Client: Parkin Architects Limited

Drawing No.: 16

SUBSURFACE PROFILE				SAMPLE						
Depth (m)	Symbol	Description	Elevation (m)	Type	N = Blows/300mm	Recovery (%)	U.Wt (kN/m3)	- SPT Blows/300mm 20 40 60 80	▲ Penetrometer ▲ 50 100 150 200	Moisture x Moisture% x 10 20 30
0		Ground Surface	272.9							
		TOPSOIL - 75mm	272.9							
		FILL - SILT compact, brown, moist, some clay, some sand, trace gravel, trace topsoil, trace rootlets	272.2	SS1	16	100		○		×
1		***SILT*** compact, brown, moist, some sand, trace clay, trace gravel		SS2	23	80		○		×
				SS3	24	70		○		×
2			271.0							
		END OF BOREHOLE								
3		Notes: 1. Boreholes advanced using solid stem augers to 2.0m depth on July 29, 2024. 2. Borehole was found to be dry upon completion of drilling.								
4										
5										
6										

Drill Method: S/S Auger

Drill Date: July 29, 2024

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Datum: Geodetic

Checked by: L.G.

Project No: 44148A

Borehole #: BH16

Project: Proposed Helicopter Hanger

Borehole Location: See Figure 1

Location: 350 Garfield Wright Boulevard, East Gwillimbury, ON

Project Engineer: L.G.

Client: Parkin Architects Limited

Drawing No.: 17

SUBSURFACE PROFILE				SAMPLE						
Depth (m)	Symbol	Description	Elevation (m)	Type	N = Blows/300mm	Recovery (%)	U.Wt.(kN/m3)	- SPT Blows/300mm 20 40 60 80	▲ Penetrometer ▲ 50 100 150 200	Moisture x Moisture% x 10 20 30
0		Ground Surface	273.2							
		TOPSOIL - 75mm	273.1							
		FILL - SILT compact, brown, moist, some clay, some sand, trace gravel, trace topsoil, trace rootlets		SS1	14	100		○		×
1			272.2	SS2	20	90		○		×
		SILT compact, brown, moist, some sand, trace clay, trace gravel		SS3	21	70		○		×
2			271.2							
		END OF BOREHOLE								
3		Notes: 1. Boreholes advanced using solid stem augers to 2.0m depth on July 29, 2024. 2. Borehole was found to be dry upon completion of drilling.								
4										
5										
6										

Drill Method: S/S Auger

Drill Date: July 29, 2024

PATRIOT ENGINEERING LTD.
80 Nashdene Road., Unit 62, Toronto, ON, M1V 5E4
Phone: (416) 293-7716 Fax: (416) 293-6722
e-mail: info@patrioteng.ca

Datum: Geodetic

Checked by: L.G.

Project No: 44148A

Borehole #: BH17

Project: Proposed Helicopter Hanger

Borehole Location: See Figure 1

Location: 350 Garfield Wright Boulevard, East Gwillimbury, ON

Project Engineer: L.G.

Client: Parkin Architects Limited

Drawing No.: 18

SUBSURFACE PROFILE				SAMPLE						
Depth (m)	Symbol	Description	Elevation (m)	Type	N = Blows/300mm	Recovery (%)	U.Wt.(kN/m3)	○ - SPT Blows/300mm ○ 20 40 60 80	▲ Penetrometer ▲ 50 100 150 200	Moisture x Moisture% x 10 20 30
0		Ground Surface	273.7							
		~~275.6~~								
		TOPSOIL - 75mm								
		FILL - SILT compact, brown, moist, some clay, some sand, trace gravel, trace topsoil, trace rootlets, trace wood pieces		SS1	13	60		○		×
1				SS2	14	95		○		×
			272.1							
		SILT dense, brown, moist, some sand, trace clay, trace gravel	271.7	SS3	30	80		○		×
2		***END OF BOREHOLE***								
		Notes:								
		1. Boreholes advanced using solid stem augers to 2.0m depth on July 29, 2024.								
		2. Borehole was found to be dry upon completion of drilling.								
3										
4										
5										
6										

Drill Method: S/S Auger

Drill Date: July 29, 2024

PATRIOT ENGINEERING LTD.
80 Nashdene Road., Unit 62, Toronto, ON, M1V 5E4
Phone: (416) 293-7716 Fax: (416) 293-6722
e-mail: info@patrioteng.ca

Datum: Geodetic

Checked by: L.G.

Project No: 44148A

Borehole #: BH18

Project: Proposed Helicopter Hanger

Borehole Location: See Figure 1

Location: 350 Garfield Wright Boulevard, East Gwillimbury, ON

Project Engineer: L.G.

Client: Parkin Architects Limited

Drawing No.: 19

SUBSURFACE PROFILE				SAMPLE						
Depth (m)	Symbol	Description	Elevation (m)	Type	N = Blows/300mm	Recovery (%)	U.Wt (kN/m3)	- SPT Blows/300mm 20 40 60 80	▲ Penetrometer ▲ 50 100 150 200	Moisture x Moisture% x 10 20 30
0		Ground Surface	273.3							
		TOPSOIL - 75mm	273.2							
		FILL - SILT compact, brown, moist, some clay, some sand, trace gravel, trace topsoil, trace rootlets, trace wood peices		SS1	11	60		○		×
			272.4							
1		***SILT*** compact, brown, moist, some sand, trace clay, trace gravel		SS2	25	95		○		×
				SS3	24	80		○		×
			271.3							
2		***END OF BOREHOLE*** Notes: 1. Boreholes advanced using solid stem augers to 2.0m depth on July 29, 2024. 2. Borehole was found to be dry upon completion of drilling.								
3										
4										
5										
6										

Drill Method: S/S Auger

Drill Date: July 29, 2024

PATRIOT ENGINEERING LTD.
80 Nashdene Road., Unit 62, Toronto, ON, M1V 5E4
Phone: (416) 293-7716 Fax: (416) 293-6722
e-mail: info@patrioteng.ca

Datum: Geodetic

Checked by: L.G.

Project No: 44148A

Borehole #: BH19

Project: Proposed Helicopter Hanger

Borehole Location: See Figure 1

Location: 350 Garfield Wright Boulevard, East Gwillimbury, ON

Project Engineer: L.G.

Client: Parkin Architects Limited

Drawing No.: 20

SUBSURFACE PROFILE				SAMPLE				- SPT Blows/300mm 20 40 60 80	▲ Penetrometer ▲ 50 100 150 200	Moisture x Moisture% x 10 20 30
Depth (m)	Symbol	Description	Elevation (m)	Type	N = Blows/300mm	Recovery (%)	U.Wt.(kN/m3)			
0		Ground Surface	273.8							
		TOPSOIL - 60mm		SS1	16	100				
		FILL - SILT compact to dense, brown, moist, some clay, some sand, trace gravel, trace topsoil, trace rootlets		SS2	28	95				
1										
				SS3	39	100				
2			271.7							
		SILT compact to very dense, brown becoming grey below 4.6m depth, moist to saturated, some sand, trace clay, trace gravel, isolated pockets of clay, oxidized, dilated		SS4	15	100				
3				SS5	21	100				
4										
				SS6	18	100				
5										
6				SS7	25	100				
			266.8							
7		***SANDY SILT*** very dense, grey, moist, some clay, trace gravel, minor dilation								
			265.7	SS8	62	100				
8		***END OF BOREHOLE*** Notes: 1. Boreholes advanced using solid stem augers to 8.1m depth on September 23, 2024. 2. Short term groundwater water level measured at 5m depth upon completion of drilling.								
9										
10										

Drill Method: S/S Auger

Drill Date: September 23, 2024

PATRIOT ENGINEERING LTD.
80 Nashdene Road., Unit 62, Toronto, ON, M1V 5E4
Phone: (416) 293-7716 Fax: (416) 293-6722
e-mail: info@patrioteng.ca

Datum: Geodetic

Checked by: L.G.

Project No: 44148A

Borehole #: BH20

Project: Proposed Helicopter Hanger

Borehole Location: See Figure 1

Location: 350 Garfield Wright Boulevard, East Gwillimbury, ON

Project Engineer: L.G.

Client: Parkin Architects Limited

Drawing No.: 21

SUBSURFACE PROFILE				SAMPLE						
Depth (m)	Symbol	Description	Elevation (m)	Type	N = Blows/300mm	Recovery (%)	U.Wt (kN/m3)	- SPT Blows/300mm 20 40 60 80	▲ Penetrometer ▲ 50 100 150 200	Moisture x Moisture% x 10 20 30
		Ground Surface	274.2							
0		***TOPSOIL - 60mm***		SS1	17	100				
		FILL - SILT compact, brown, moist, some clay, some sand, trace gravel, trace topsoil, trace rootlets		SS2	25	100				
1										
				SS3	23	100				
2			272.1							
		SILT compact, brown becoming grey below 4.6m depth, moist to saturated, some sand, trace clay, trace gravel, isolated pockets of clay, oxidized, dilated		SS4	17	100				
3				SS5	10	100				
4										
				SS6	19	100				
5			268.6							
		SANDY SILT very dense, grey, moist, trace clay, trace gravel		SS7	56	100				
6										
7										
				SS8	50	30		/125mm		
8			266.1							
		END OF BOREHOLE Notes: 1. Boreholes advanced using solid stem augers to 8.1m depth on September 23, 2024. 2. Short term groundwater water level measured at 5.4m depth upon completion of drilling.								
9										
10										

Drill Method: S/S Auger

Drill Date: September 23, 2024

PATRIOT ENGINEERING LTD.
80 Nashdene Road., Unit 62, Toronto, ON, M1V 5E4
Phone: (416) 293-7716 Fax: (416) 293-6722
e-mail: info@patrioteng.ca

Datum: Geodetic

Checked by: L.G.

Project No: 44148A

Borehole #: BH21

Project: Proposed Helicopter Hanger

Borehole Location: See Figure 1

Location: 350 Garfield Wright Boulevard, East Gwillimbury, ON

Project Engineer: L.G.

Client: Parkin Architects Limited

Drawing No.: 22

SUBSURFACE PROFILE				SAMPLE						
Depth (m)	Symbol	Description	Elevation (m)	Type	N = Blows/300mm	Recovery (%)	U.Wt.(kN/m3)	○ - SPT Blows/300mm ○ 20 40 60 80	▲ Penetrometer ▲ 50 100 150 200	Moisture x Moisture% x 10 20 30
0		Ground Surface	273.9							
		TOPSOIL - 75mm		SS1	17	100		○		×
		FILL - SILT compact, brown, moist, some clay, trace to some sand, trace gravel, trace topsoil, trace rootlets, trace wood pieces		SS2	20	100		○		×
1				SS3	42	90		○		×
2				SS4	36	100		○		×
3				SS5	30	100		○		×
4			269.8							
		SILT compact to very dense, brown becoming grey below 4.6m depth, slightly moist to saturated, trace sand, some clay, trace gravel, isolated pockets of clay, oxidized, dilated at Sample SS6		SS6	11	100		○		×
5										
6				SS7	85	100		○		×
			266.9							
7		***SANDY SILT*** very dense, grey, slightly moist, trace clay, trace gravel								
			265.8	SS8	50	20		○/125mm		×
8		***END OF BOREHOLE*** Notes: 1. Boreholes advanced using solid stem augers to 8.1m depth on September 23, 2024. 2. Short term groundwater water level measured at 5.4m depth upon completion of drilling.								
9										
10										

Drill Method: S/S Auger

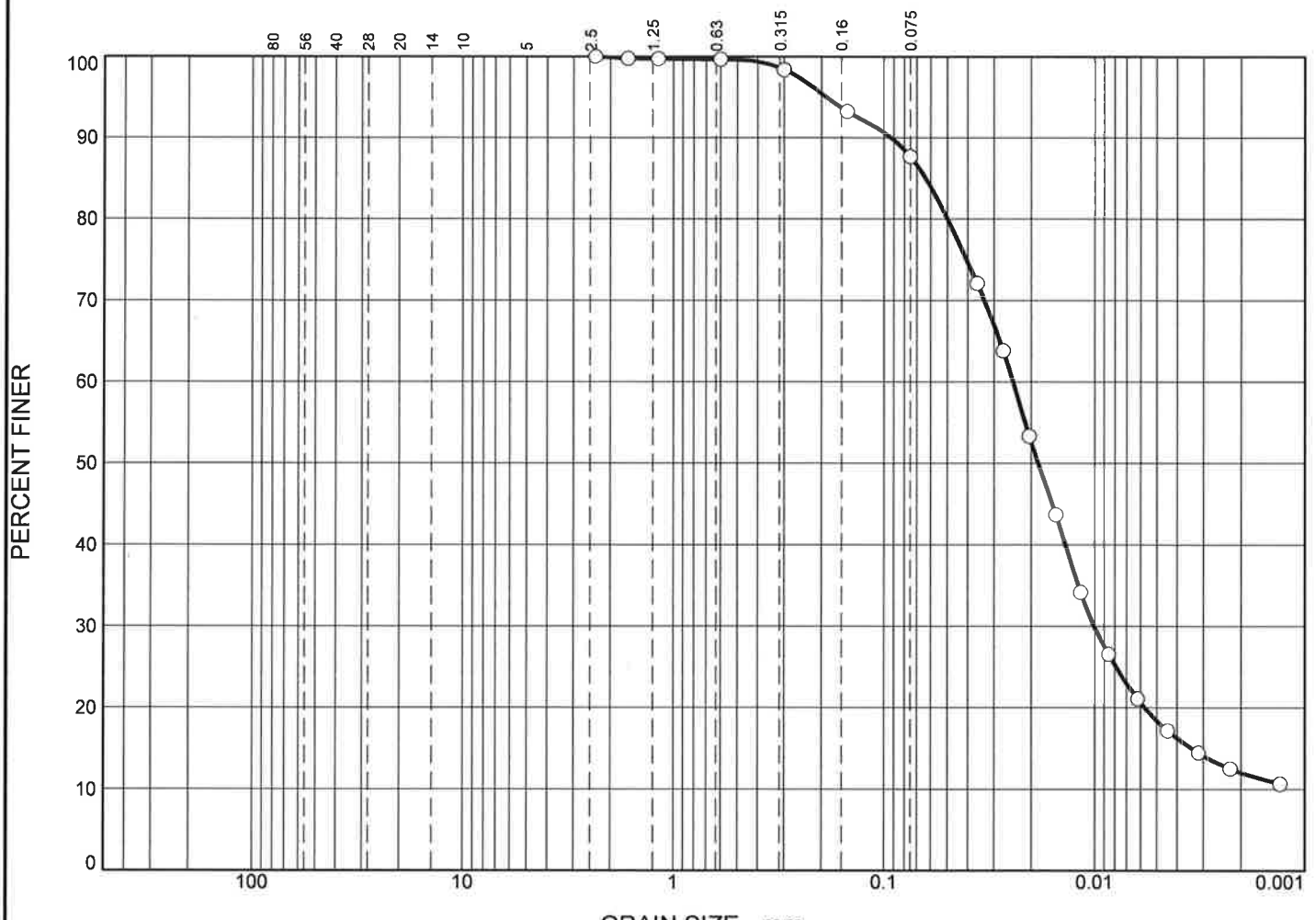
Drill Date: September 23, 2024

PATRIOT ENGINEERING LTD.
80 Nashdene Road., Unit 62, Toronto, ON, M1V 5E4
Phone: (416) 293-7716 Fax: (416) 293-6722
e-mail: info@patrioteng.ca

Datum: Geodetic

Checked by: L.G.

Particle Size Distribution Report



	% Cobbles	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.1	0.4	11.8	75.7	12.0

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.0635	0.0244	0.0185	0.0101	0.0034			

Material Description	USCS	AASHTO
○ Silt, some sand, some clay		

Project No. 44148A **Client:** Parkin Architects Limited

Project: Proposed Helicopter Hangar, 350 Garfield Wright Boulevard, East Gwillimbury, Ontario

○ **Source:** BH4 SS3 **Depth:** 5' to 6.5' **Sample No.:** R5071

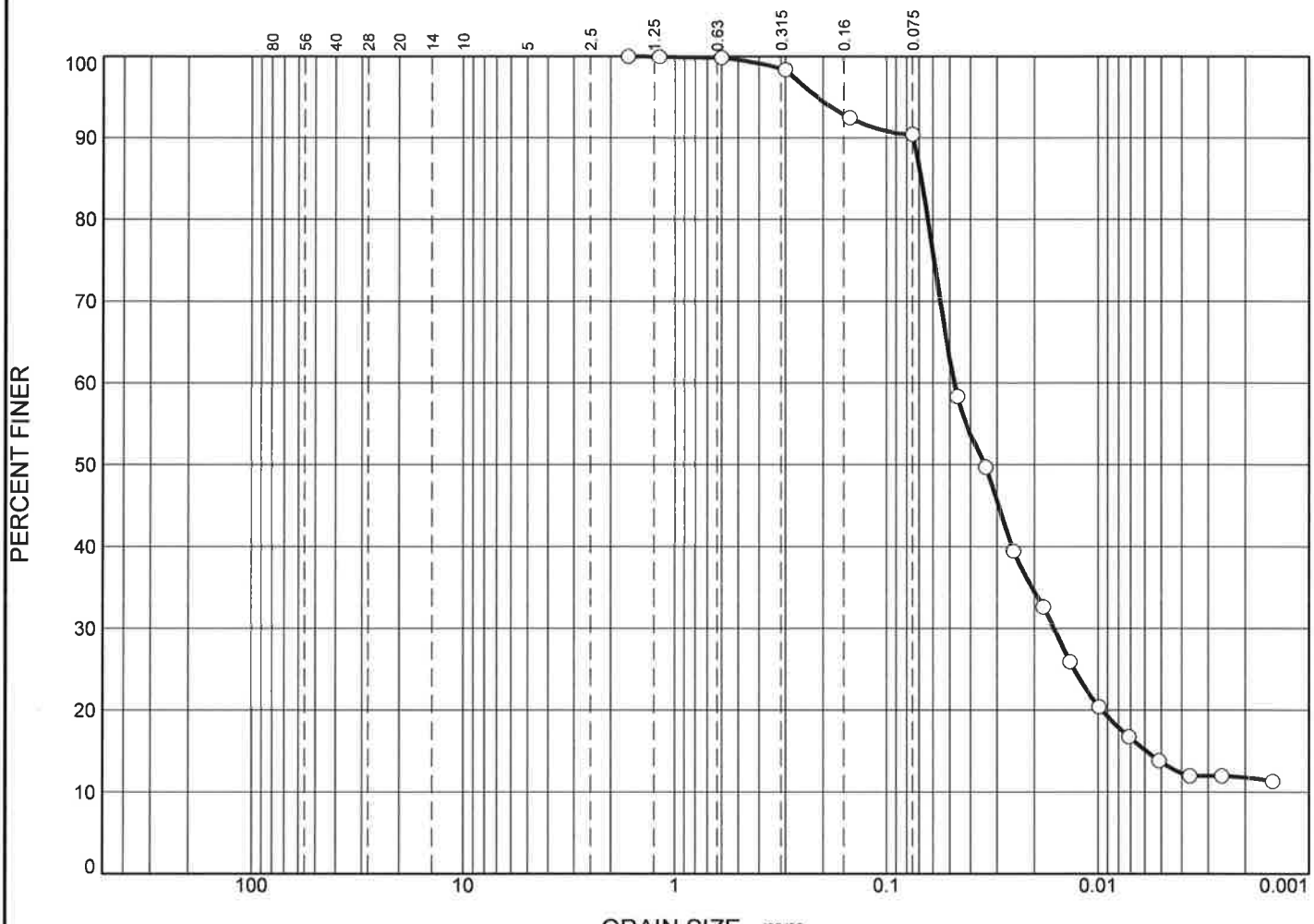
Remarks:

○ Date of Sampling: July 25, 2024

PATRIOT ENGINEERING LTD. - CONSULTING ENGINEERS

Figure 23

Particle Size Distribution Report



	% Cobbles	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.7	8.9	76.8	13.6

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.0682	0.0476	0.0343	0.0162	0.0059			

Material Description	USCS	AASHTO
○ silt, some clay, trace sand		

Project No. 44148A **Client:** Parkin Architects Limited

Project: Proposed Helicopter Hangar, 350 Garfield Wright Boulevard, East Gwillimbury, Ontario

○ **Source:** BH21 SS3 **Depth:** 5' to 6.5' **Sample No.:** R5078

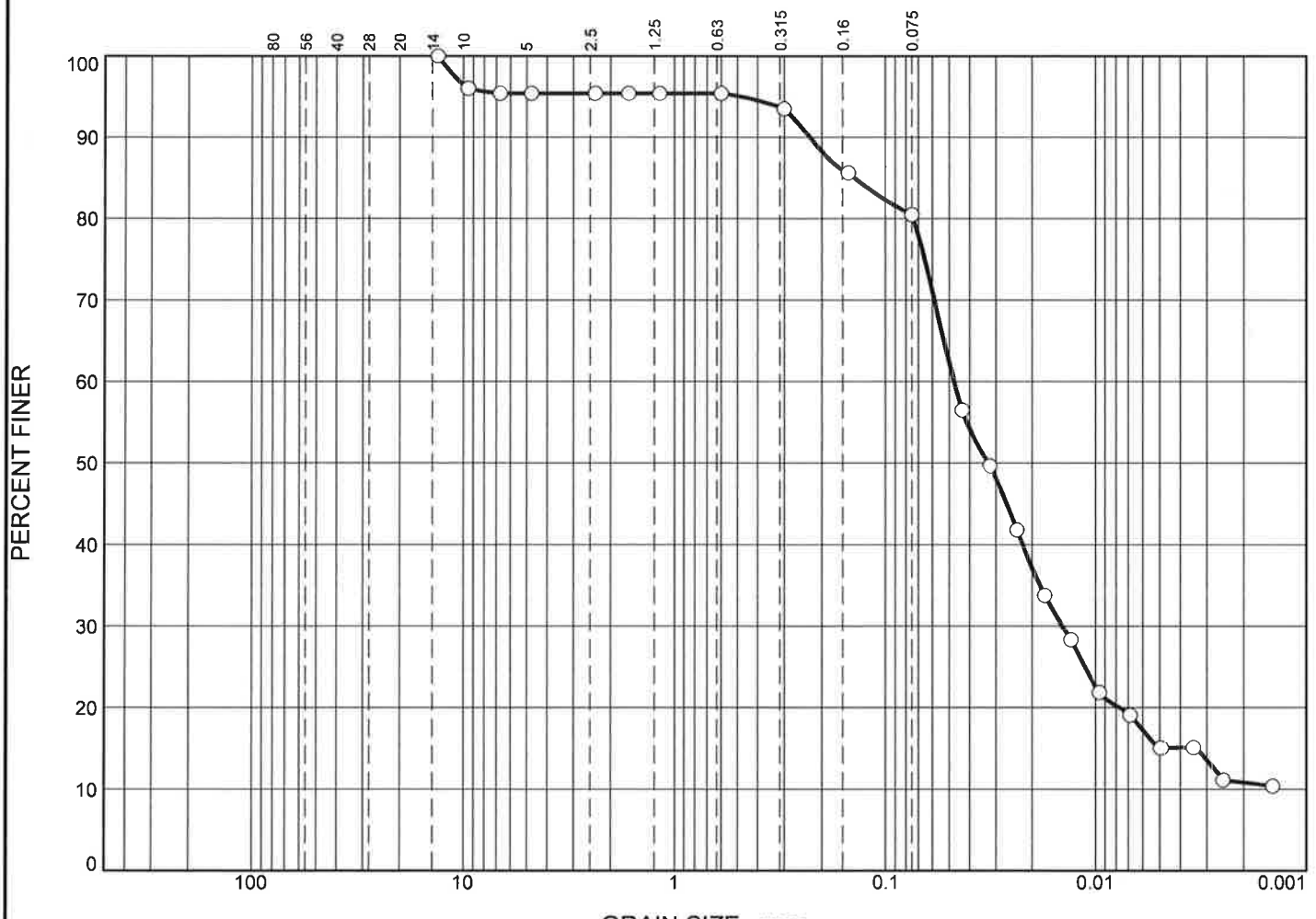
Remarks:

○ Date of Sampling
September 23, 2024

PATRIOT ENGINEERING LTD. - CONSULTING ENGINEERS

Figure 24

Particle Size Distribution Report



	% Cobbles	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	4.6	0.0	0.7	14.2	69.7	10.8

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.1403	0.0475	0.0327	0.0144	0.0034			

Material Description	USCS	AASHTO
○ Silt, some clay, some sand, trace gravel		

Project No. 44148A **Client:** Parkin Architects Limited

Project: Proposed Helicopter Hangar, 350 Garfield Wright Boulevard, East Gwillimbury, Ontario

○ **Source:** BH2 SS3 **Depth:** 7.5' to 9' **Sample No.:** R5063

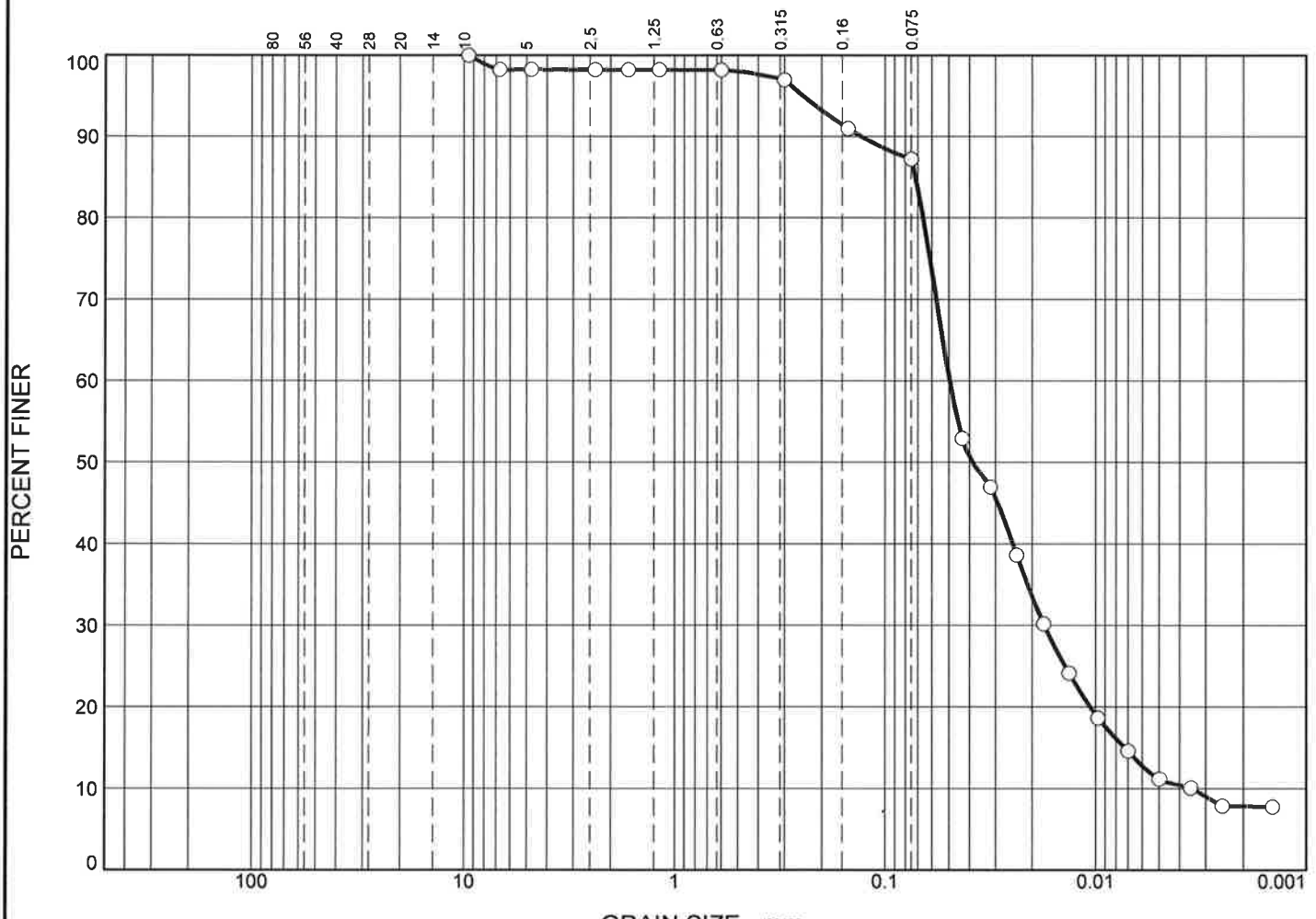
Remarks:

○ Date of Sampling; July 25, 2024

PATRIOT ENGINEERING LTD. - CONSULTING ENGINEERS

Figure 25

Particle Size Distribution Report



	% Cobbles	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	1.8	0.0	0.5	10.5	79.4	7.8

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.0717	0.0495	0.0388	0.0175	0.0073	0.0035	1.77	14.12

Material Description	USCS	AASHTO
○ Silt, some sand, trace clay, trace gravel		

Project No. 44148A **Client:** Parkin Architects Limited

Project: Proposed Helicopter Hangar, 350 Garfield Wright Boulevard, East Gwillimbury, Ontario

○ **Source:** BH5 SS3 **Depth:** 7.5' to 9' **Sample No.:** R5064

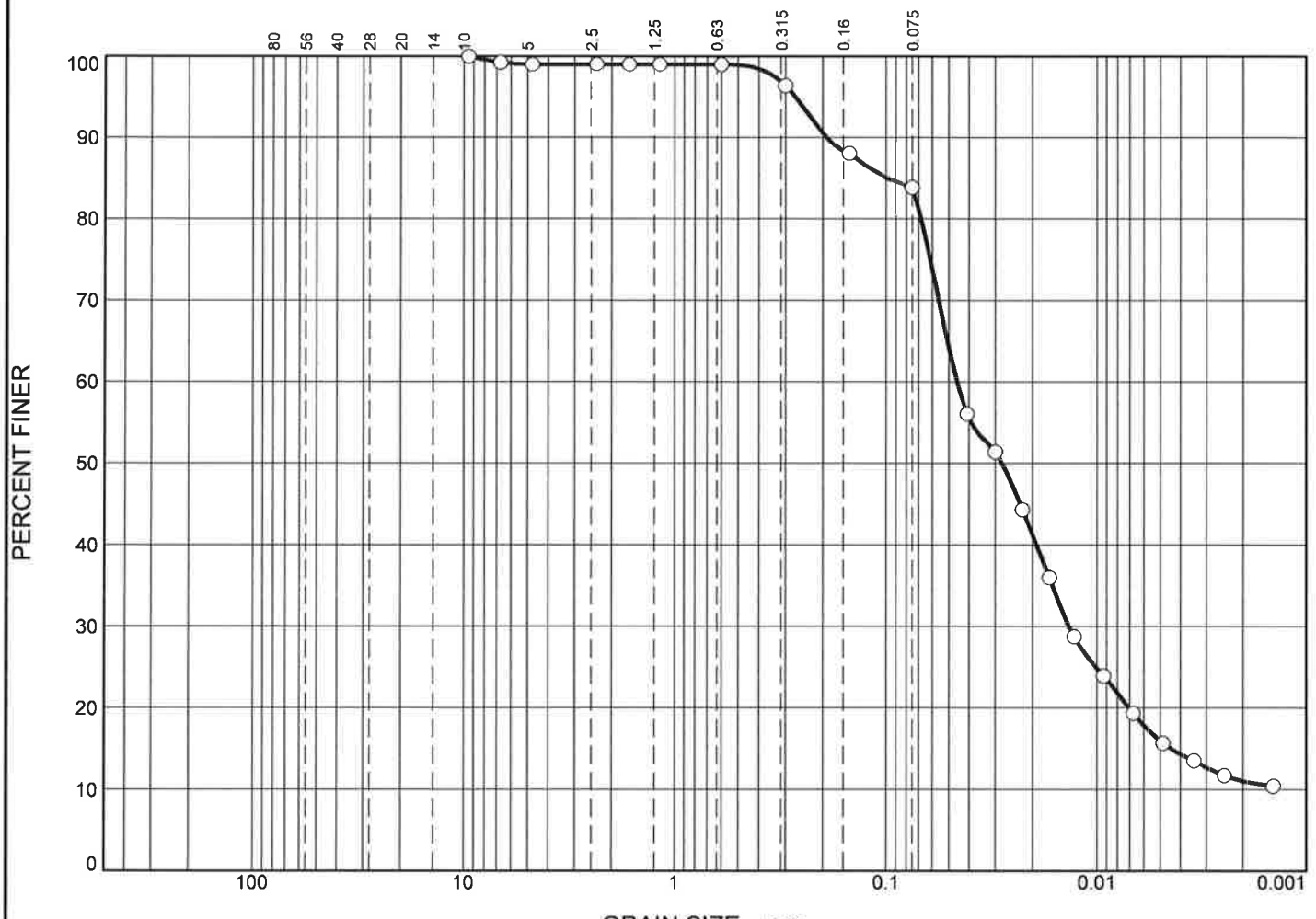
Remarks:

○ Date of Sampling, July 25, 2024

PATRIOT ENGINEERING LTD. - CONSULTING ENGINEERS

Figure 26

Particle Size Distribution Report



	% Cobbles	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	1.0	0.0	0.4	14.7	72.9	11.0

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.0991	0.0457	0.0279	0.0135	0.0044			

Material Description	USCS	AASHTO
○ Silt, some sand, trace clay, trace gravel		

Project No. 44148A **Client:** Parkin Architects Limited

Project: Proposed Helicopter Hangar, 350 Garfield Wright Boulevard, East Gwillimbury, Ontario

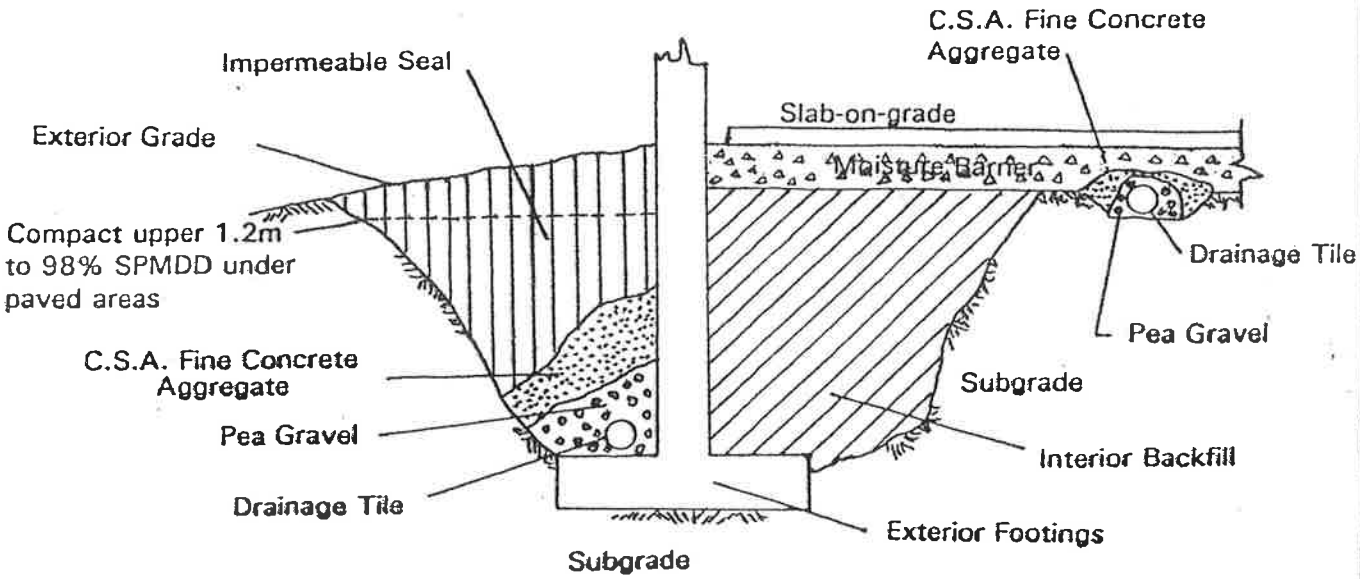
○ **Source:** BH9 SS3 **Depth:** 7.5' to 9' **Sample No.:** R5065

Remarks:

○ Date of Sampling, July 26, 2024

PATRIOT ENGINEERING LTD. - CONSULTING ENGINEERS

Figure 27



NOTES:

1. Drainage tile to consist of 10cm (4") diameter weeping tile or equivalent perforated pipe leading to a positive sump or outlet. Invert to be minimum of 15cm (6") below underside of floor slab.
2. Pea gravel 15cm (6") top and sides of drain. If drain is not on footing, place 10cm (4") of pea gravel below drain. 20mm (3/4") stone is an alternative, provided it is covered by an approved geotextile.
3. C.S.A. fine concrete aggregate to act as filter material. Minimum 30cm (12") top and side of tile drain. This may be replaced by an approved porous plastic membrane as indicated in 2.
4. Impermeable backfill seal-compacted clay, clay silt or equivalent. If original soil is free-draining, seal may be omitted.
5. The interior fill may be any clean, non organic soil which may be compacted to at least 98% Standard Proctor density in this confined space.
6. Do not use heavy compaction equipment within 0.5m (18") of the wall. Do not fill or compact within 1.8m (6') of wall unless the fill is placed on both sides simultaneously.
7. Moisture barrier to be at least 20cm (8") of compacted Granular "A" fill or equivalent free-draining material to be approved by our geotechnical staff.
8. The moisture barrier is to be compacted to 98% Standard Proctor maximum dry density.
9. Slab-on-grade should not be structurally connected to the wall or the footing.
10. Exterior grade to slope away from wall.
11. Underfloor drain invert to be at least 300mm (1') below the underside of floor slab. Tile placed in parallel rows 6-8m (20'- 25') centres one way.
12. Do not connect the underfloor drains to perimeter drains.
13. If the 20mm (3/4") stone requires surface blinding, use 6mm (1/4") stone chips.

DRAINAGE AND BACKFILL RECOMMENDATIONS

Not to Scale

	Name	Date
Drawn By		
Checked By		
Revisions		
Scale		

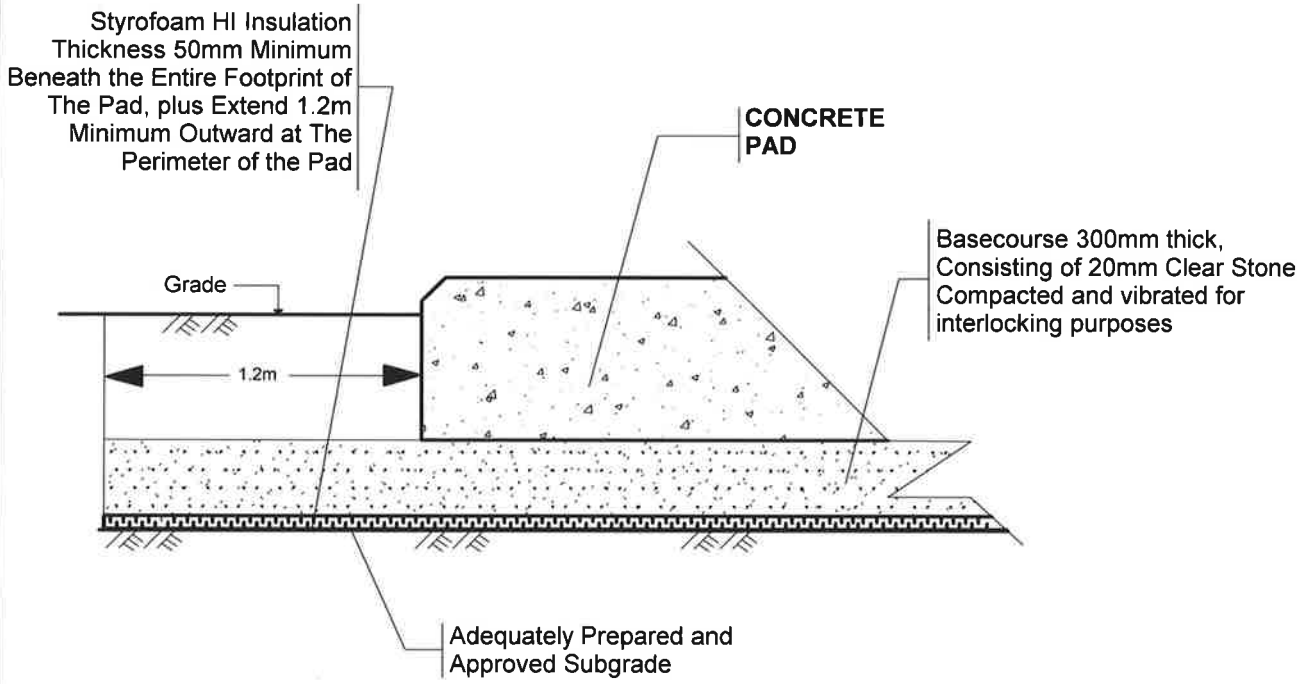
PATRIOT ENGINEERING LTD.
Consulting Engineers

Project : 44148A

Figure: 28

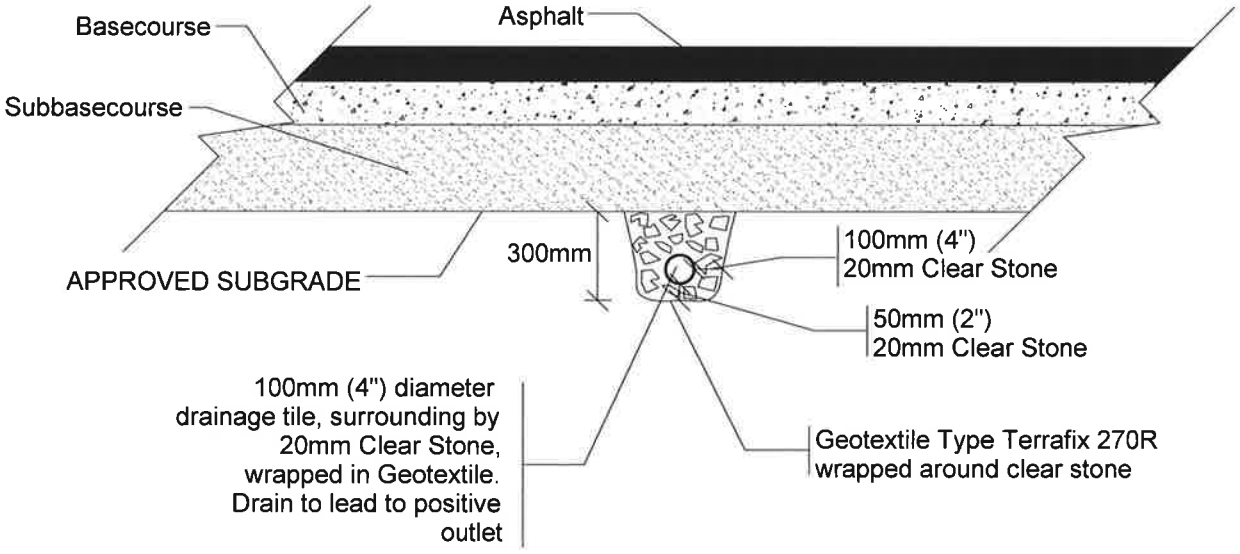
SCHEMATIC DETAIL FOR EXTERIOR CONCRETE PAD

1. A minimum of 0.3m (1ft) of exterior soil cover is required.
2. Good site grading is to be provided to prevent ponded water at pad base, otherwise adequately filtered perimeter drainage will be required.
3. Insulation should have at least two overlapping layers, have tight splices, glue should be used on any vertical surfaces and spot glue on the horizontal surfaces.
4. Provide a continuous Styrofoam HI insulation pad beneath the entire footprint of the pad, plus it must extend outward a minimum of 1.2m from the edge of the pad at the sides, as shown in the diagram below.
5. Basecourse to be at least 300mm thick consisting of 20mm (3/4 inch) clear stone compacted and vibrated for interlocking purposes.
6. The drawings must be reviewed with accompanying text.
7. Diagram provided below is for guidance only. In all cases, manufacturers' specifications must be followed for installing insulation.



Drawn By	Name	Date		**PATRIOT ENGINEERING LTD.** Consulting Engineers	
Checked By					
Revisions				Project: 44148A	Figure: 29
Scale	N.T.S.				

TYPICAL SUBDRAIN DETAIL



Drawn By	Name	Date		**PATRIOT ENGINEERING LTD.** Consulting Engineers	
Checked By					
Revisions				Project: 44148A	Figure: 30
Scale	N.T.S.				

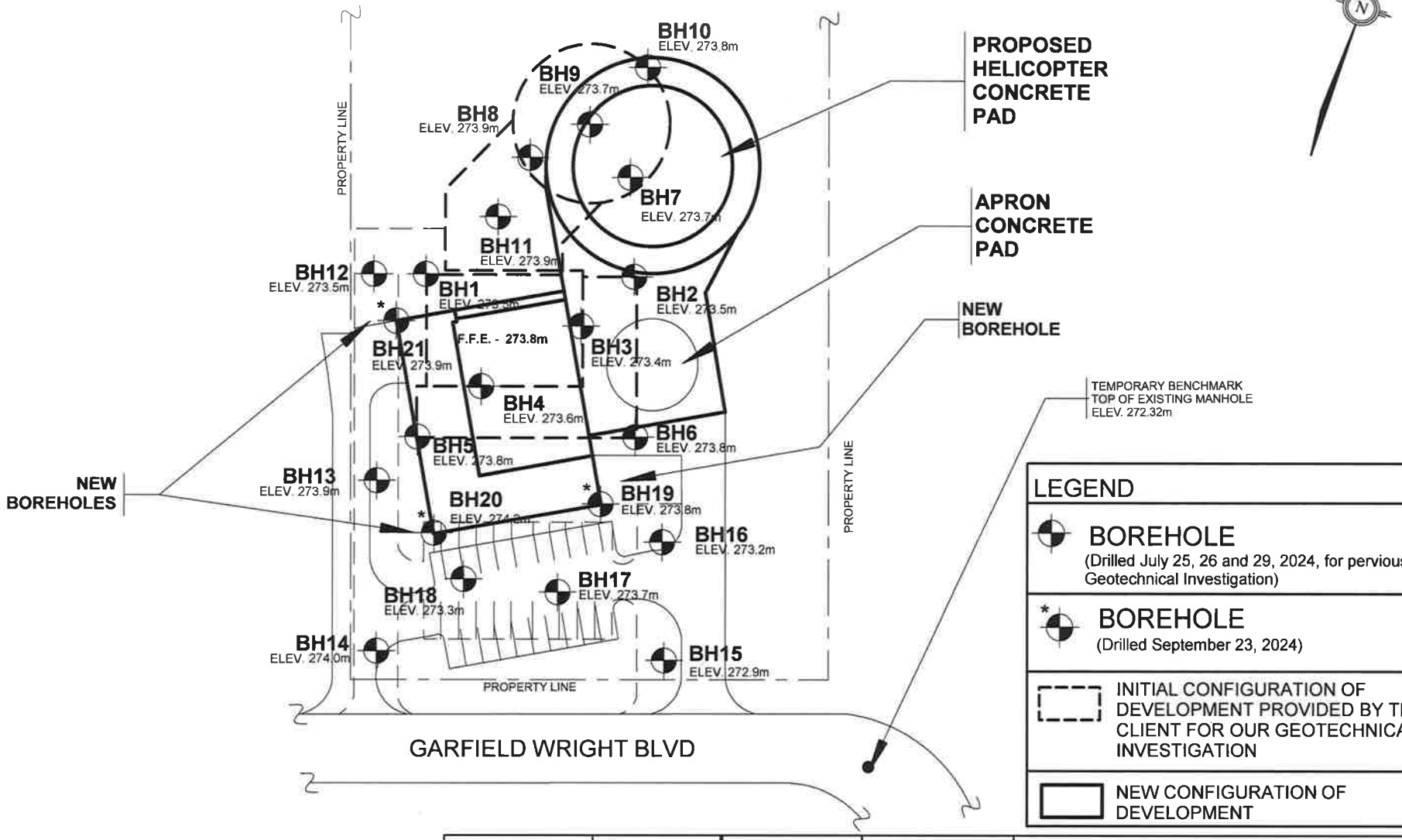
APPENDIX A

FOOTPRINTS OF ORIGINAL DEVELOPMENT AND NEW DEVELOPMENT
PROPOSED HELICOPTER HANGAR
350 GARFIELD WRIGHT BOULEVARD
EAST GWILLIMBURY, ONTARIO

FIGURE 1: PARTIAL SITE PLAN SHOWING THE APPROXIMATE BOREHOLE LOCATIONS

PROPOSED HELICOPTER HANGAR

350 GARFIELD WRIGHT BOULEVARD, EAST GWILLIMBURY, ONTARIO



LEGEND	
BOREHOLE (Drilled July 25, 26 and 29, 2024, for pervious Geotechnical Investigation)	
* BOREHOLE (Drilled September 23, 2024)	
INITIAL CONFIGURATION OF DEVELOPMENT PROVIDED BY THE CLIENT FOR OUR GEOTECHNICAL INVESTIGATION	
NEW CONFIGURATION OF DEVELOPMENT	

REFERENCE:

PARTIAL SITE PLAN INFORMATION ADAPTED FROM OVERALL SITE PLAN DRAWING NO. A-002, PREPARED BY PARKIN ARCHITECTS LIMITED, DATED APRIL 15, 2024, AS WELL AS THE REVISED DRAWING SUBMITTED TO US ON AUGUST 31, 2024 BY PARKIN ARCHITECTS LIMITED.

	Name	Date
Drawn By	M.A.	Sept '24
Checked By	L.G.	Sept '24
Revisions		
Scale	Reduced From Original	

PATRIOT ENGINEERING LTD.

Consulting Engineers

Project: 44148A

Figure: A1

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Consulting Engineers

EXPLANATION OF TERMS

1. SAMPLING PROCEDURES

AS	Auger Sample	GS	Grab Sample
SS	Split Spoon	ST	Shelby Tube

2. PENETRATION RESISTANCE

Standard Penetration Resistance 'N'

The number of blows that are required to advance a standard split spoon sampler 0.3 m into the subsurface soil, that is driven by means of a 63.5 kg hammer falling freely for a distance of 0.76 m.

Dynamic Penetration Resistance:

The number of blows that are required to advance a 51 mm diameter, 60 degree cone, fitted to the end of drill rods, 0.3m into subsurface soil. The driving energy is 475 J per blow.

3. DESCRIPTION OF SOIL

The description of the soil is based on visual examination of the samples obtained and laboratory testing. Each layer is described according to the following classification and terminology:

Classification*	Particle Size
Clay	less than 0.002 mm
Silt	from 0.002 to 0.075 mm
Sand	from 0.075 to 4.75 mm
Gravel	from 4.75 to 75 mm
Cobbles	from 75 to 200 mm
Boulders	larger than 200 mm

* Unified Soil Classification System (ASTM D2487-75).

Terminology	Proportion
Trace, or occasional	Less than 10%
Some	10 to 20%
Adjective (e.g. silty or sandy)	20 to 35%
And (e.g. sand and gravel)	35 to 50%

The relative density of the cohesionless soils and the consistency of cohesive soils are defined below:

Cohesionless Soils		Cohesive Soils		
Relative Density	Penetration Resistance "N" Blows/0.3 m or Blows/foot	Consistency	Underdrained Shear Strength**	
			kPa	psf
Very loose	0 to 4	Very soft	0 to 12	0 to 250
Loose	4 to 10	Soft	12 to 25	250 to 500
Compact	10 to 30	Firm	25 to 50	500 to 1000
Dense	30 to 50	Stiff	50 to 100	1000 to 2000
Very dense	over 50	Very Stiff	100 to 200	2000 to 4000
		Hard	over 200	over 4000

** The compressive strength obtained from the quick (Q) triaxial test is equal to twice the shear strength of the clay tested.

DRAFT

GEOTECHNICAL INVESTIGATION
PROPOSED HELICOPTER HANGER
350 GARFIELD WRIGHT BOULEVARD
EAST GWILLIMBURY, ONTARIO

Prepared for:

PARKIN ARCHITECTS LIMITED

PATRIOT ENGINEERING LTD.
Consulting Engineers

Project 44148
August 30, 2024

80 Nashdene Road, Unit 62
Toronto, Ontario
M1V 5E4
416-293-7716

DRAFT

TABLE OF CONTENTS

TEXT

DRAWINGS

DRAFT

PATRIOT
ENGINEERING LTD.
Consulting Engineers

Project 44148

August 30, 2024

Parkin Architects Limited
1 Valleybrook Drive
Toronto, Ontario
M3B 2S7

Attention: Mr. Lind Nyman
Principal

Geotechnical Investigation
Proposed Helicopter Hangar
350 Garfield Wright Boulevard
East Gwillimbury, Ontario

1.0 INTRODUCTION

It is our understanding that the proposed development at the above site will consist of constructing a helicopter hangar and an attached one storey building without a basement. An above grade Helicopter pad, an apron pad and a parking lot will also be constructed.

In light of this, Patriot Engineering Ltd., has carried out a geotechnical investigation to determine the subsurface soil and groundwater conditions in order to provide geotechnical recommendations for type of foundations, safe soil bearing pressures, earthquake design parameters, earth pressure coefficients, excavation and backfill procedures, slab-on-grade floor construction, plus pavement thicknesses. Authorization to proceed with this investigation was provided by Mr. Lind Nyman, from Parkin Architects Limited, on June 19, 2024, on behalf of the Owner.

The site is located approximately 400m north and 840m west from the intersection of Warden Avenue and Davis Drive, in East Gwillimbury, Ontario. It is vacant and unoccupied. The terrain is relatively flat. The site is generally covered with vegetation consisting of grass, shrubs and a few trees.

2.0 FIELDWORK

The fieldwork for this investigation took place on July 25, 26 and 29, 2024, and consisted of drilling a total of eighteen (18) boreholes using solid stem augers. A summary of the boreholes, their designations and their depths for this investigation is shown below:

(a) For the Helicopter Hangar and Attached One Storey Building
Six (6) boreholes (BH1 to BH6) to a depth of 8.1m each

(b) For the Helicopter Pad
Four (4) boreholes (BH7 to BH10) to a depth of 5.0m each

(c) For the Apron Concrete Pad Adjacent to Helicopter Concrete Pad
One (1) borehole (BH11) to a depth of 2.0m

(d) For the Parking Lot and Driveways
Seven (7) boreholes (BH12 to BH18) to a depth of 2.0m each

All boreholes were backfilled in accordance with Regulation 903.

The approximate borehole locations along with their surface elevations at the time of our drilling activity are shown on the Partial Site Plan, Figure 1.

The boreholes were drilled by using continuous flight solid stem augurs by a specialist drilling contractor under the supervision of Patriot Engineering Ltd. field engineering staff. Samples were obtained at regular depth intervals using a 50mm diameter split spoon sampler that was driven into the soil with a 63.5 kg drop hammer falling 760mm, in accordance with Standard Penetration Test (SPT) procedures (ASTM D1586). During the fieldwork, our staff member also inspected the samples and logged them. The samples were then brought to our laboratory for detailed inspections and laboratory testing. Samples were generally tested for moisture contents and selected samples were tested for gradation analysis / hydrometers.

Groundwater level readings were obtained during our drilling activity.

Surveying of the ground surface elevations at the borehole locations were determined by our field engineering personnel and referenced at the following datum:

> Top of manhole on Garfield Wright Boulevard, near the southeast corner of the property. The location of this manhole is also shown on Figure 1.

The elevation at this point is understood to be at Elev. 272.32m.

The scope of work for the geotechnical investigation for this project is as it is presented in this report, which is being provided on the assumption that the applicable codes and standards will be met. If there are any changes in the design features relevant to the geotechnical analysis, or if there are any apparent deviations of the report from relevant codes and standards, our office should be contacted to review the design.

3.0 SUBSURFACE CONDITIONS

The detailed subsurface stratigraphy encountered in the boreholes is presented on the Borehole Logs, Drawings 2 to 19.

In general, all boreholes were drilled from above grass covered regions at the site and initially advanced through a topsoil layer that ranged in thickness from approximately 50mm to 75mm.

Below the topsoil layer, earth fill material was encountered in all boreholes and consisted of brown, slightly moist to saturated, silt. This silt fill layer also contained some sand, plus traces of clay, gravel, topsoil, rootlets, wood pieces, brick fragments and plastic pieces. The "N" values (blows/foot) that were recorded within this fill material ranged from 6 to 55, revealing relative densities that were loose to very dense. The moisture contents varied from 4% to 21%. Some degree of dilation was noted in a few samples that were extracted from this layer. Figure 20 shows the grain size distribution test results that was performed on a sample extracted from this silt fill layer. Local variations of the composition of the material can occur at the sampling locations. It is our understanding that the location of the proposed development was part of a large construction site in the past where the subgrade was raised. Our boreholes indicate that this material was used to raise the subgrade.

The depth of the fill layers inside the boreholes which were drilled for the proposed building ranged from approximately 1.4m to 3.4m below existing grade. The depth of the fill layers inside the boreholes which were drilled for the helicopter pad and adjacent apron slab varied from 0.7m to 2.2m below existing slab. Similarly, The depth of the fill layers inside the boreholes which were drilled for the parking lot / driveway areas varied from approximately 0.7m to 1.6m below existing grade.

Below the earth fill material, all boreholes next encountered native soil that was composed of brown and/or grey, slightly moist to saturated, silt. This material also contained some sand, traces to some clay, plus traces of gravel and cobbles. The "N" values that were recorded within this layer ranged from 12 to well over 50, demonstrating relative densities that were compact to very dense. The moisture contents varied from 5% to 27%. Dilation was noted in several samples that were obtained from this layer. The results from our grain size distribution tests performed on three samples obtained from this native, silt layer are shown on Figures 21, 22 and 23. All boreholes with the exception of Boreholes BH1 and BH4, were terminated within this silt layer.

In Boreholes BH1 and BH4 only, beneath the silt layer, the soil that was encountered next consisted of grey, moist, sandy silt. The "N" values that were obtained from this layer were well over 50, displaying relative densities that were very dense. The moisture contents were 10% and 12%. Both Boreholes BH1 and BH4 were terminated in this sandy silt material.

Groundwater level readings were obtained upon the completion of drilling from each borehole. These short term groundwater levels that were recorded in each borehole are indicated below on Table 1.

Table 1
Measured Short Term Groundwater Level Readings Obtained Upon Completion of Drilling of Each Borehole

Borehole No.	Depth of Borehole (m)	Borehole Surface Elevation (m)	Approximate Depth of Groundwater Level Below Existing Ground (m)	Approximate Groundwater Elevation (m)
BH1	8.1	273.5	5.0	268.5
BH2	8.1	273.5	5.3	268.2
BH3	8.1	273.4	5.3	268.1
BH4	8.1	273.6	4.3	230.6
BH5	8.1	273.8	5.3	268.5
BH6	8.1	273.8	4.7	269.1
BH7	5.0	273.9	DRY	-
BH8	5.0	273.9	DRY	-
BH9	5.0	273.7	DRY	-
BH10	5.0	273.8	DRY	-
BH11	2.0	273.7	DRY	-
BH12	2.0	273.5	DRY	-
BH13	2.0	273.9	DRY	-
BH14	2.0	274.0	DRY	-
BH15	2.0	272.9	DRY	-
BH16	2.0	273.2	DRY	-
BH17	2.0	273.7	DRY	-
BH18	2.0	273.3	DRY	-

All groundwater level readings are also shown on the individual borehole logs.

Some seasonal fluctuations and higher water levels should be anticipated.

The soil and groundwater conditions presented in this report have been deducted from soil sampling that was noncontinuous and therefore, should not be taken to represent exact planes of geological change. Furthermore, the geotechnical recommendations and comments provided in this report have been based on boreholes that were widely spaced. Therefore, the soil and groundwater conditions between the boreholes could vary significantly. The interpretation between boreholes and the recommendations in this report must therefore be checked through field inspections, provided by our office during the construction stages, to validate the information for use.

4.0 GEOTECHNICAL RECOMMENDATIONS

The comments provided in this report are intended only for the guidance of design engineers. The amount of boreholes required to determine the localized underground conditions between boreholes that would affect construction costs, sequencing, equipment, scheduling construction techniques, and the like, would be much greater than that carried out for design purposes. Contractors and/or subcontractors bidding on or undertaking the work should, in this light, decide on their own interpretations of the factual borehole results, so that they may draw their own conclusions as to how the subsurface conditions may affect them and their scope of work.

4.1 Foundations: Conventional Spread Footings

It is our understanding that the elevation of the top surface of the ground floor slab has been established at Elev. 273.8m. The anticipated footings are expected to be founded approximately 1.5m below the ground floor slab, corresponding approximately to Elev. 272.3m.

As previously mentioned, we had been informed by Parkin Architects Limited that the location of the proposed development was part of a large construction site in the past where material was used to backfill the site and raise the subgrade. At the footprint of the building, the depth that the fill material that was used ranged from approximately 1.4m to 3.4m below existing grade. We have also been provided with documentation that is available that indicates that compaction testing was carried out on the material that was used to raise the subgrade and the results showed that specified compaction was achieved.

Our review of the soil samples show that the fill materials appeared to be uniform in structure. The recorded "N" values (blow/foot) that were obtained within the fill layer, especially at or near the proposed footing founding elevation, demonstrated that the existing fill layer had undergone through compaction procedures and is generally yielding densities that are in a compact to very dense state. The available records indicate that the fill material was installed approximately 9 years ago. It is expected that it has self consolidated during the course of this time duration, and therefore, it should not induce above normal settlement. Therefore, it is our opinion that the existing fill layer is considered suitable for sustaining conventional spread footings.

Based on the subsurface information recorded at the borehole locations, conventional spread footings may be used for the proposed building and shall be founded below all topsoil, wet, deleterious materials and loosened soil, on the compact to very dense silt fill material as indicated in Boreholes BH1, BH2, BH3, BH4 and BH6, and on the native, undisturbed, compact to very dense, silt as indicated in Borehole BH5. The following soil bearing pressures and specified founding depths as shown below on Table 2 are recommended:

Table 2
Soil Bearing Pressures for Spread Footings

Borehole No.	Serviceability Limit State (SLS) (kPa)	Factored Bearing Capacity at Ultimate Limit State (ULS) (kPa)	Approximate Founding Depth Below Existing Ground (m)	Approximate Founding Elevation (m)
BH1	75	115	Below 0.8	Below 272.7
BH2	75	115	Below 0.8	Below 272.7
BH3	75	115	Below 0.8	Below 272.6
BH4	75	115	Below 0.8	Below 272.8
BH5	75	115	Below 0.8	Below 273.0
BH6	75	115	Below 1.0	Below 272.8

Foundations designed using the soil pressures pertaining to the Serviceability Limit State (SLS) condition shown above, should not exceed the total and differential settlements of 25mm (1 inch) and 20mm (3/4 inch), respectively, provided that the foundation bases are not disturbed by excavation, surface water inflow, or freezing and thawing action.

Nominal reinforcement will be required in footings and foundation walls placed on the fill material. This is a precautionary measure to ensure that soft subgrade areas, if any, are adequately bridged with the reinforcement of foundations.

In general, fills are more susceptible to the effects of weather than are natural soils. Therefore, they must be protected from excessive wetting, drying and erosion.

Foundations exposed to freezing ground conditions must be protected against frost action with a minimum of 1.2m (4 ft.) of soil cover or equivalent.

Any footings constructed at different founding levels must be stepped along a line of 7 vertical to 10 drawn from the bottom of the lower footing.

All foundation bases should be inspected by a geotechnical engineer from our office prior to placing concrete to verify the bearing pressures, plus the consistency of the founding conditions that is suggested in this report.

It is recommended that the foundation drawings be reviewed by our office for general conformance with our geotechnical recommendations.

Higher bearing capacities are also available at deep zones of our boreholes on native soils, if required. See Section 4.2 below.

4.2 Alternate Foundation Method Using Helical Pier Foundations

If higher bearing capacities are required, then an alternate foundation method for the soil conditions encountered at the site is deep foundations consisting of helical piers in combination with grade beams to support the building loads. The helical piers should be supplied by Chance, or equivalent.

The installation of the helical pier foundations will transfer the building loads beyond the fill layers plus beyond the relatively weak native soils and into much deeper zones towards the bottom of our boreholes, where the soil conditions appear to be more favourable for bearing purposes.

Helical piers may be founded below all topsoil, fill, soft, loosened and deleterious soils into the native, undisturbed, very dense, silt, and/or native undisturbed, very dense, sandy silt.

The design load sustained by the individual helical piers should be provided by the Structural Engineer.

Besides the soil conditions encountered, the capacity of a helical pier also depends on the type and size selected, plus the number of helices. Therefore, the specialist contractor/supplier will finalize the selection of the pier size which will achieve this design capacity that is specified by the structural engineer. The general specifications for the installation and testing will also be provided by the specialist contractor/supplier.

A compression load test is recommended to be carried out on a minimum of one helical pier, to verify its capacity.

All helical pier installation work should be inspected on a full-time basis by a geotechnical engineer from our office to ensure that they have been installed into the specified native layers at adequate depths and have achieved the designated torque requirements.

Excavations for any new grade beams and foundations must be stepped along a line of 7 vertical to 10 horizontal where founding grades are variable and must not interfere with adjacent foundation systems, underground services and the like.

Foundations / grade beams exposed to freezing ground conditions must be protected against frost action with a minimum of 1.2m (4 ft.) of soil cover or equivalent.

Provisions should be made by the contractor when advancing through the upper fill zones which could have obstacles, oversized concrete chunks, construction rubble, caving and the like, plus in the native soils as cobbles and boulders may be present.

It is recommended that the foundation drawings be reviewed by our office for general conformance with our geotechnical recommendations.

4.3 Earthquake Design Parameters

In accordance to the Ontario Building Code, the site's classification for Seismic Response would be Class C.

4.4 Earth Pressure Coefficients

For this site, the following parameters may be used to assess the earth pressure:

Soil	γ (kN/m^3)	ϕ degrees	K_a	K_o	K_p
Onsite Compacted Fill or Compacted Granular Fill - OPSS Granular B	21	32	0.31	0.47	3.25
Native Subsoil	21.5	33	0.3	0.46	3.39

Where γ = bulk unit weight of soil, kN/m^3

ϕ = internal angle of friction, degrees

K_a = coefficient of active earth pressure

K_o = coefficient of earth pressure at rest

K_p = coefficient of passive earth pressure

Also,

μ = Coefficient of Static Friction
Between footings and Underlying Soil
use 0.4

4.5 Excavation and Backfill

In general, based on the groundwater levels presented on Table 1, no significant groundwater issues are expected with excavations on this site. Any flow from surface water and any minor seepage from perched water levels should be controlled with properly filtered sumps with pumps. However, given the fluctuation of the groundwater, if excavations are to be carried out to depths close to or below the groundwater level, then high capacity pumps should then be installed inside the sumps to sufficiently draw down the groundwater. Depending on the season of construction, groundwater levels can increase significantly. If so, then a well point dewatering system may be required to be installed to control and effectively reduce the groundwater levels. It is recommended that a specialist dewatering contractor be contacted to provide their recommendations during the construction stages, if excavations encounter groundwater.

Provisions should be made by the contractor during the excavations for handling possible oversized concrete chunks, construction rubble and obstructions in the fill materials, plus cobbles and boulders in the underlying native soils.

All temporary shallow excavations may be cut at 1 vertical to 1 horizontal. If some sloughing occurs at the upper fill zones, or if wet conditions are encountered, then shallower slopes may be required in localized areas. All excavations must be made to conform to regulations set out in the Occupational Health and Safety Act. Using the classification system described in the Occupational Health and Safety Act, the fill soils on site can be classified as Type 3. The native soils can also be considered as Type 3. Any wet and saturated soils, or soils located below the groundwater level are classified as Type 4.

Excavations shall not be cut below an imaginary line drawn downward from existing foundations and/or underground services at 7 vertical to 10 horizontal. If this cannot be achieved then adequate temporary shoring and/or underpinning will be required.

The on site materials are not free draining and highly susceptible to frost. They should not be used for exterior foundation backfilling as this could potentially result to damage of the foundation walls from frost adhesion. Therefore, the exterior foundations should be backfilled with approved OPSS Granular B Type I (sand and gravel) material, placed in loose lifts with a maximum thickness of 300mm and compacted to a minimum of 95% Standard Proctor maximum dry density. The upper 1.2m (4 ft.) zone of backfill material should be compacted to a minimum of 98% Standard Proctor maximum dry density.

The underslab interior excavations should be backfilled with approved onsite soils and/or approved OPSS Granular B Type I (sand and gravel) material, placed in loose lifts with a maximum thickness of 300mm and compacted to a minimum of 98% Standard Proctor maximum dry density.

Backfilling of service trenches under proposed pavement areas may be carried out using approved onsite soils and/or approved OPSS Granular B Type I (sand and gravel) material placed in loose lifts with a maximum thickness of 300mm and compacted to a minimum of 95% Standard Proctor maximum dry density. The upper 1.2m (4 ft.) zone of backfill material should be compacted to a minimum of 98% Standard Proctor maximum dry density.

The silt materials onsite have the capacity to retain water, they are not free draining and may be too wet to be used for backfilling. In some cases, drying the material, if space restriction permit this, will assist in salvaging some portion of this material for reuse. In other cases they may be found to be too wet and rendered unusable. In this regard, the suitability for reuse of the onsite material as backfill should be inspected and evaluated during the initial stages of construction. Materials that have been approved for reuse should be maintained within 2% of their optimum moisture content. Tarps may be required to cover and protect the approved material.

4.6 Slab-On-Grade Floor

From our borehole investigation, it is noted that the site contains fill material consisting of silt. The fill material extends to depths varying from approximately 1.4m to 3.4m below existing grade. This indicates that the exposed subgrade surface at the envelope of the proposed building is expected to be constructed within this fill layer. The fill material appeared to be uniform in structure. It is our opinion that the fill layer is considered suitable to remain as a subgrade. Therefore, the concrete floor may be constructed by conventional slab-on-grade techniques on an adequately prepared subgrade consisting of compact to very dense silt fill, provided that the following items are complied with:

1. The exposed subgrade must be stripped of any topsoil, vegetation, loose, wet and deleterious materials.

2. Any weak spots encountered on the exposed subgrade must be excavated and removed.

3. The amount of organics appeared minor in the samples, however, during construction, if it becomes greater then localized areas of the fill containing excessive organics must be excavated and removed.

4. The exposed surface of the subgrade within the footprint of the proposed building must be heavily proofrolled under geotechnical supervision and compacted to a minimum of 98% Standard Proctor maximum dry density. It must be inspected and approved by a geotechnical engineer.

5. The grade must then be raised to the design subgrade level to fill any such voids as indicated on Items 2 and 3 above, and/or to fill any areas with relatively lower surface elevations with approved onsite soils and/or approved OPSS Granular B Type I (sand and gravel) material, placed in loose lifts with a maximum thickness of 300mm and compacted to a minimum of 98% Standard Proctor maximum dry density.

A basecourse / moisture barrier consisting of at least 200mm (8 inch) thick of 20mm (3/4 inch) of OPSS Granular A crusher run limestone must be provided under the proposed floor slab. It shall be compacted to at least 98% Standard Proctor maximum dry density.

The proposed concrete floor may then be constructed by conventional slab-on-grade techniques directly above the Granular A crusher run limestone basecourse.

A Modulus of Subgrade Reaction (k_S) of 30,000 kN/m^3 is suggested for designing the proposed floor slab.

The general requirements for the perimeter drainage, underfloor fill and backfill are provided on Figure 24.

5.0 GEOTECHNICAL RECOMMENDATIONS FOR PROPOSED HELICOPTER CONCRETE PAD AND APRON CONCRETE PAD

The on site silt materials retain water, they are not free draining and are highly susceptible to frost and heave action. They have the potential to cause the development of cracks on the overlying concrete pad surfaces from the oscillations and floating movement during the freezing and thawing cycles. Taking this into consideration, for the soil and groundwater conditions encountered at their respective locations, two options may be used to construct the above concrete pads. The first option involves constructing the pads with excavations extending to 1.2m below existing grade which is discussed in Section 5.1. While the second option involves constructing the pads on a basecourse layer in combination with insulation and this is discussed in Section 5.2. The selection between these two pad options will depend on factors, such as, economics, duration of activity, availability and scheduling.

5.1 Concrete Pads: Option 1 - Concrete Pads Constructed with Excavations Extending to 1.2m Below Existing Grade

Given the frost susceptible soil conditions that are present at the site, it is recommended that the following geotechnical recommendations be complied with for developing the proposed concrete pads for both the helicopter pad and apron pad:

1. It is recommended that excavations for the floating concrete pads to extend to a depth of 1.2m (4 ft.) below their proposed final grade. It is expected that the exposed subgrade to consist of compact to very dense, silt fill material (Boreholes BH7 to BH10) and/or dense to very dense native silt (Borehole BH11). The exposed subgrade must be inspected and approved by a geotechnical engineer. Any weak spots, deleterious materials and organic materials detected at the exposed surface must be sub-excavated and removed. The exposed fill portion of the subgrade surface must be compacted to a minimum of 98% Standard Proctor maximum dry density. While the exposed native portion of the subgrade surface must be heavily proofrolled under geotechnical supervision.

2. It is recommended that excavations extend laterally outward for a minimum of 1.2m (4 ft.) from the edge of the pad at sides.

3. It is recommended that weeping tiles to be placed in parallel rows of 6m centres one way, above the excavated subgrade (at 1.2m depth) leading to a positive outlet, such as manholes or catch basins. The tiles should consist of a 100mm diameter PVC perforated weeping tile surrounded with a layer of 150mm thick of 20mm Clear Stone at the top and sides of the pipe and 50mm of stone at the base. The stone should be then be wrapped with an approved geotextile cloth, type Terrafix 270R, or equivalent. The subgrade should be shaped and crowned to allow drainage into these pipes.

4. The subgrade shall then be raised to the desired level using approved OPSS Granular B (Sand and Gravel) material placed in loose lifts with a maximum thickness of 300mm and compacted to a minimum of 100% Standard Proctor maximum dry density.

5. A provision shall be made to allow for a basecourse / moisture barrier, consisting of at least 300mm (12 inches) of 20mm (3/4 inch) approved OPSS Granular A crusher run limestone to be placed under the concrete slabs. The Granular A material must be compacted to at least 100% Standard Proctor maximum dry density. The proposed concrete slabs may then be constructed by conventional slab-on-grade techniques directly above the compacted Granular A basecourse.

A Modulus of Subgrade Reaction (k_S) of 30,000 kN/m^3 is suggested for designing the proposed concrete pads.

It is recommended that the concrete pad drawings be reviewed by our office for general conformance with our geotechnical recommendations.

5.2 Concrete Pads: Option 2 - Concrete Pads Constructed on Basecourse Layer in Combination with Insulation

Based on the frost susceptible soil conditions encountered at the borehole locations, the following procedure is recommended for constructing the concrete pads for both the helicopter pad and apron pad:

1. Figure 25 shows the general geotechnical guidelines for constructing the concrete pad. It is expected that the exposed subgrade to consist of compact to very dense, silt fill material (Boreholes BH7 to BH10) and/or dense to very dense native silt (Borehole BH11). The exposed fill portion of the subgrade surface must be compacted to a minimum of 98% Standard Proctor maximum dry density. While the exposed native portion of the subgrade surface must be heavily proofrolled under geotechnical supervision. The exposed subgrade must be inspected and approved by a geotechnical engineer. Any weak spots, deleterious materials and organic materials detected at the exposed surface must be sub-excavated and removed. The grade can then be raised to the design subgrade level to fill any such voids using approved OPSS Granular B Type I (sand and gravel) material placed in loose lifts with a maximum thickness of 300mm and compacted to a minimum of 100% Standard Proctor maximum dry density.

2. It is recommended that excavations extend laterally outward for a minimum of 1.2m (4 ft.) from the edge of the pad at sides.

3. In order to minimize the amount of oscillations and floating movement during the freezing and thawing cycles, a layer of polystyrene board insulation (SM Blue), or equivalent, consisting of a minimum thickness of 50mm be placed below the entire area of the proposed pad and extend 1.2m laterally outwards. It should be placed above the approved subgrade. Insulation requirements should be in general conformance as shown in Figure 25 and the manufacturer's specifications.

4. A basecourse / moisture barrier, consisting of at least 300mm (12 inchs) of 20mm (3/4 inch) clear stone should be provided under the concrete pad. It should be compacted and vibrated for interlocking purposes.

5. The pad may then be constructed above the basecourse layer.

A Modulus of Subgrade Reaction (k_s) of 30,000 kN/m^3 is suggested for designing the proposed concrete pads.

It is recommended that the concrete pad drawings be reviewed by our office for general conformance with our geotechnical recommendations.

6.0 PAVEMENT STRUCTURES

It is our understanding that the proposed development will require the construction of flexible pavement areas with light duty and heavy duty applications.

The pavement areas may be constructed on an adequately prepared subgrade, inspected and approved by a geotechnical engineer. The subgrade may consist of compact, silt fill and/or compact to dense, native, silt. The exposed subgrade must be stripped of all topsoil, vegetation, loose, wet and deleterious materials. The exposed fill portion of the subgrade surface must be compacted to a minimum of 98% Standard Proctor maximum dry density. While the exposed native portion of the subgrade surface must be heavily proofrolled under geotechnical supervision. If any weak or soft areas are encountered at the exposed subgrade surface they must be further sub-excavated and removed. The grade must then be raised to the design subgrade level using approved onsite materials, and/or approved OPSS Granular B Type I (sand and gravel) material, placed in loose lifts with a maximum thickness of 300mm and compacted to a minimum of 98% Standard Proctor maximum dry density. Stringent construction control procedures must be maintained to ensure uniform subgrade moisture and density conditions are achieved.

Based on the subgrade conditions encountered and normal anticipated traffic loading, the pavement structures indicated below in Table 3 are recommended:

Table 3
Recommended Pavement Structures and Thicknesses

Material	Light Duty	Heavy Duty
HL 3 Surface Asphalt	40mm	40mm
HL 8 Binder Asphalt	40mm	100mm
Granular Basecourse OPSS Granular "A" Consisting of 20mm Crusher Run Limestone	150mm	150mm
Granular Subbase OPSS Granular "B" Type II 50mm Crusher Run Limestone	300mm	500mm
Total Combined Thickness	530mm	790mm
Granular Base Equivalents (GBE)	510mm	770mm

Grading of the final subgrade should be shaped and crowned to allow drainage to adequately spaced catch basins installed with subdrains leading to a positive outlet. Figure 26, shows a typical subdrain detail. We emphasize the need for adequate drainage. Catch basins must contain subdrains for drainage infiltration from the granular basecourse leading into these drainage structures. Subdrains may also be installed along the driveway areas plus be installed to extend between catch basins.

It is recommended that all granular components to be placed in loose lifts with a maximum thickness of 300mm and compacted to a minimum 98% Standard Proctor maximum dry density. The asphalt components to be placed and compacted to be within the acceptable compaction requirements of 92.0% to 96.5% Maximum Relative Density.

The completed pavement surface must not contain any depressions and must be adequately sloped to provide effective surface drainage toward the catch basins. Additionally, surface water shall not be allowed to accumulate adjacent to the outside edges of the pavement areas. Subdrains shall be installed to collect the excess subsurface moisture and prevent the subgrade from softening.

In order to minimize the adverse affects of settlement, it is recommended that the surface asphalt course be delayed for approximately one year after the binder asphalt course is placed, where practical.

Frost action can often result in differential movement taking place between the pavement and catch basins and/or manholes. As a result, it is recommended that these structures be backfilled with granular materials which are not as susceptible to frost, such as, approved OPSS Granular B Type I (sand and gravel), placed in loose lifts with a maximum thickness of 300mm and compacted to a minimum of 98% Standard Proctor maximum dry density. Hand controlled light compaction equipment shall be used when backfilling these structures to avoid damaging them.

The quality, performance and life expectancy of the finished product is highly dependent upon adequate subgrade preparation work, the quality and proper placement of the pavement components and the compaction level achieved. Therefore, it is important that geotechnical inspections be carried out during the construction period to ensure construction practice is in conformance with design requirements.

We trust that the information contained in this report will assist you with your proposed development. Should you have any questions, please do not hesitate to contact our office.

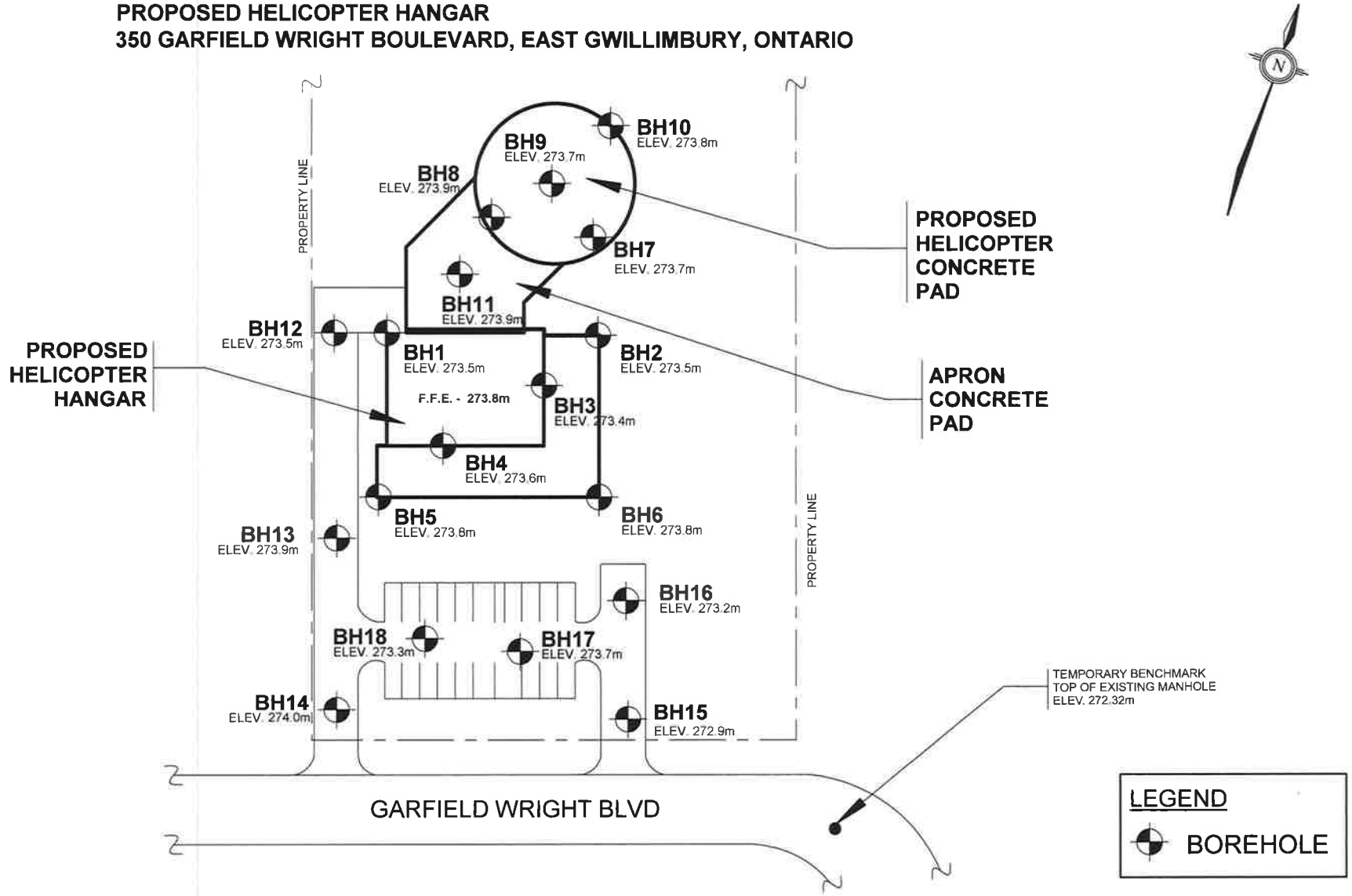
Yours truly,
PATRIOT ENGINEERING LTD.

Larry Galimanis, P.Eng.
Principal / Consulting Engineer

Distribution: Mr. Lind Nyman, Parkin Architects Limited (4)

FIGURE 1: PARTIAL SITE PLAN SHOWING THE APPROXIMATE BOREHOLE LOCATIONS

PROPOSED HELICOPTER HANGAR
350 GARFIELD WRIGHT BOULEVARD, EAST GWILLIMBURY, ONTARIO



REFERENCE:

PARTIAL SITE PLAN INFORMATION ADAPTED FROM OVERALL SITE PLAN DRAWING NO. A-002, PREPARED BY PARKIN ARCHITECTS LIMITED, DATED APRIL 15, 2024.

	Name	Date
Drawn By	M.A.	Aug '24
Checked By	L.G.	Aug '24
Revisions		
Scale	Reduced From Original	

PATRIOT ENGINEERING LTD.
Consulting Engineers

Project: 44148 | Figure: 1

Project No: 44148

Borehole #: BH1

Project: Proposed Helicopter Hanger

Borehole Location: See Figure 1

Location: 350 Garfield Wright Boulevard, East Gwillimbury, ON

Project Engineer: L.G.

Client: Parkin Architects Limited

Drawing No.: 2

SUBSURFACE PROFILE				SAMPLE						
Depth (m)	Symbol	Description	Elevation (m)	Type	N = Blows/300mm	Recovery (%)	U.Wt.(kN/m3)	- SPT Blows/300mm 20 40 60 80	▲ Penetrometer ▲ 50 100 150 200	Moisture x Moisture% x 10 20 30
0		Ground Surface	273.5							
		TOPSOIL - 75mm		SS1	16	80		○		×
		FILL - SILT compact to dense, brown, slightly moist to moist, some clay, some sand, trace gravel, trace topsoil, trace plastic pieces		SS2	15	65		○		×
1				SS3	37	75		○		×
2			271.4							
		SILT compact to very dense, brown becoming grey below 4.6m depth, moist to saturated, trace to some clay, trace gravel, trace cobbles, dilated at Samples SS6 and SS7		SS4	43	0*		○		
3				SS5	28	85		○		×
4										
				SS6	12	100		○		×
5										
6				SS7	22	100		○		×
7			266.4							
		SANDY SILT very dense, grey, moist, trace clay, trace gravel		SS8	69	100		○		×
8			265.4							
		END OF BOREHOLE See next page for notes...								
9										
10										

Drill Method: S/S Auger

Drill Date: July 25 & 26, 2024

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Datum: Geodetic

Checked by: L.G.

Project No: 44148

Borehole #: BH1

Project: Proposed Helicopter Hanger

Borehole Location: See Figure 1

Location: 350 Garfield Wright Boulevard, East Gwillimbury, ON

Project Engineer: L.G.

Client: Parkin Architects Limited

Drawing No.: 2

SUBSURFACE PROFILE				SAMPLE						
Depth (m)	Symbol	Description	Elevation (m)	Type	N = Blows/300mm	Recovery (%)	U.Wt.(kN/m3)	- SPT Blows/300mm 20 40 60 80	▲ Penetrometer ▲ 50 100 150 200	Moisture x Moisture% x 10 20 30
11		Notes: * There was no sample recovered in the spoon. The auger sample was not representative. 1. Boreholes advanced using solid stem augers to 8.1m depth on July 25 & 26, 2024. 2. Short term groundwater water level measured at 5.0m depth upon completion of drilling.								
12										
13										
14										
15										
16										
17										
18										
19										
20										

Drill Method: S/S Auger

Drill Date: July 25 & 26, 2024

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Datum: Geodetic

Checked by: L.G.

Project No: 44148

Borehole #: BH2

Project: Proposed Helicopter Hanger

Borehole Location: See Figure 1

Location: 350 Garfield Wright Boulevard, East Gwillimbury, ON

Project Engineer: L.G.

Client: Parkin Architects Limited

Drawing No.: 3

SUBSURFACE PROFILE				SAMPLE				- SPT Blows/300mm (20 40 60 80)	▲ Penetrometer ▲ (50 100 150 200)	Moisture x Moisture% x (10 20 30)
Depth (m)	Symbol	Description	Elevation (m)	Type	N = Blows/300mm	Recovery (%)	U.Wt.(kN/m3)			
		Ground Surface	273.5							
0		***TOPSOIL - 75mm***		SS1	10	45				
		FILL - SILT compact to dense, brown, slightly moist to moist, some clay, some sand, trace gravel, trace topsoil, trace rootlets		SS2	31	85				
1			272.1							
		SILT compact to very dense, brown, moist to saturated, some clay, trace sand, trace gravel, isolated pockets of clay, oxidized, minor dilation at Samples SS5, SS6, SS7 and SS8		SS3	44	100				
2				SS4	16	50				
3				SS5	19	90				
4										
				SS6	19	80				
5										
6				SS7	27	100				
7										
				SS8	55	100				
8			265.3							
		END OF BOREHOLE Notes: 1. Boreholes advanced using solid stem augers to 8.1m depth on July 25, 2024. 2. Short term groundwater water level measured at 5.3m depth upon completion of drilling.								
9										
10										

Drill Method: S/S Auger

Drill Date: July 25, 2024

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Datum: Geodetic

Checked by: L.G.

Project No: 44148

Borehole #: BH3

Project: Proposed Helicopter Hanger

Borehole Location: See Figure 1

Location: 350 Garfield Wright Boulevard, East Gwillimbury, ON

Project Engineer: L.G.

Client: Parkin Architects Limited

Drawing No.: 4

SUBSURFACE PROFILE				SAMPLE						
Depth (m)	Symbol	Description	Elevation (m)	Type	N = Blows/300mm	Recovery (%)	U.Wt. (kN/m3)	- SPT Blows/300mm 20 40 60 80	▲ Penetrometer ▲ 50 100 150 200	Moisture x Moisture% x 10 20 30
0		Ground Surface	273.4							
		TOPSOIL - 75mm		SS1	10	65		○		×
		FILL - SILT compact to dense, brown, moist, some clay, some sand, trace gravel, trace topsoil, trace rootlets, minor dilation at Samples SS4 and SS5		SS2	43	60		○		×
2				SS3	26	80		○		×
				SS4	12	75		○		×
3			270.0	SS5	23	70		○		×
		SILT compact to very dense, brown becoming grey below 4.6m depth, moist to saturated, trace clay, some sand, trace gravel, isolated pockets of clay, oxidized, dilated at Samples SS6 and SS7								
5				SS6	18	100		○		×
6				SS7	42	100		○		×
8			265.3	SS8	65	100		○		×
		END OF BOREHOLE Notes: 1. Borehole advanced using solid stem augers to 8.1m depth on July 25, 2024. 2. Short term groundwater level measured at 5.3m depth upon completion of drilling.								
10										

Drill Method: S/S Auger

Drill Date: July 25, 2024

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Datum: Geodetic

Checked by: L.G.

Project No: 44148

Borehole #: BH4

Project: Proposed Helicopter Hanger

Borehole Location: See Figure 1

Location: 350 Garfield Wright Boulevard, East Gwillimbury, ON

Project Engineer: L.G.

Client: Parkin Architects Limited

Drawing No.: 5

SUBSURFACE PROFILE				SAMPLE				- SPT Blows/300mm 20 40 60 80	▲ Penetrometer ▲ 50 100 150 200	Moisture x Moisture% x 10 20 30
Depth (m)	Symbol	Description	Elevation (m)	Type	N = Blows/300mm	Recovery (%)	U.Wt.(kN/m3)			
		Ground Surface	273.6							
0		***TOPSOIL - 55mm***		SS1	13	45				
		FILL - SILT compact to dense, brown, very moist to moist, some clay, some sand, trace gravel, trace topsoil, trace rootlets								
1				SS2	35	85				
				SS3	30	100				
2										
				SS4	19	50				
3			270.2	SS5	43	90				
		SILT compact to very dense, brown becoming grey below 4.6m depth, moist to saturated, some clay, some sand, trace gravel, isolated pockets of clay, oxidized, dilated at Sample SS6								
4										
				SS6	23	80				
5										
6				SS7	50	100		/140mm		
			266.5							
7		***SANDY SILT*** very dense, grey, moist, trace clay, trace gravel								
			265.5	SS8	50	100		/140mm		
8		***END OF BOREHOLE*** Notes: 1. Boreholes advanced using solid stem augers to 8.1m depth on July 25, 2024. 2. Short term groundwater water level measured at 4.3m depth upon completion of drilling.								
9										
10										

Drill Method: S/S Auger

Drill Date: July 25, 2024

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Datum: Geodetic

Checked by: L.G.

Project No: 44148

Borehole #: BH5

Project: Proposed Helicopter Hanger

Borehole Location: See Figure 1

Location: 350 Garfield Wright Boulevard, East Gwillimbury, ON

Project Engineer: L.G.

Client: Parkin Architects Limited

Drawing No.: 6

SUBSURFACE PROFILE				SAMPLE				- SPT Blows/300mm 20 40 60 80	▲ Penetrometer ▲ 50 100 150 200	Moisture x Moisture% x 10 20 30
Depth (m)	Symbol	Description	Elevation (m)	Type	N = Blows/300mm	Recovery (%)	U.Wt.(kN/m3)			
0		Ground Surface	273.8							
		TOPSOIL - 75mm		SS1	14	80		○		×
		FILL - SILT compact to very dense, brown, moist, some clay, some sand, trace gravel, trace topsoil, trace rootlets, trace wood peices	272.4	SS2	52	70		○		×
		SILT compact to very dense, brown becoming grey below 6.2m depth, slightly moist to saturated, some sand, trace clay, trace gravel, isolated pockets of clay, oxidized, dilated in Samples SS6, SS7 and SS8		SS3	57	85		○		×
				SS4	37	80		○		×
				SS5	27	55		○		×
				SS6	26	80		○		×
				SS7	42	100				×
			265.7	SS8	50	85		○/50mm		×
		END OF BOREHOLE Notes: 1. Boreholes advanced using solid stem augers to 8.1m depth on July 25, 2024. 2. Short term groundwater water level measured at 5.3m depth upon completion of drilling.								

Drill Method: S/S Auger

Drill Date: July 25, 2024

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Checked by: L.G.

Project No: 44148

Borehole #: BH6

Project: Proposed Helicopter Hanger

Borehole Location: See Figure 1

Location: 350 Garfield Wright Boulevard, East Gwillimbury, ON

Project Engineer: L.G.

Client: Parkin Architects Limited

Drawing No.: 7

SUBSURFACE PROFILE				SAMPLE				- SPT Blows/300mm 20 40 60 80	▲ Penetrometer ▲ 50 100 150 200	Moisture x Moisture% x 10 20 30
Depth (m)	Symbol	Description	Elevation (m)	Type	N = Blows/300mm	Recovery (%)	U.Wt.(kN/m3)			
0		Ground Surface	273.8							
		TOPSOIL - 60mm		SS1	7	45				
		FILL - SILT loose to very dense, brown, moist, some clay, some sand, trace gravel, trace topsoil, trace rootlets		SS2	38	95				
1										
				SS3	55	100				
2										
				SS4	51	10				
3										
			270.4	SS5	31	100				
		SILT compact to very dense, brown becoming grey below 4.6m depth, moist to saturated, some sand, trace clay, trace gravel, isolated pockets of clay, oxidized, dilated in Samples SS6, SS7 and SS8								
4										
				SS6	13	100				
5										
6				SS7	66	100				
7										
			265.7	SS8	50	55		/125mm		
8		***END OF BOREHOLE*** Notes: 1. Boreholes advanced using solid stem augers to 8.1m depth on July 25, 2024. 2. Short term groundwater water level measured at 4.7m depth upon completion of drilling.								
9										
10										

Drill Method: S/S Auger

Drill Date: July 25, 2024

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Checked by: L.G.

Project No: 44148

Borehole #: BH7

Project: Proposed Helicopter Hanger

Borehole Location: See Figure 1

Location: 350 Garfield Wright Boulevard, East Gwillimbury, ON

Project Engineer: L.G.

Client: Parkin Architects Limited

Drawing No.: 8

SUBSURFACE PROFILE				SAMPLE				- SPT Blows/300mm (20 40 60 80)	▲ Penetrometer ▲ (50 100 150 200)	Moisture x Moisture% x (10 20 30)
Depth (m)	Symbol	Description	Elevation (m)	Type	N = Blows/300mm	Recovery (%)	U.Wt (kN/m3)			
0		Ground Surface	273.9							
		TOPSOIL - 55mm		SS1	12	55				
		FILL - SILT compact, brown, slightly moist to moist, some clay, some sand, trace gravel, trace topsoil, trace rootlets, isolated pockets of topsoil		SS2	10	90				
1			272.5							
		SILT compact to very dense, brown, moist, some sand, trace clay, trace gravel		SS3	17	80				
2				SS4	55	100				
3				SS5	78	90				
4										
			268.9	SS6	28	85				
5		***END OF BOREHOLE***								
6		Notes: 1. Boreholes advanced using solid stem augers to 5.0m depth on July 26, 2024. 2. Borehole was found to be dry upon completion of drilling.								
7										
8										
9										
10										

Drill Method: S/S Auger

Drill Date: July 26, 2024

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Checked by: L.G.

Project No: 44148

Borehole #: BH8

Project: Proposed Helicopter Hanger

Borehole Location: See Figure 1

Location: 350 Garfield Wright Boulevard, East Gwillimbury, ON

Project Engineer: L.G.

Client: Parkin Architects Limited

Drawing No.: 9

SUBSURFACE PROFILE				SAMPLE						
Depth (m)	Symbol	Description	Elevation (m)	Type	N = Blows/300mm	Recovery (%)	U.Wt.(kN/m3)	- SPT Blows/300mm 20 40 60 80	▲ Penetrometer ▲ 50 100 150 200	Moisture x Moisture% x 10 20 30
0		Ground Surface	273.9							
		TOPSOIL - 75mm		SS1	10	45		○		×
		FILL - SILT compact, brown, slightly moist to moist, some clay, some sand, trace gravel, trace topsoil, trace rootlets, oxidized		SS2	13	80		○		×
1			272.2							
		SILT compact to dense, brown becoming grey below 4.6m, moist, some sand, trace clay, trace gravel, oxidized		SS3	28	90		○		×
2										
				SS4	39	70		○		×
3				SS5	29	100		○		×
4										
			268.9	SS6	30	80		○		×
5		***END OF BOREHOLE***								
		Notes:								
6		1. Boreholes advanced using solid stem augers to 5.0m depth on July 26, 2024.								
		2. Borehole was found to be dry upon completion of drilling.								
7										
8										
9										
10										

Drill Method: S/S Auger

Drill Date: July 26, 2024

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Datum: Geodetic

Checked by: L.G.

Project No: 44148

Borehole #: BH9

Project: Proposed Helicopter Hanger

Borehole Location: See Figure 1

Location: 350 Garfield Wright Boulevard, East Gwillimbury, ON

Project Engineer: L.G.

Client: Parkin Architects Limited

Drawing No.: 10

SUBSURFACE PROFILE				SAMPLE						
Depth (m)	Symbol	Description	Elevation (m)	Type	N = Blows/300mm	Recovery (%)	U.Wt.(kN/m3)	- SPT Blows/300mm 20 40 60 80	▲ Penetrometer ▲ 50 100 150 200	Moisture x Moisture% x 10 20 30
		Ground Surface	273.7							
0		***TOPSOIL - 75mm***		SS1	9	55		○		×
		FILL - SILT loose to compact, brown, moist, some clay, som sand, trace gravel, trace topsoil, trace rootlets		SS2	23	80		○		×
1			272.0	SS3	24	95		○		×
		SILT compact to dense, brown, moist, some sand, trace clay, trace gravel, oxidized, minor dilation in Sample SS4		SS4	20	100		○		
2										
				SS5	20	65		○		×
3										
4										
			268.7	SS6	36	100		○		×
5		***END OF BOREHOLE***								
		Notes:								
6		1. Boreholes advanced using solid stem augers to 5.0m depth on July 26, 2024.								
		2. Borehole was found to be dry upon completion of drilling.								
7										
8										
9										
10										

Drill Method: S/S Auger

Drill Date: July 26, 2024

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Datum: Geodetic

Checked by: L.G.

Project No: 44148

Borehole #: BH10

Project: Proposed Helicopter Hanger

Borehole Location: See Figure 1

Location: 350 Garfield Wright Boulevard, East Gwillimbury, ON

Project Engineer: L.G.

Client: Parkin Architects Limited

Drawing No.: 11

SUBSURFACE PROFILE				SAMPLE						
Depth (m)	Symbol	Description	Elevation (m)	Type	N = Blows/300mm	Recovery (%)	U.Wt.(kN/m3)	- SPT Blows/300mm (20 40 60 80)	▲ Penetrometer ▲ (50 100 150 200)	Moisture x Moisture% x (10 20 30)
		Ground Surface	273.8							
0		***TOPSOIL - 50mm***		SS1	14	85		○		×
		FILL - SILT compact to very dense, brown, moist, some clay, some sand, trace gravel, trace topsoil, trace rootlets, trace brick fragments		SS2	55	95		○		×
1				SS3	20	65		○		×
2			271.6							
		SILT dense, brown, moist, some sand, trace clay, trace gravel, oxidized		SS4	32	65		○		×
3				SS5	37	55		○		×
4										
			268.7	SS6	33	100		○		×
5		***END OF BOREHOLE***								
6		Notes: 1. Boreholes advanced using solid stem augers to 5.0m depth on July 26, 2024. 2. Borehole was found to be dry upon completion of drilling.								
7										
8										
9										
10										

Drill Method: S/S Auger

Drill Date: July 26, 2024

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Checked by: L.G.

Project No: 44148

Borehole #: BH11

Project: Proposed Helicopter Hanger

Borehole Location: See Figure 1

Location: 350 Garfield Wright Boulevard, East Gwillimbury, ON

Project Engineer: L.G.

Client: Parkin Architects Limited

Drawing No.: 12

SUBSURFACE PROFILE				SAMPLE						
Depth (m)	Symbol	Description	Elevation (m)	Type	N = Blows/300mm	Recovery (%)	U.Wt (kN/m3)	- SPT Blows/300mm 20 40 60 80	▲ Penetrometer ▲ 50 100 150 200	Moisture x Moisture% x 10 20 30
		Ground Surface	273.7							
0		***TOPSOIL - 65mm***								
		FILL - SILT compact, brown, slightly moist, some clay, some sand, trace gravel, trace topsoil, trace rootlets	273.0	SS1	10	60		○		×
1		***SILT*** very dense to dense, brown, slightly moist to moist, some sand, trace clay, trace gravel		SS2	59	95		○		×
				SS3	32	85		○		×
2			271.7							
		END OF BOREHOLE								
3										
4										
5										
6										

Notes:

1. Boreholes advanced using solid stem augers to 2.0m depth on July 29, 2024.

2. Borehole was found to be dry upon completion of drilling.

Drill Method: S/S Auger

Drill Date: July 29, 2024

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Checked by: L.G.

Project No: 44148

Borehole #: BH12

Project: Proposed Helicopter Hanger

Borehole Location: See Figure 1

Location: 350 Garfield Wright Boulevard, East Gwillimbury, ON

Project Engineer: L.G.

Client: Parkin Architects Limited

Drawing No.: 13

SUBSURFACE PROFILE				SAMPLE				- SPT Blows/300mm 20 40 60 80	▲ Penetrometer ▲ 50 100 150 200	Moisture x Moisture% x 10 20 30
Depth (m)	Symbol	Description	Elevation (m)	Type	N = Blows/300mm	Recovery (%)	U.Wt (kN/m3)			
		Ground Surface	273.5							
0		***TOPSOIL - 50mm***								
		FILL - SILT compact to loose, brown, moist to saturated, some clay, some sand, trace gravel, trace topsoil, trace rootlets, dilated at Sample SS2		SS1	13	65		○		×
1				SS2	6	80		○		×
			271.9							
		SILT dense, brown, moist, some sand, trace clay, trace gravel	271.5	SS3	30	70		○		×
2		***END OF BOREHOLE***								
		Notes: 1. Boreholes advanced using solid stem augers to 2.0m depth on July 29, 2024. 2. Borehole was found to be dry upon completion of drilling.								
3										
4										
5										
6										

Drill Method: S/S Auger

Drill Date: July 29, 2024

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Datum: Geodetic

Checked by: L.G.

Project No: 44148

Borehole #: BH13

Project: Proposed Helicopter Hanger

Borehole Location: See Figure 1

Location: 350 Garfield Wright Boulevard, East Gwillimbury, ON

Project Engineer: L.G.

Client: Parkin Architects Limited

Drawing No.: 14

SUBSURFACE PROFILE				SAMPLE						
Depth (m)	Symbol	Description	Elevation (m)	Type	N = Blows/300mm	Recovery (%)	U.Wt.(kN/m3)	○ - SPT Blows/300mm ○ 20 40 60 80	▲ Penetrometer ▲ 50 100 150 200	Moisture x Moisture% x 10 20 30
0		Ground Surface	273.9							
		TOPSOIL - 50mm								
		FILL - SILT compact, brown, moist, some clay, some sand, trace gravel, trace topsoil, trace rootlets	273.2	SS1	11	45		○		×
1		***SILT*** compact, brown, moist, some sand, trace clay, trace gravel		SS2	22	90		○		×
				SS3	23	80		○		×
2			272.0							
		END OF BOREHOLE								
		Notes: 1. Boreholes advanced using solid stem augers to 2.0m depth on July 29, 2024. 2. Borehole was found to be dry upon completion of drilling.								
3										
4										
5										
6										

Drill Method: S/S Auger

Drill Date: July 29, 2024

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Checked by: L.G.

Project No: 44148

Borehole #: BH14

Project: Proposed Helicopter Hanger

Borehole Location: See Figure 1

Location: 350 Garfield Wright Boulevard, East Gwillimbury, ON

Project Engineer: L.G.

Client: Parkin Architects Limited

Drawing No.: 15

SUBSURFACE PROFILE				SAMPLE						
Depth (m)	Symbol	Description	Elevation (m)	Type	N = Blows/300mm	Recovery (%)	U.Wt.(kN/m3)	○ - SPT Blows/300mm ○ 20 40 60 80	▲ Penetrometer ▲ 50 100 150 200	Moisture x Moisture% x 10 20 30
0		Ground Surface	274.0							
		TOPSOIL - 60mm								
		FILL - SILT compact, brown, moist, some clay, some sand, trace gravel, trace topsoil, trace rootlets	273.3	SS1	20	60		○		×
1		***SILT*** compact, brown, moist to saturated, some sand, trace clay, trace gravel, minor dilation in Sample SS3		SS2	14	80		○		×
			272.0	SS3	22	100		○		×
2		***END OF BOREHOLE***								
3		Notes: 1. Boreholes advanced using solid stem augers to 2.0m depth on July 29, 2024. 2. Borehole was found to be dry upon completion of drilling.								
4										
5										
6										

Drill Method: S/S Auger

Drill Date: July 29, 2024

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Checked by: L.G.

Project No: 44148

Borehole #: BH15

Project: Proposed Helicopter Hanger

Borehole Location: See Figure 1

Location: 350 Garfield Wright Boulevard, East Gwillimbury, ON

Project Engineer: L.G.

Client: Parkin Architects Limited

Drawing No.: 16

SUBSURFACE PROFILE				SAMPLE						
Depth (m)	Symbol	Description	Elevation (m)	Type	N = Blows/300mm	Recovery (%)	U.Wt.(kN/m3)	○ - SPT Blows/300mm ○ 20 40 60 80	▲ Penetrometer ▲ 50 100 150 200	Moisture x Moisture% x 10 20 30
0		Ground Surface	272.9							
		TOPSOIL - 75mm	272.9							
		FILL - SILT compact, brown, moist, some clay, some sand, trace gravel, trace topsoil, trace rootlets	272.2	SS1	16	100		○		×
1		***SILT*** compact, brown, moist, some sand, trace clay, trace gravel		SS2	23	80		○		×
				SS3	24	70		○		×
2			271.0							
		END OF BOREHOLE								
3		Notes: 1. Boreholes advanced using solid stem augers to 2.0m depth on July 29, 2024. 2. Borehole was found to be dry upon completion of drilling.								
4										
5										
6										

Drill Method: S/S Auger

Drill Date: July 29, 2024

PATRIOT ENGINEERING LTD.
80 Nashdene Road., Unit 62, Toronto, ON, M1V 5E4
Phone: (416) 293-7716 Fax: (416) 293-6722
e-mail: info@patrioteng.ca

Datum: Geodetic

Checked by: L.G.

Project No: 44148

Borehole #: BH16

Project: Proposed Helicopter Hanger

Borehole Location: See Figure 1

Location: 350 Garfield Wright Boulevard, East Gwillimbury, ON

Project Engineer: L.G.

Client: Parkin Architects Limited

Drawing No.: 17

SUBSURFACE PROFILE				SAMPLE						
Depth (m)	Symbol	Description	Elevation (m)	Type	N = Blows/300mm	Recovery (%)	U.Wt.(kN/m3)	- SPT Blows/300mm 20 40 60 80	▲ Penetrometer ▲ 50 100 150 200	Moisture x Moisture% x 10 20 30
0		Ground Surface	273.2							
		TOPSOIL - 75mm	273.1							
		FILL - SILT compact, brown, moist, some clay, some sand, trace gravel, trace topsoil, trace rootlets		SS1	14	100		○		×
1			272.2	SS2	20	90		○		×
		SILT compact, brown, moist, some sand, trace clay, trace gravel		SS3	21	70		○		×
2			271.2							
		END OF BOREHOLE								
3		Notes: 1. Boreholes advanced using solid stem augers to 2.0m depth on July 29, 2024. 2. Borehole was found to be dry upon completion of drilling.								
4										
5										
6										

Drill Method: S/S Auger

Drill Date: July 29, 2024

PATRIOT ENGINEERING LTD.
80 Nashdene Road., Unit 62, Toronto, ON, M1V 5E4
Phone: (416) 293-7716 Fax: (416) 293-6722
e-mail: info@patrioteng.ca

Datum: Geodetic

Checked by: L.G.

Project No: 44148

Borehole #: BH17

Project: Proposed Helicopter Hanger

Borehole Location: See Figure 1

Location: 350 Garfield Wright Boulevard, East Gwillimbury, ON

Project Engineer: L.G.

Client: Parkin Architects Limited

Drawing No.: 18

SUBSURFACE PROFILE				SAMPLE						
Depth (m)	Symbol	Description	Elevation (m)	Type	N = Blows/300mm	Recovery (%)	U.Wt.(kN/m3)	- SPT Blows/300mm 20 40 60 80	▲ Penetrometer ▲ 50 100 150 200	Moisture x Moisture% x 10 20 30
		Ground Surface	273.7							
0		***TOPSOIL - 75mm***	273.6							
		FILL - SILT compact, brown, moist, some clay, some sand, trace gravel, trace topsoil, trace rootlets, trace wood pieces		SS1	13	60		○		×
1				SS2	14	95		○		×
			272.1							
		SILT dense, brown, moist, some sand, trace clay, trace gravel	271.7	SS3	30	80		○		×
2		***END OF BOREHOLE***								
		Notes: 1. Boreholes advanced using solid stem augers to 2.0m depth on July 29, 2024. 2. Borehole was found to be dry upon completion of drilling.								
3										
4										
5										
6										

Drill Method: S/S Auger

Drill Date: July 29, 2024

PATRIOT ENGINEERING LTD.
80 Nashdene Road., Unit 62, Toronto, ON, M1V 5E4
Phone: (416) 293-7716 Fax: (416) 293-6722
e-mail: info@patrioteng.ca

Datum: Geodetic

Checked by: L.G.

Project No: 44148

Borehole #: BH18

Project: Proposed Helicopter Hanger

Borehole Location: See Figure 1

Location: 350 Garfield Wright Boulevard, East Gwillimbury, ON

Project Engineer: L.G.

Client: Parkin Architects Limited

Drawing No.: 19

SUBSURFACE PROFILE				SAMPLE						
Depth (m)	Symbol	Description	Elevation (m)	Type	N = Blows/300mm	Recovery (%)	U.Wt.(kN/m3)	- SPT Blows/300mm 20 40 60 80	▲ Penetrometer ▲ 50 100 150 200	Moisture x Moisture% x 10 20 30
0		Ground Surface	273.3							
		TOPSOIL - 75mm	273.2							
		FILL - SILT compact, brown, moist, some clay, some sand, trace gravel, trace topsoil, trace rootlets, trace wood peices		SS1	11	60		○		×
			272.4							
1		***SILT*** compact, brown, moist, some sand, trace clay, trace gravel		SS2	25	95		○		×
				SS3	24	80		○		×
			271.3							
2		***END OF BOREHOLE***								
		Notes:								
		1. Boreholes advanced using solid stem augers to 2.0m depth on July 29, 2024.								
		2. Borehole was found to be dry upon completion of drilling.								
3										
4										
5										
6										

Drill Method: S/S Auger

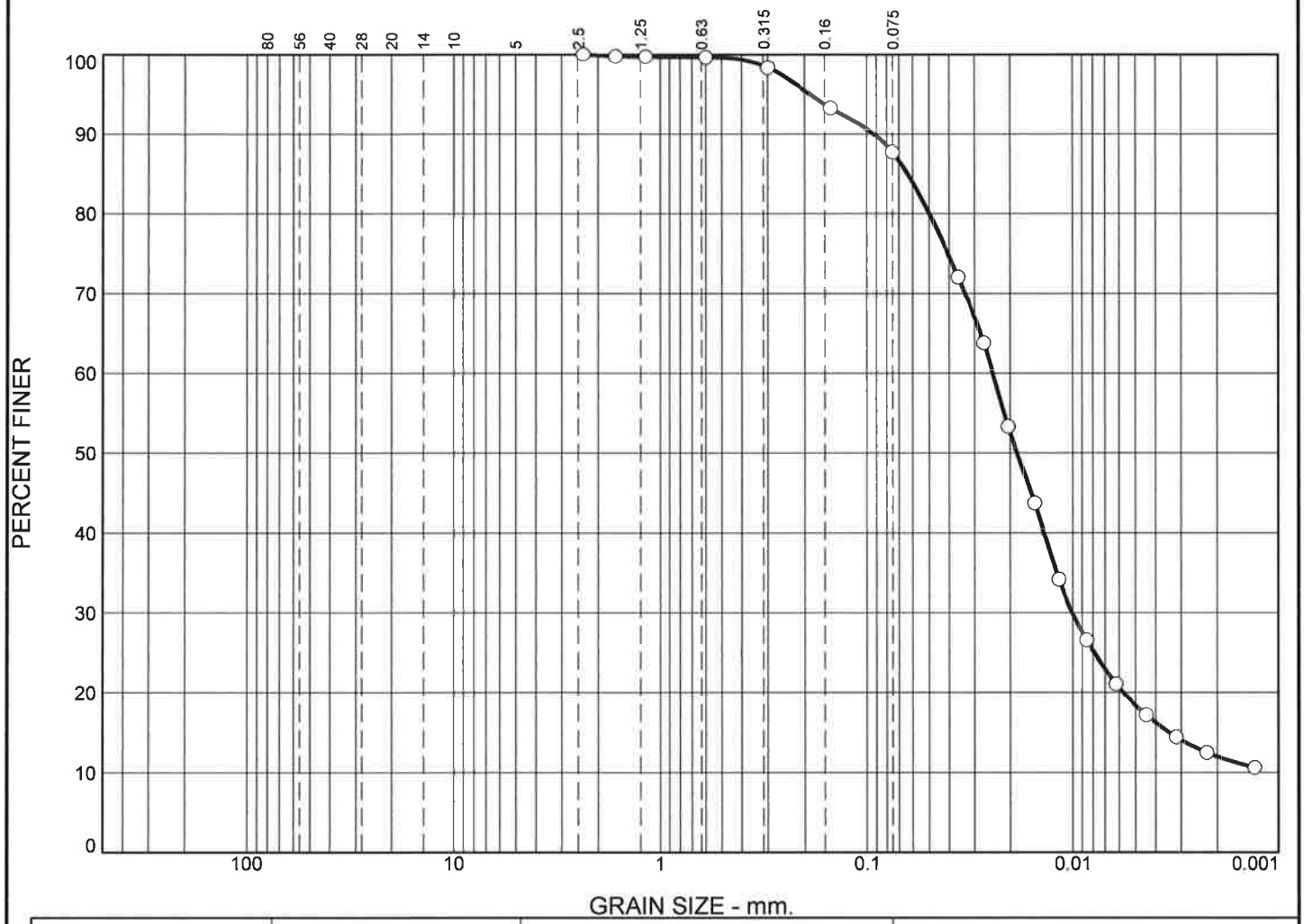
Drill Date: July 29, 2024

PATRIOT ENGINEERING LTD.
80 Nashdene Road., Unit 62, Toronto, ON, M1V 5E4
Phone: (416) 293-7716 Fax: (416) 293-6722
e-mail: info@patrioteng.ca

Datum: Geodetic

Checked by: L.G.

Particle Size Distribution Report



	% Cobbles	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.1	0.4	11.8	75.7	12.0

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.0635	0.0244	0.0185	0.0101	0.0034			

Material Description	USCS	AASHTO
○ Silt, some sand, some clay		

Project No. 44148 **Client:** Parkin Architects Limited

Project: Proposed Helicopter Hangar, 350 Garfield Wright Boulevard, East Gwillimbury, Ontario

○ **Source:** BH4 SS3 **Depth:** 5' to 6.5' **Sample No.:** R5071

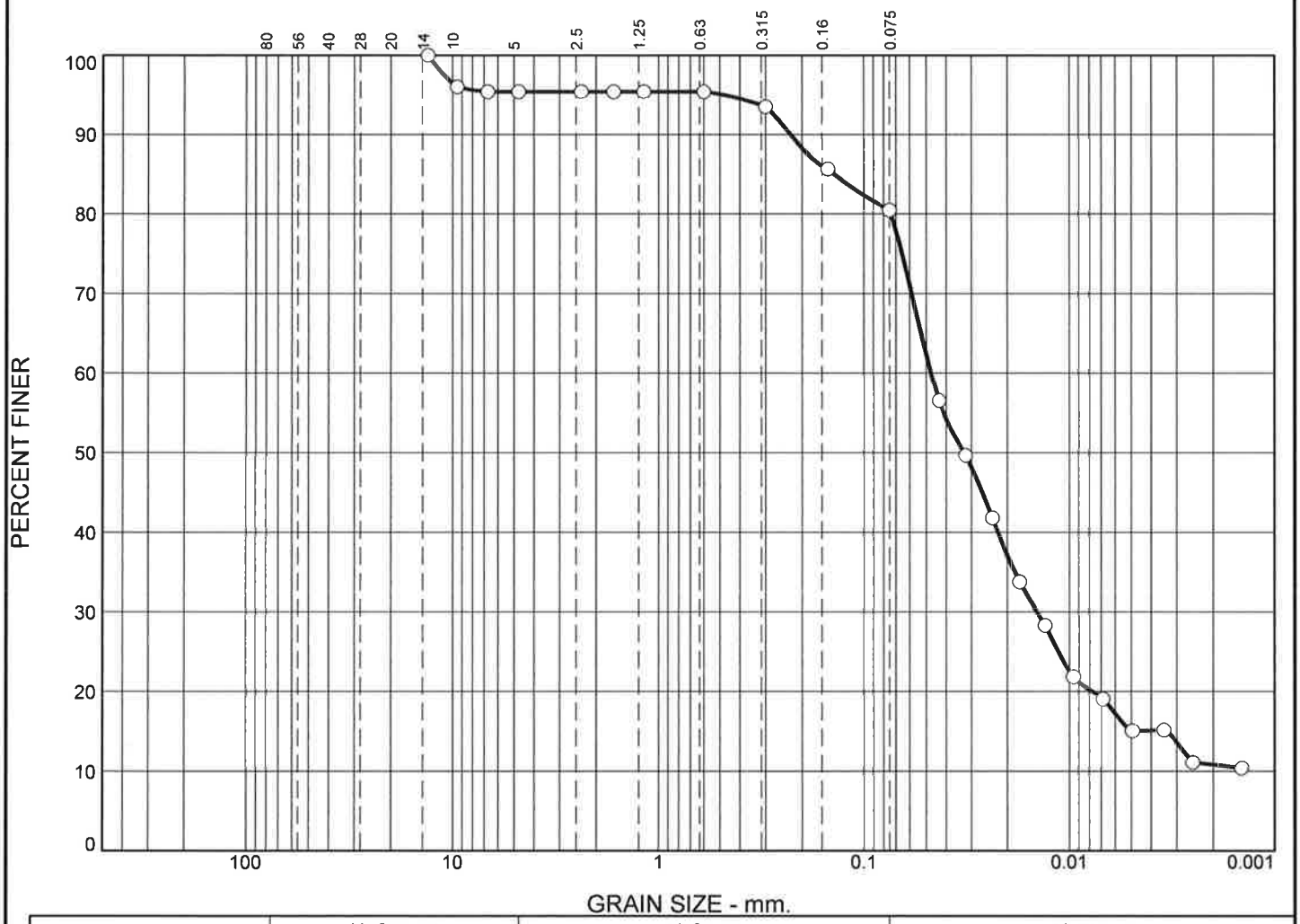
Remarks:

○ Date of Sampling: July 25, 2024

PATRIOT ENGINEERING LTD. - CONSULTING ENGINEERS

Figure 20

Particle Size Distribution Report



	% Cobbles	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	4.6	0.0	0.7	14.2	69.7	10.8

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.1403	0.0475	0.0327	0.0144	0.0034			

Material Description	USCS	AASHTO
○ Silt, some clay, some sand, trace gravel		

Project No. 44148 **Client:** Parkin Architects Limited

Project: Proposed Helicopter Hangar, 350 Garfield Wright Boulevard, East Gwillimbury, Ontario

○ **Source:** BH2 SS3 **Depth:** 7.5' to 9' **Sample No.:** R5063

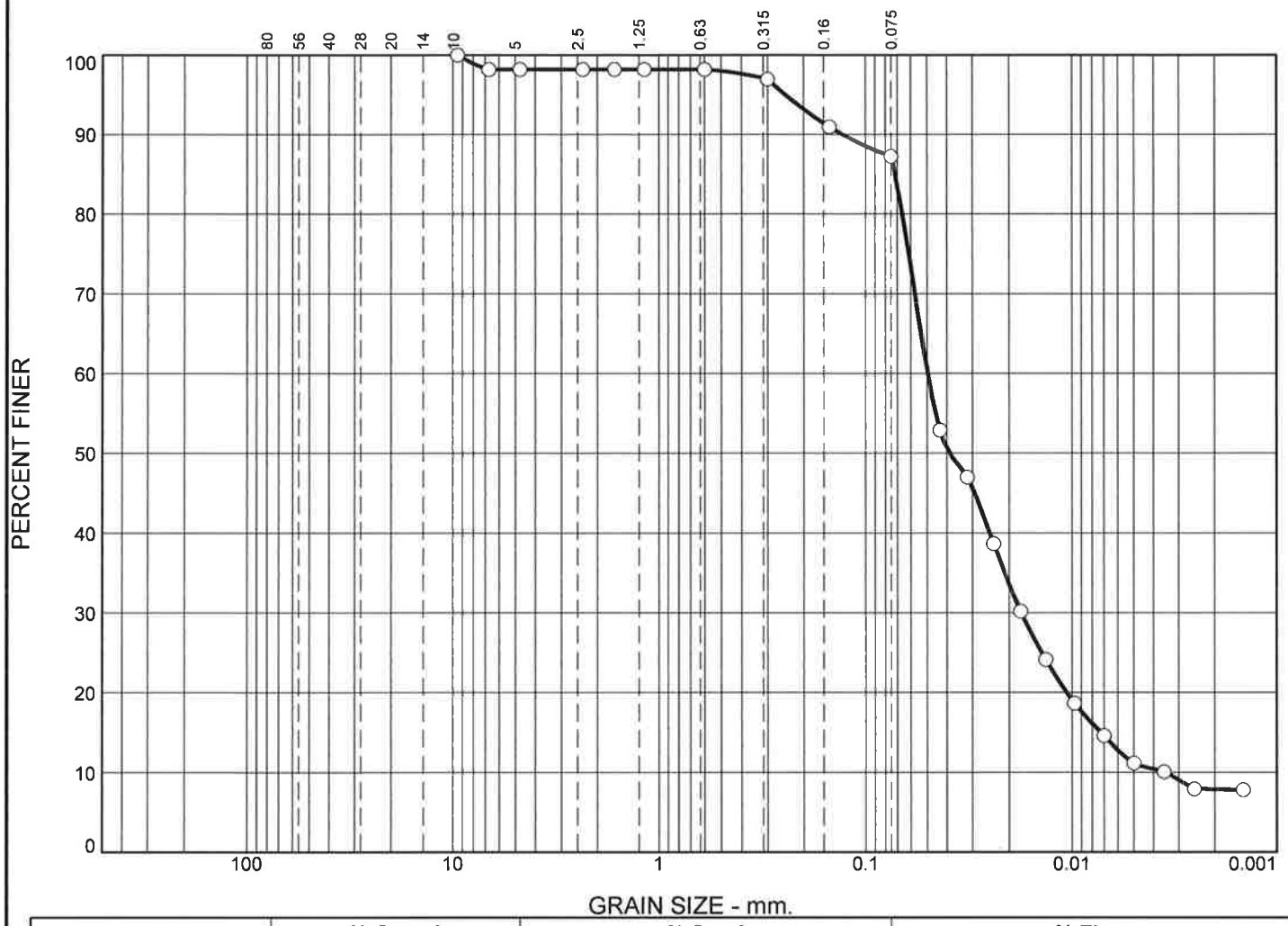
Remarks:

○ Date of Sampling; July 25, 2024

PATRIOT ENGINEERING LTD. - CONSULTING ENGINEERS

Figure 21

Particle Size Distribution Report



	% Cobbles	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	1.8	0.0	0.5	10.5	79.4	7.8

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.0717	0.0495	0.0388	0.0175	0.0073	0.0035	1.77	14.12

Material Description	USCS	AASHTO
○ Silt, some sand, trace clay, trace gravel		

Project No. 44148 **Client:** Parkin Architects Limited

Project: Proposed Helicopter Hangar, 350 Garfield Wright Boulevard, East Gwillimbury, Ontario

○ **Source:** BH5 SS3 **Depth:** 7.5' to 9' **Sample No.:** R5064

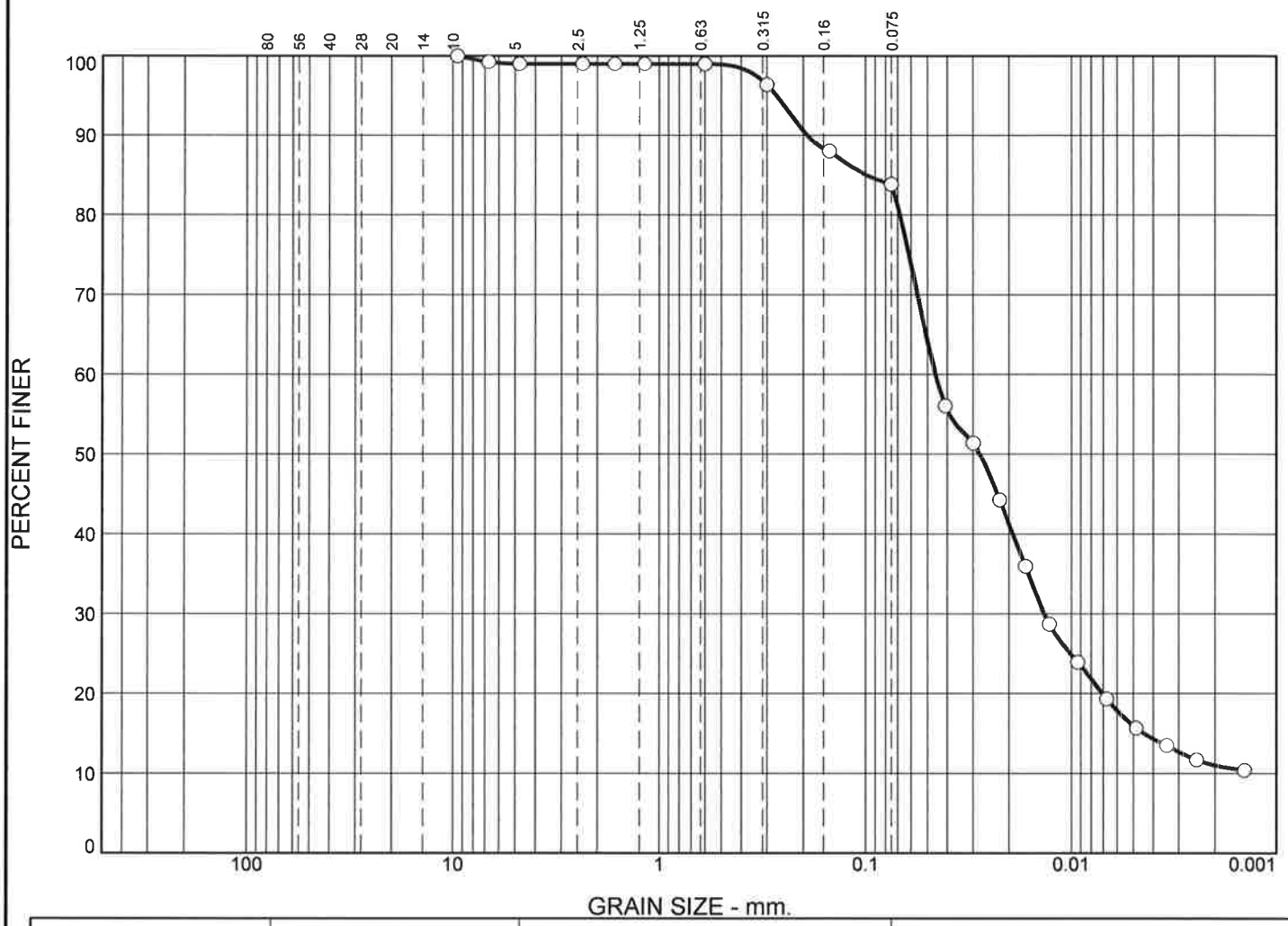
Remarks:

○ Date of Sampling, July 25, 2024

PATRIOT ENGINEERING LTD. - CONSULTING ENGINEERS

Figure 22

Particle Size Distribution Report



	% Cobbles	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	1.0	0.0	0.4	14.7	72.9	11.0

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.0991	0.0457	0.0279	0.0135	0.0044			

Material Description	USCS	AASHTO
○ Silt, some sand, trace clay, trace gravel		

Project No. 44148 **Client:** Parkin Architects Limited

Project: Proposed Helicopter Hangar, 350 Garfield Wright Boulevard, East Gwillimbury, Ontario

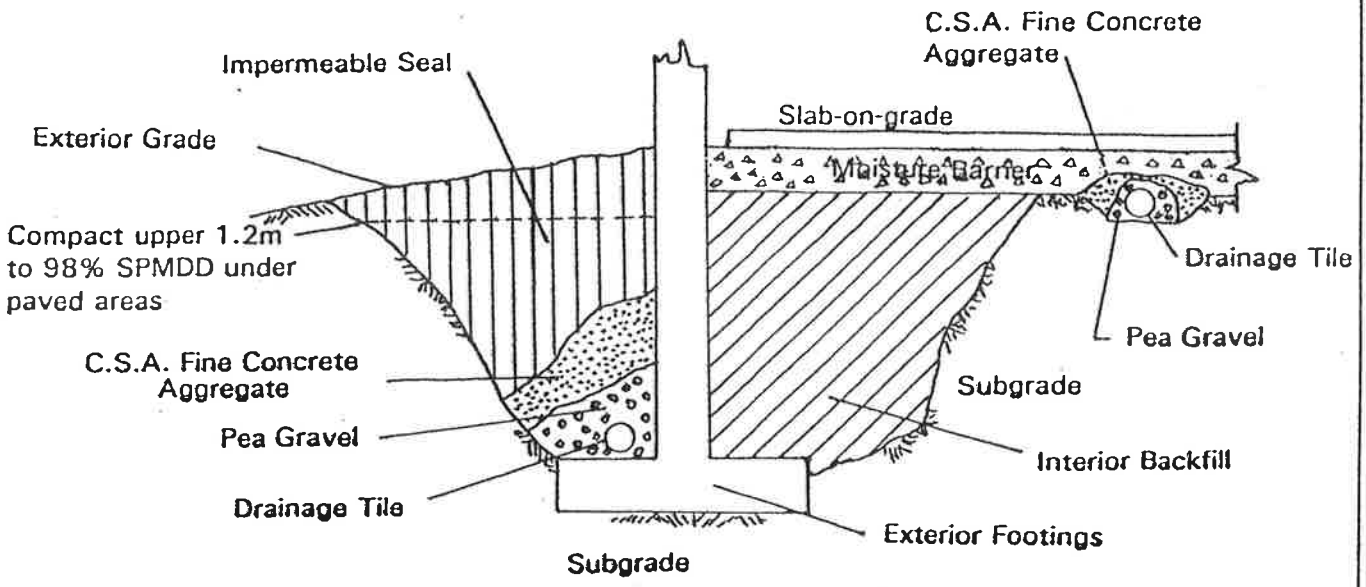
○ **Source:** BH9 SS3 **Depth:** 7.5' to 9' **Sample No.:** R5065

Remarks:

○ Date of Sampling, July 26, 2024

PATRIOT ENGINEERING LTD. - CONSULTING ENGINEERS

Figure 23



NOTES:

1. Drainage tile to consist of 10cm (4") diameter weeping tile or equivalent perforated pipe leading to a positive sump or outlet. Invert to be minimum of 15cm (6") below underside of floor slab.
2. Pea gravel 15cm (6") top and sides of drain. If drain is not on footing, place 10cm (4") of pea gravel below drain. 20mm (3/4") stone is an alternative, provided it is covered by an approved geotextile.
3. C.S.A. fine concrete aggregate to act as filter material. Minimum 30cm (12") top and side of tile drain. This may be replaced by an approved porous plastic membrane as indicated in 2.
4. Impermeable backfill seal-compacted clay, clay silt or equivalent. If original soil is free-draining, seal may be omitted.
5. The interior fill may be any clean, non organic soil which may be compacted to at least 98% Standard Proctor density in this confined space.
6. Do not use heavy compaction equipment within 0.5m (18") of the wall. Do not fill or compact within 1.8m (6') of wall unless the fill is placed on both sides simultaneously.
7. Moisture barrier to be at least 20cm (8") of compacted Granular "A" fill or equivalent free-draining material to be approved by our geotechnical staff.
8. The moisture barrier is to be compacted to 98% Standard Proctor maximum dry density.
9. Slab-on-grade should not be structurally connected to the wall or the footing.
10. Exterior grade to slope away from wall.
11. Underfloor drain invert to be at least 300mm (1') below the underside of floor slab. Tile placed in parallel rows 6-8m (20'- 25') centres one way.
12. Do not connect the underfloor drains to perimeter drains.
13. If the 20mm (3/4") stone requires surface blinding, use 6mm (1/4") stone chips.

DRAINAGE AND BACKFILL RECOMMENDATIONS

Not to Scale

	Name	Date
Drawn By		
Checked By		
Revisions		
Scale		

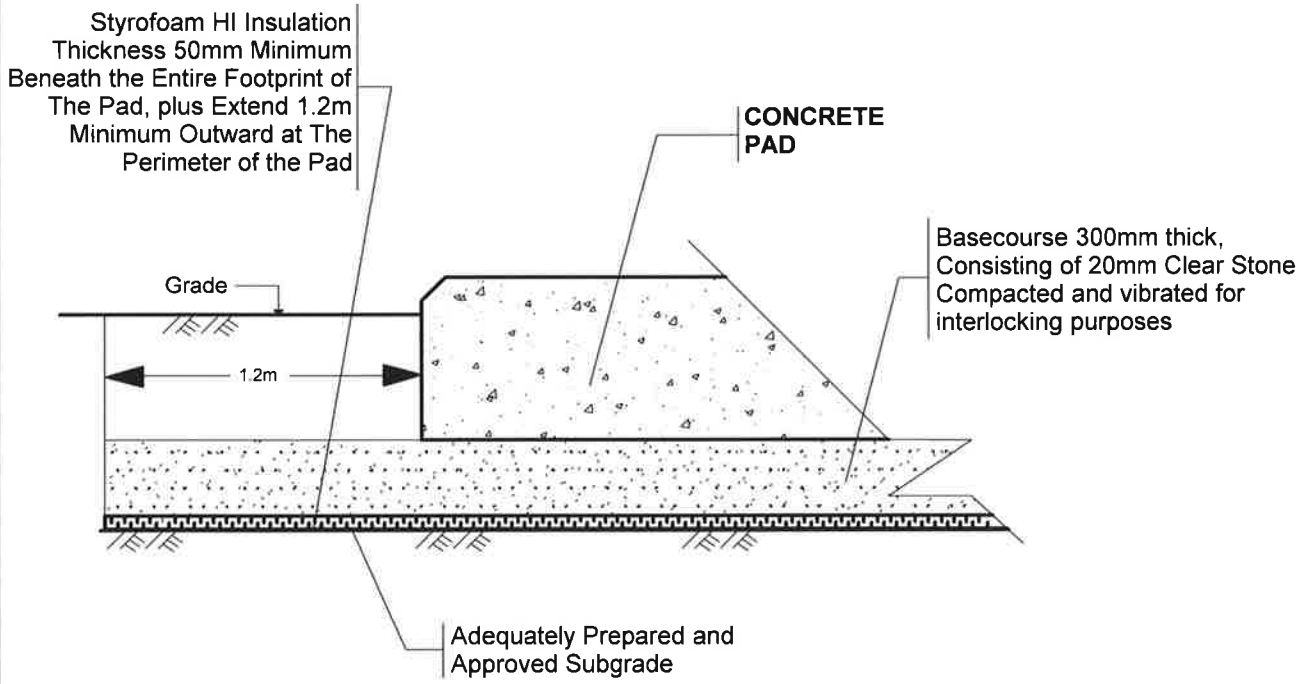
PATRIOT ENGINEERING LTD.
Consulting Engineers

Project : 44148

Figure: 24

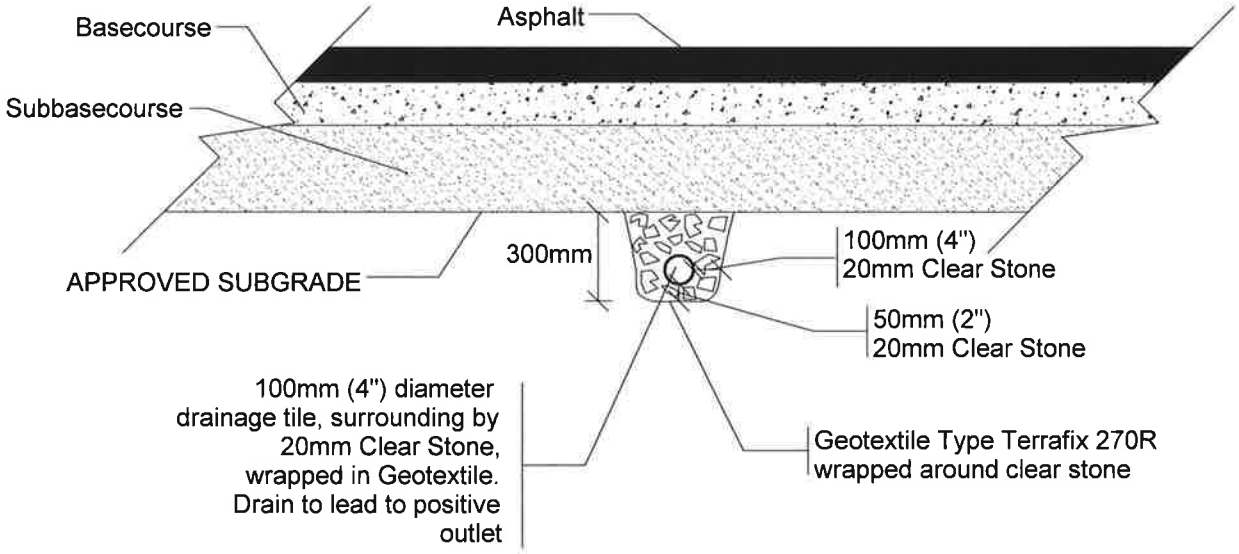
SCHEMATIC DETAIL FOR EXTERIOR CONCRETE PAD

1. A minimum of 0.3m (1ft) of exterior soil cover is required.
2. Good site grading is to be provided to prevent ponded water at pad base, otherwise adequately filtered perimeter drainage will be required.
3. Insulation should have at least two overlapping layers, have tight splices, glue should be used on any vertical surfaces and spot glue on the horizontal surfaces.
4. Provide a continuous Styrofoam HI insulation pad beneath the entire footprint of the pad, plus it must extend outward a minimum of 1.2m from the edge of the pad at the sides, as shown in the diagram below.
5. Basecourse to be at least 300mm thick consisting of 20mm (3/4 inch) clear stone compacted and vibrated for interlocking purposes.
6. The drawings must be reviewed with accompanying text.
7. Diagram provided below is for guidance only. In all cases, manufacturers' specifications must be followed for installing insulation.



Drawn By	Name	Date		**PATRIOT ENGINEERING LTD.** Consulting Engineers	
Checked By					
Revisions				Project: 44148	Figure: 25
Scale	N.T.S.				

TYPICAL SUBDRAIN DETAIL



Drawn By	Name	Date		**PATRIOT ENGINEERING LTD.** Consulting Engineers	
Checked By					
Revisions				Project: 44148	Figure: 26
Scale	N.T.S.				

PATRIOT
ENGINEERING LTD.
Consulting Engineers

EXPLANATION OF TERMS

1. SAMPLING PROCEDURES

AS	Auger Sample	GS	Grab Sample
SS	Split Spoon	ST	Shelby Tube

2. PENETRATION RESISTANCE

Standard Penetration Resistance 'N'

The number of blows that are required to advance a standard split spoon sampler 0.3 m into the subsurface soil, that is driven by means of a 63.5 kg hammer falling freely for a distance of 0.76 m.

Dynamic Penetration Resistance:

The number of blows that are required to advance a 51 mm diameter, 60 degree cone, fitted to the end of drill rods, 0.3m into subsurface soil. The driving energy is 475 J per blow.

3. DESCRIPTION OF SOIL

The description of the soil is based on visual examination of the samples obtained and laboratory testing. Each layer is described according to the following classification and terminology:

Classification*	Particle Size
Clay	less than 0.002 mm
Silt	from 0.002 to 0.075 mm
Sand	from 0.075 to 4.75 mm
Gravel	from 4.75 to 75 mm
Cobbles	from 75 to 200 mm
Boulders	larger than 200 mm

* Unified Soil Classification System (ASTM D2487-75).

Terminology	Proportion
Trace, or occasional	Less than 10%
Some	10 to 20%
Adjective (e.g. silty or sandy)	20 to 35%
And (e.g. sand and gravel)	35 to 50%

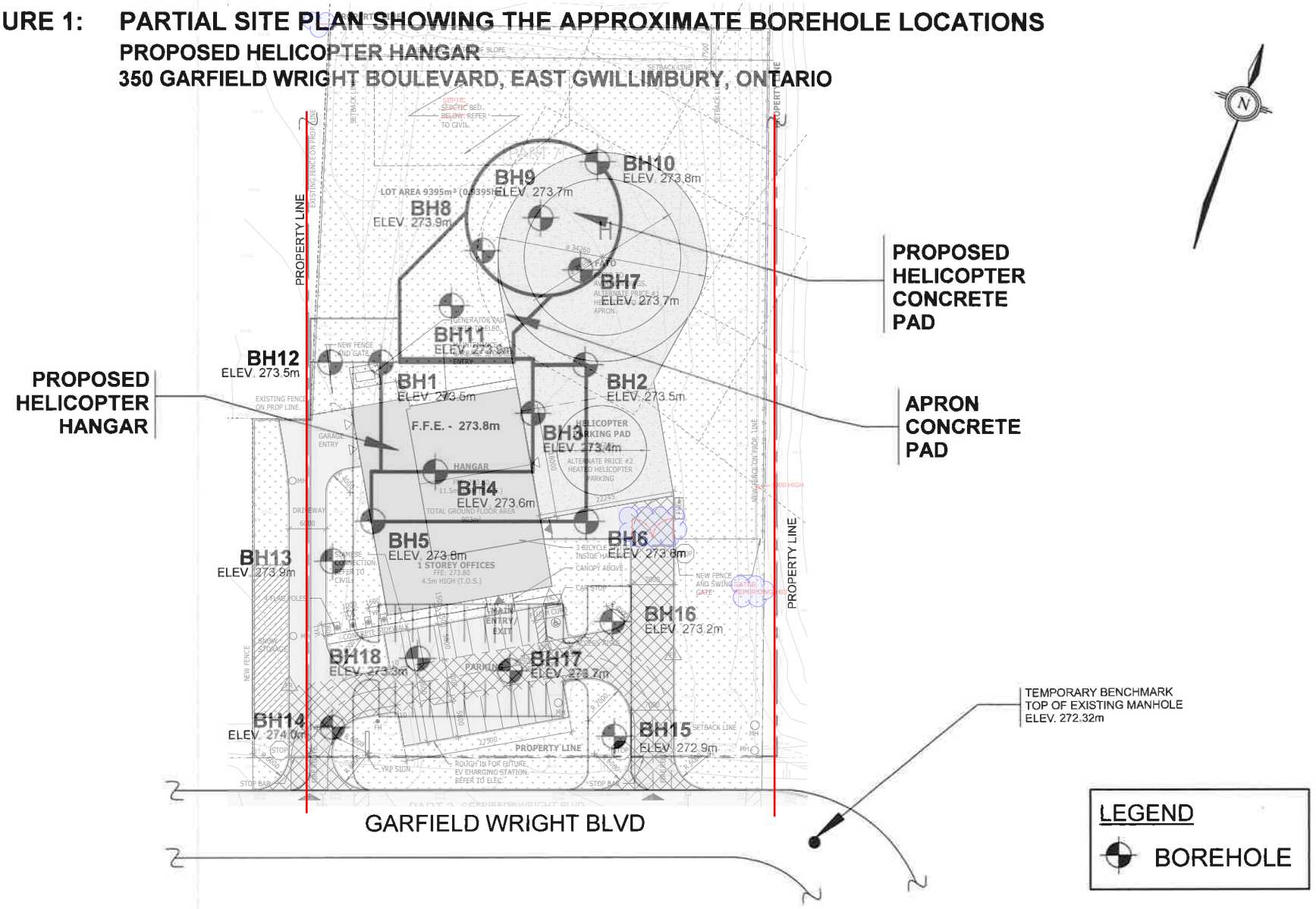
The relative density of the cohesionless soils and the consistency of cohesive soils are defined below:

Cohesionless Soils		Cohesive Soils		
Relative Density	Penetration Resistance "N" Blows/0.3 m or Blows/foot	Consistency	Underdrained Shear Strength**	
			kPa	psf
Very loose	0 to 4	Very soft	0 to 12	0 to 250
Loose	4 to 10	Soft	12 to 25	250 to 500
Compact	10 to 30	Firm	25 to 50	500 to 1000
Dense	30 to 50	Stiff	50 to 100	1000 to 2000
Very dense	over 50	Very Stiff	100 to 200	2000 to 4000
		Hard	over 200	over 4000

** The compressive strength obtained from the quick (Q) triaxial test is equal to twice the shear strength of the clay tested.

FIGURE 1: PARTIAL SITE PLAN SHOWING THE APPROXIMATE BOREHOLE LOCATIONS

PROPOSED HELICOPTER HANGAR
350 GARFIELD WRIGHT BOULEVARD, EAST GWILLIMBURY, ONTARIO



REFERENCE:

PARTIAL SITE PLAN INFORMATION ADAPTED FROM OVERALL SITE PLAN DRAWING NO. A-002, PREPARED BY PARKIN ARCHITECTS LIMITED, DATED APRIL 15, 2024.

	Name	Date
Drawn By	M.A.	Aug '24
Checked By	L.G.	Aug '24
Revisions		
Scale	Reduced From Original	

PATRIOT ENGINEERING LTD.
Consulting Engineers

Project: 44148 | Figure: 1

PART 1 - GENERAL

1.1 PRICING

.1 All costs associated with the work required by this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL INSTRUCTIONS

.1 Read and conform to:

.1 the General Conditions and Supplementary Conditions of the Contract.

.2 Division 1 requirements and documents referred to therein.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

.1 **The Work consists of following:**

.1 The Work of this Contract includes furnishing labour, materials, equipment, services and other related expenses necessary to execute the complete construction of the facility specified in the Contract Documents and the Supply of Products in ample time to be installed into the Work together with templates, measurements and other information required for placement.

.2 Without limiting the generality of the foregoing, the Contractor is responsible for coordination of the various parts of the Work so that no part is left in an unfinished or incomplete condition.

1.4 SPECIFICATIONS FORMATS AND CONVENTIONS

.1 Specifications are addressed to the Contractor. Specifications are not intended to be a detailed description of installation methods but serve to indicate particular requirements in completing the Work.

.2 Where Contract Documents do not provide sufficient information for the complete installation of an item, then the Contractor shall comply with any applicable or relevant manufacturer's written instructions for quality of Work.

1.5 DISCREPANCIES/CONFLICTS/OMISSIONS

.1 Drawings, Specifications and other Contract Documents are intended to be in compliance with federal, provincial and municipal laws, by-laws, regulations and other requirements of Authorities Having Jurisdiction at the Place of the Work, although the Owner and Consultant make no guarantee or representation that there is such compliance. The Contractor shall perform the Work in conformity with such requirements. If, at any time, the Contractor finds errors, inconsistencies, or omissions in the Contract Documents or has any doubt as to the meaning or intent of any part thereof, the Contractor shall immediately notify the Consultant, and request a Supplemental Instruction, Change Order, or Change Directive, as the case may require.

.2 If discrepancies or conflicts in, or omissions from Drawings, Specifications or other Contract Documents are suspected, or if there is doubt as to meaning or intent thereof, notify the Consultant at once. To the extent multiple standards, requirements or levels of performance are

prescribed by the Contract Documents, the most stringent of such standards, requirements or levels of performance (as determined by the Consultant) shall apply to the Work and prevail over the others.

.3 Comply with the Consultant's written instructions or explanations.

.4 Promptly, and not later than within 10 Working Days of becoming aware of circumstances which may require a change in the Work or other directions, give written notice to the Consultant outlining such circumstances and request written directions. The Contractor shall not work in the affected area without the Consultant's prior written approval in order to ensure that the Consultant is capable of properly assessing the situation or evaluating the change (if applicable). The Consultant's interpretations and findings will be given in writing to the parties within a reasonable time.

1.6 WORK RESTRICTIONS

.1 Site Access

.1 Coordinate with the Owner regarding access to the Site.

.2 Assume responsibility for care, custody and control of property which is assigned for performance of the Work. Protect the Work and the Owner's property and property adjacent to, or in the vicinity of, or proximate to, the Place of the Work from damage and be responsible for damage which may arise as the result of the Contractor's performance or failure to perform under the Contract.

.3 Temporary vehicular access and parking shall be in accordance with requirements of Section 01 50 00 – Temporary Facilities and Controls.

.4 All work on municipal property shall be carried out in accordance with the regulations of the respective municipality and any other Authorities Having Jurisdiction (which shall include, without limitation, being responsible for any associated fees, permits, insurance or bonding that is required by such regulations).

.2 Signs, Advertising and Publications

.1 Do not erect or display devices, signs or advertisements of labour, materials or services provided to the Work. Signs related to fire, danger and safety are exempted from this requirement.

.2 Do not consent to advertising of the Work, of any kind, without the Owner's and Consultant's written approval. Do not consent to mention of the Work in any advertising or articles in any publication relating to the Work without approval and written permission from the Owner and Consultant.

.3 Security Clearance of Employees.

.1 Workers on Site may be subject to security checks and may be required to obtain security clearance to the satisfaction of the Owner at its sole discretion before commencing any Work on Site.

.2 All workers and Subcontractors employed in the Work shall complete a Confidential Personal History Form - YRP 419 (sample attached as a supplement to this Section). Those forms shall be provided to Owner, who shall provide security clearances.

.3 Only persons with security clearances will be permitted to access or perform Work at Site. Any persons who fail to obtain a security clearance, or who decline to consent to a security clearance, will not be permitted access to the Site.

.4 During the course of the Work, any new workers shall also require a security clearance prior to being permitted access to Site. Such clearances shall follow the procedure outlined above.

.5 The Owner may, in its sole and unfettered discretion, refuse to issue a security clearance to any person, and may revoke a security clearance previously issued, without prior notice to any person or to the Contractor. Upon revocation of the security clearance of a person, that person shall not be permitted access to Site. It is understood that the Owner may conduct checks of any person at any time during the Work for the purpose of determining whether a security clearance should be granted, maintained, altered or revoked.

.6 Workers employed on Site shall sign the “Daily Register” provided, showing “IN” and ”OUT” times and the number of hours worked on each shift

.4 **Existing Site Services**

.1 Before commencing the Work, determine the location of all underground utilities and structures indicated in or reasonably inferable from the Contract Documents and notify the Consultant of findings.

.2 Consult public and service companies' records and become fully informed of locations and extent of buried and overhead services and utilities.

.3 If interruption to existing services or utilities is to occur during execution of the Work and is necessary, give the Owner 5 Working Days’ prior written notice. Provide temporary services and obtain prior acceptance from the Consultant and Owner with regard to timing and methods for providing temporary services.

.4 Submit a schedule to and obtain approval from the Consultant for each proposed shut-down of active service or facility. Adhere to the approved schedule and provide notice to the affected parties. Disconnect and relocate public utilities encountered in connection with the Work with minimum disturbance to occupants, their activities, pedestrian and vehicular traffic, and public and private property. To the extent necessary to ensure the proper performance of the Work in accordance with the Contract, issue notices and arrange for or provide services (including temporary services if necessary) involving the following utilities or conditions that may exist at the Site:

.1 gas mains.
.2 water pipes.
.3 sanitary and storm sewers.
.4 telephone conduits and cables.
.5 electrical conduits and cables.
.6 fire hydrants.
.7 lampposts.
.8 sign posts.
.9 other similar items.

.5 Should any piping, sewers, cables, or similar services be encountered during the Work of this Contract that are not known from Owner's and utility companies' records, notify the Consultant and do not proceed with removal or cutting until directed. In the case of such encounters, the Contractor shall proceed in accordance with the applicable terms of the Contract, including GC 6.4 CONCEALED OR UNKNOWN CONDITIONS of the General Conditions of the Contract.

1.7 SITE WORK

.1 Restore existing paving, sidewalks, curbs and landscaping damaged during construction. Provide paving, walks, curbs and landscaping to match existing conditions unless otherwise shown on the Contract Drawings.

.2 Provide sod to replace damaged grass and maintain it until it has rooted properly.

1.8 SUPPLEMENTS

.1 The document listed below, which are attached following “End of Section”, forms part of this Section:

.1 YORK REGIONAL POLICE – CONTRACTOR/SERVICE PROVIDERS & VOLUNTEERS SECURITY CLEARANCE FORM - INSTRUCTIONS

END OF SECTION

Updated through ADD#8

PART 1 - GENERAL

Inspection & testing amount updated through cost saving

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL INSTRUCTIONS

.1 Read and conform to:

.1 the General Conditions and Supplementary Conditions of the Contract.

.2 Division 1 requirements and documents referred to therein.

1.3 CASH ALLOWANCES

.1 Disbursements from cash allowances are intended for Work not shown or described in the Contract Documents and shall be authorized by the Owner, through the Consultant, in writing, as applicable.

.2 Extend to the Owner refunds and trade and quantity discounts which may be received from purchasing under cash allowances, except cash discounts for prompt payment.

.3 In submitting final adjustments of cash allowances, include duplicate, summary statements and copies of receipted invoices substantiating purchases under cash allowances.

.4 Provide cash allowances as noted on the Bid Form.

1.4 LIST OF CASH ALLOWANCES

.1 Provide the cash allowances as follows:

No.	Description	Amount
1.	Inspection and Testing: For inspection and testing services provided by independent inspection and testing companies and consultants.	$ 150,000.00
2.	Commissioning of mechanical and electrical work by independent commissioning consultant in compliance with specified requirements. Normal commissioning by mechanical and electrical trades shall be included in Total Bid Price and excluded from this cash allowance item.	$ 100,000.00
3.	Electrical Municipal Utilities connection charges. All Work shown on the Drawings shall be included as part of Total Bid Price and excluded from this cash allowance.	$ 50,000.00
4.	Supply and installation of security system and equipment (excluding empty conduit which shall be included in Total Bid Price).	$ 75,000.00
5.	Supply and installation of Fuel Tank including the fuel tank equipment and its components, layout, testing, and engineering fees. The empty conduit shall be included in Total Bid Price and excluded from this cash allowance.	$ 150,000.00
	Total Of Cash Allowances	$ 525,000.00

.4

END OF SECTION

PART 1 - GENERAL

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL INSTRUCTIONS

.1 Read and conform to:

.1 the General Conditions and Supplementary Conditions of the Contract;

.2 Division 1 requirements and documents referred to therein.

1.3 REFERENCES

.1 Definitions: For the purposes of this paragraph, the term “overhead” means the following:

.1 Project-related operating expenses associated with the following:

.1 salaries, wages, benefits for personnel including but not limited to:

.1 staff, general managers, warehouse personnel, maintenance workers, timekeepers, accountants and clerks, estimators, shop stewards, draft-persons/CAD operators, and other employees engaged in daily operations of the business;

.2 general office expenses including but not limited to:

.1 rent, leases, mortgages, financing costs (including holdback), bonding and insurance;
.2 utilities, phone, fax, printing, courier charges and/or office equipment rentals;

.3 lodging and travel;
.4 leased or rented equipment, furniture and facilities not used on the Project site;
.5 permits and/or licences required by Authorities Having Jurisdiction;
.6 shipping, haulage and hoisting; and
.7 disposal charges and related services;

.2 Project-related site expenses associated with the following:

.1 salaries, wages, benefits for personnel directly employed on the Work including but not limited to:

.1 Project managers, superintendents, mechanical and electrical coordinators, foremen, engineers, timekeepers, accountants, clerks, watch persons and other personnel directly employed on the Project;

.2 non-productive labour such as breaks (washroom, lunch or otherwise);
.3 site/trailer/temporary office, sheds or other general temporary site support facilities (including without limitation Project signage, site cleaning, temporary sanitary facilities and the like)
.4 temporary utilities and associated temporary facilities including but not limited to: water, power, heat, telephone, and data;
.5 snow removal and similar activities;
.6 equipment rentals and small tools;

.7 activities, personnel and equipment associated with Project safety including but not limited to:

.1 site security and fire prevention, hoarding, temporary protection of areas adjacent to the Work, signage and bump lines;

.8 activities associated with coordination with other contractors and trades (including without limitation related to surveying, interferences and site measurements), and coordination with the Owner (including with respect to service disruptions, move-in notifications, and the like);

.9 close-out submittals including but not limited to: As-Built Drawings (electronic and/or hardcopies), operation and maintenance (O&M) manuals and similar documentation.

1.4 CASH FLOW SCHEDULE

.1 Prior to commencement of the Work, submit a detailed cash flow projection schedule indicating anticipated billings on a month-by-month basis for duration of the Work, including timing of holdback release.

.2 Update cash flow schedule monthly, recording cumulative as well as monthly totals.

1.5 PROGRESS BILLING BREAKDOWN

.1 Prior to commencement of the Work, submit a detailed progress billing breakdown and obtain approval of the Consultant.

.2 Progress billing breakdown shall include itemized values (each excluding the Harmonized Sales Tax (HST)), applied against each of following:

.1 mobilization and start-up;

.2 general site expenses;

.3 each cash allowance;

.4 each Section of the Specifications (Divisions 2-49 inclusive);

.5 as-built and record Drawings broken down by architectural, structural, mechanical and electrical disciplines;

.6 Project closeout documentation, comprising of separate sums for:

.1 manuals;
.2 maintenance materials; and
.3 commissioning and training/demonstration for Owner's staff.

1.6 UNIT PRICES

.1 Unit prices (when requested in the Bid) shall include all labour, materials, Products, equipment, services, and respective overhead, profit, taxes (excluding HST), disbursements, and related charges.

.2 Unit prices are amounts stipulated by bidders for Owner-solicited unit prices which can be stated as additions for extra work, deductions for deleted work or no change to the Contract Price. Without limiting its rights under the Request for Tenders, the Owner reserves the right to accept or reject any or all of the unit prices. Unit prices do not include HST, but include all other eligible taxes. These amounts shall be irrevocable for the period of the Contract.

1.7 PROVISIONAL ITEMS

.1 The price for provisional items (when requested in the Bid Form) shall include all labour, materials, Products, equipment, services and respective overhead, profit, taxes (excluding HST), disbursements and related charges required for substituting, deleting or changing of materials, Products and/or construction from those shown or specified in the Contract and shall represent the total amounts which will be deducted from the Contract Price (as noted for each item).

1.8 LUMP SUM PRICES

.1 Lump sum prices (when requested in the Bid) shall be included in the Contract Price.

.2 Lump sum prices shall include all labour, materials, Products, equipment, services, and respective overhead, profit, taxes (excluding HST), disbursements and related charges required to provide these items and represent total amounts in the Contract Price.

1.9 CHANGES IN THE WORK DUE TO A SUPPLEMENTAL INSTRUCTION

.1 Supplemental Instructions issued by the Consultant do not normally include any change in Contract Price or in Contract Time.

.2 If, in the opinion of the Contractor, performance of the Supplemental Instruction will result in an increase or decrease to the Contract Price or to the Contract Time, the Contractor shall, within 10 Working Days of receipt of the Supplemental Instruction, provide the Consultant with Notice in Writing of the cause and duration of the delay and of any increase in Contract Price. Failure to provide the Notice in Writing shall be deemed acceptance of the Supplemental Instruction by the Contractor without adjustment in the Contract Price or Contract Time.

1.10 CONTRACT MODIFICATION PROCEDURES

.1 Conform to Part 6 CHANGES IN THE WORK of the General Conditions.

.2 Further to PART 6 CHANGE SIN THE WORK of the General Conditions, promptly and no later than 10 Working Days after becoming aware of circumstances which may require a change in Work or other directions, give written notice to the Consultant outlining such circumstances and requesting proposed change. Do not perform any Work in the affected area that would prevent the Consultant from properly evaluating circumstances and proposed change, without obtaining written approval of the Consultant. The Consultant will act promptly to give the Contractor directions so the Work is not unreasonably delayed.

.3 The Contractor shall review the Contract Documents and shall report promptly to the Owner and the Consultant any error, inconsistency, or omission the Contractor may discover. If the Contractor does discover any error, inconsistency, or omission in the Contract Documents, the Contractor shall not proceed with the Work affected until the error, inconsistency or omission has been addressed and in dealing with such error, inconsistency or omission the Contractor shall co-operate with the Owner in good faith to resolve such errors, inconsistency or omission so as to avoid any increase in the Contract Price or delay in the progress of the Work

1.11 CONTEMPLATED CHANGE ORDER, CHANGE DIRECTIVE AND CHANGE ORDER

.1 Conform to Part 6 CHANGES IN THE WORK of the General Conditions.

.2 Any variation in the Contract involving a change in total amount of Contract Price or in Contract Time shall be initiated through the Consultant in the form of a Contemplated Change Order (CCO) describing the Work proposed under variation and requesting a quotation from Contractor. When a Change in the Work is proposed, the Owner or the Consultant shall prepare a Contemplated Change Order (CCO) describing the proposed change(s) and submit the CCO

to the Contractor for consideration. The Contractor shall propose, with the appropriate supporting documentation, its proposed method of adjustment and the amount of adjustment to the Contract Price, if any, and the proposed adjustment in the Contract Time, for the work included in the CCO. The Owner and/or the Consultant will assess the merits of the proposed adjustments to the Contract Price and/or the Contract Time in accordance with the process outlined in GC 6.2 – CHANGE ORDER. If the Owner and the Contractor agree to the adjustments in the Contract Price and/or Contract Time or the method to be used to determine the adjustments, such agreement shall be effective immediately and shall be recorded in a Change Order.

.3 The value of a change shall be determined in one or more of the methods described in paragraph 6.2.4 of GC 6.2 – CHANGE ORDER, as directed by the Consultant or the Owner.

.4 When providing copies of CCOs or Change Directives (CDs) to the Contractor, the Consultant shall provide three (3) copies of such CCOs or CDs, including associated Drawings and Schedules.

.5 Immediately inform all relevant Subcontractors and Suppliers of the proposed Change in the Work.

.6 The Contractor shall not proceed with any changes in the Work until it has received a copy of the Change Order or Change Directive. No claims for changes in the Contract Price or Contract Time shall be valid unless provided for by the Owner in the Change Order.

.7 Upon receipt of a CD, begin the work described therein without delay and prepare a quotation for the Work. If the Owner requires the Contractor to proceed with a Change in the Work prior to the Owner and the Contractor agreeing upon the adjustments to the Contract Price and/or the Contract Time, the Owner or the Consultant shall issue a Change Directive. Upon receipt of the Change Directive, the Contractor shall promptly proceed to execute the Work described in the Change Directive. The adjustment in the Contract Price for a change carried out by way of a Change Directive shall be determined in one of the methods described in paragraph 6.3.2 of GC 6.3 – CHANGE DIRECTIVES.

.8 Submit a quotation within 20 Working Days of receipt of the CCO or CD issuance and return one copy of the original CCO or CD with the quotation for the Work.

.9 Include all work described in the CCO and all other work caused, however incidental it may be, by the proposed change. Once the CO is issued by Owner, no further claims for extra costs or time extensions will be accepted.

.10 If the quotation received is unacceptable, the Consultant will reject the quotation and request a revised quotation from the Contractor.

.11 When the Consultant deems a quotation as acceptable, it will prepare a CO.

.12 The value of changes in Work shall be determined and processed in accordance with the General Conditions of the Contract.

1.12 APPLICATION FOR PROGRESS PAYMENTS AND PROGRESS PAYMENTS

.1 Conform to the requirements of Article A-5 – PAYMENT of the Agreement Between Owner and Contractor and GC 5.2 APPLICATIONS FOR PROGRESS PAYMENT of the General Conditions.

END OF SECTION

PART 1 - GENERAL

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL

.1 Read and conform to:

.1 the General Conditions and Supplementary Conditions of the Contract.

.2 Division 1 requirements and documents referred to therein.

1.3 PROJECT COORDINATION

.1 Refer to Section 01 29 00 – Payment Procedures regarding Contract modification procedures.

.2 Conform to the requirements of PART 3 – EXECUTION OF THE WORK of the General Conditions of the Contract,

.3 Study the Contract Documents to determine the extent of the Work. Coordinate the scope and extent of work to be performed by each trade. Neither organization of Specifications into divisions and CSC/CSI 3-part Section format nor arrangements of Drawings, schedules and standard Drawings shall affect in any way the Contractor's control in, or diminish its responsibility for, dividing the Work or establishing each trade's scope of work. Claims against the Owner for additional compensation arising from disputes between trades due to lack of coordination by the Contractor will not be accepted or considered.

.4 Coordinate the work of each Section of the Specifications as required for satisfactory and expeditious completion of the Work. Take field dimensions required. Take into account existing installations to assure best arrangements of components in available space. Consult with the related Subcontractors before commencing any Work in critical locations. Fabricate and erect the Work to suit field dimensions and field conditions.

.5 Pay the cost of extra work caused by, and make up time lost resulting from, the Contractor’s failure to comply with the requirements of this Section.

.6 Coordinate the work of all trades including construction sequence, schedule and interfacing of all Work. Coordinate the Work as required to incorporate metric modular components. Coordinate the work of each trade as required for satisfactory and expeditious completion of the Work. Ensure components to be built in or recessed are supplied promptly with setting Drawings and other related information pertinent to the installation of such components.

.7 Cooperate and coordinate with the Consultant for moving the Owner's equipment into the building when the Work or a substantial part thereof is ready for use for the purpose intended.

1.4 DOCUMENTS ON SITE

.1 Maintain at the Site, one copy of each of the following documents: a

.1 Contract Drawings.

.2 Specifications.

.3 Addenda.

.4 Reviewed shop drawings.

.5 List of outstanding Shop Drawings.

.6 Contemplated Change Orders.

.7 Change Orders.

.8 Change Directives.

.9 Site instructions.

.10 Other modifications to the Contract.

.11 Field test reports.

.12 Copy of approved work schedule and progress schedules.

.13 Health and safety plan and other safety related documents.

.14 Manufacturer's installation and application instructions.

.15 Progress photographs.

.16 As-built drawings.

.17 Minutes of Site meetings.

.18 Other documents as specified in the Contract Documents.

1.5 START-UP MEETING

.1 A start-up meeting shall be held and presided over by the Consultant after award of the Contract.

.2 Attendees of the start-up meeting shall include:

.1 Consultant(s)

.2 Contractor

.3 Contractor's superintendent

.4 Subcontractors (mechanical, electrical)

.5 Others as appropriate.

.3 The agenda of the start-up meeting shall include, at a minimum, the following:

.1 list of major Subcontractors and Suppliers;

.2 tentative construction progress schedules;

.3 start date, submission of schedules and long term delivery items;

.4 insurance certificates, cash flow schedule, construction schedule, Shop Drawing submission schedule, bonds excluding Harmonized Sales Tax (HST), trade breakdown including value for close-out, workplace and safety and insurance board clearance certificate and project sign;

.5 critical work sequencing;

.6 major equipment and Product deliveries and priorities;

.7 designation of responsible personnel;

.8 building permit status;

.9 procedures for maintaining Record Documents;

.10 use of premises including office, keys, work areas, storage areas, Owner's requirements (e.g., storage delivery, path of construction activities by vehicle and by foot, carts, exterior and interior washrooms, bin location), construction facilities, controls, temporary hoarding,

dust partitions, parking, hours, noisy work, smoking, cell phone usage and construction aids;

.11 construction scheduling (particularly drying time for concrete slabs);

.12 temporary utilities;

.13 safety and first-aid procedures;

.14 security procedures;

.15 housekeeping procedures; and

.16 interference drawings submission and review

1.6 SITE COORDINATION AND PROGRESS MEETINGS

.1 Conduct Site meetings at regular intervals (every 2 weeks). The Owner, through the Consultant, also reserves the right to call additional special emergency Site meetings on short notice without any additional cost to the Owner.

.2 Attendees of the Site coordination and progress meetings shall include:

.1 Contractor's project manager and Site superintendent;

.2 mechanical and electrical Subcontractors;

.3 Subcontractors invited by the Contractor; and

.4 Owner and/or Consultant(s).

.3 Meetings shall be chaired by the Contractor.

.4 The Contractor shall prepare an agenda for meetings.

.5 Distribute written notice of each meeting a minimum 7 Days in advance of the meeting date, stating the time and place, to all persons whose presence is required.

.6 Make physical arrangements for meetings.

.7 Record minutes and attendees (include significant proceedings and decisions in the minutes).

.8 Reproduce and distribute copies of minutes within 3 Working Days after each meeting to anyone who attended the meeting, to anyone affected by decisions made at meeting, and to the Consultant.

.9 Ensure representatives of the Contractor, Contractor's consultants, Subcontractors and Suppliers attending meetings are qualified and authorized to act on behalf of each entity they represent.

.10 Ensure relevant information is available to allow meetings to be conducted efficiently.

.11 The agenda of the Site coordination and progress meetings shall include, at a minimum, the following:

.1 Review construction schedule to ensure rapid and efficient completion of the Work in accordance with Contract requirements. Keep Consultant informed of progress, of delays, and of potential delays during all stages of the Work.

.2 Review, approve and correct minutes of the previous meeting.

.3 Review Work progress since previous meeting.

.4 Review field observations, problems and conflicts.

.5 Review issues which may impede construction progress schedule.

.6 Review of off-Site fabrication and delivery schedules.

.7 Review submittals schedules.

.8 Review mock-up and sample installation requirements and schedules.

.9 Review corrective measures and procedures to maintain the Work schedule.

.10 Review quality standards.

.11 Review pending changes and substitutions.

.12 Review any other relevant business.

1.7 WORK SCHEDULE

.1 Conform to the requirements of GC 3.5 – CONSTRUCTION SCHEDULE of the General Conditions of the Contract.

.2 Prior to commencement of the Work, submit to the Owner and Consultant a detailed construction schedule indicating the critical path for the Project, using “Microsoft Project” or equivalent, demonstrating that the Work will be performed in conformity with the Contract Time, and shall conform to the phasing and sequencing requirements for the Work as set out in the Contract Documents or as otherwise required by the Consultant or the Owner, including, without limitation, a Products delivery schedule with respect to the Products whose delivery is critical to the schedule of the Work. The construction schedule shall have activities itemized to enable Contractor and Consultant to monitor progress of the Work.

.3 The Construction Schedule shall indicate at a minimum, without limitations, dates for the following items:

.1 erection and dismantling of temporary facilities,

.2 submission of Shop Drawings for the various divisions of the Work,

.3 submission of samples and installation dates for mock-ups and sample installations,

.4 commencement and completion of each major division of Work (including work to be done by Subcontractors),

.5 critical work sequencing,

.6 drying time for concrete slabs to allow for placement of moisture sensitive floor coverings,

.7 major equipment deliveries and priorities, and

.8 Substantial Performance of the Work and Total Performance of the Work dates.

.4 Update and resubmit the Construction Schedule to the Consultant on a monthly basis.

1.8 CONTRACTOR'S PERSONNEL AND SUBCONTRACTORS

.1 Conform to GC 3.6 – CONTRACTOR’S PERSONNEL COMMITMENT of the General Conditions of the Contract.

.2 Submit to the Consultant a complete list of the Contractor's Subcontractors with addresses, telephone numbers and personnel. along with Contractor's list of personnel and emergency contact information. The Contractor shall provide the Owner and the Consultant with the names, addresses and telephone numbers of the Project Manager, the Site Supervisor and other responsible field persons who may be contacted for emergency and other reasons during non-working hours.

.3 Ensure compatibility within the team of Subcontractors. The Owner takes no responsibility for the compatibility or incompatibility (labour and otherwise) of Subcontractors and Suppliers employed by the Contractor.

.4 Personnel Appointment

.1 Provide full time qualified, skilful and efficient Site superintendent staff, with a minimum of 5 years of experience in projects of comparable type and complexity, continuously during execution of the Work. Prior to commencement of the Work, the Contractor shall select a competent and experienced full time Project Manager who shall be engaged in the Work at all times, and a competent and experienced full time Site Supervisor who shall be in attendance at the Place of the Work at all times. Both the Project Manager and the Site Supervisor shall be Gold Seal Certified or equivalent. The Project Manager shall have full responsibility for the prosecution of the Work, with full authority to act in all matters as may be necessary for the proper coordination, supervision, direction and technical administration of the Work, who shall attend site meetings in order to render reports on the progress of the Work and who shall have authority to bind the contractor in all matters related to the Contract. The Project Manager and Site Supervisor shall be satisfactory to the Owner and shall not be changed except for good reason and with the prior written approval of the Owner.

.2 The Contractor may not change the Project Manager or its Site Supervisor without the Owner's prior written approval which shall not be unreasonably withheld. Further, the Contractor shall not employ or continue to employ on the Work anyone to whom the Owner may reasonably object.

.3 The Project Manager and Site Supervisor shall represent the Contractor at the Place of the Work and notices and instructions given to the Project Manager and/or the Site Supervisor shall be held to have been received by the Contractor.

1.9 GENERAL REVIEW

.1 The Consultant shall perform general review of the Work for general conformance with Contract Documents, Ontario Building Code and Authorities Having Jurisdiction. Review includes review of Shop Drawings, review of field work and review of reports produced by various inspection and testing agencies.

.2 Record each review as well as inspection and testing reports in a manner suitable for inclusion in closeout documentation and submission at completion of the Contract Work.

1.10 PRODUCT SUBSTITUTION PROPOSALS

.1 After award of the Contract, Product substitution proposals will not be reviewed except in cases where written proof from Product manufacturer/distributor has been submitted to verify that:

.1 specified Products are unavailable (providing reasons why); and

.2 specified Products were ordered in advance and in accordance with manufacturer's recommendations for lead time but timely delivery of specified Products is not possible in order to maintain the Construction Schedule.

.2 Submit the following for each Product substitution proposal:

.1 Shop Drawings (including full details);

.2 samples; and

.3 difference in price, if any, in form of certified quotations of both selected and proposed substitutions.

.3 Submit the Contractor's written acceptance of use of substituted Products and certification that substituted Products:

.1 will not exceed space requirements allocated for originally specified Products or, if they do, Contractor is including with substitution submission, design drawings to accommodate the substituted Product;

.2 are compatible with and inert to adjacent materials;

.3 will not affect the Construction Schedule due to delays in delivery and Installation.

.4 have been priced to include design adjustments required to accommodate substituted Products.

.4 Proposed substitutions require the Consultant's review and the Owner's and Consultant's acceptance.

1.11 CERTIFICATES AND TRANSCRIPTS

.1 Immediately after receiving notification of award of Contract, submit Workplace Safety and Insurance Certificate status, transcription of insurances and other certificates and transcripts required by Contract Documents or Consultant.

1.12 SUBMITTAL PROCEDURES

.1 Submit the manufacturer's literature and data sheets for each type of material provided under this Section. Data sheets shall provide all required information. Submit three (3) copies of detailed instructions for maintaining, preserving and keeping materials in clean and safe conditions and give adequate warning of maintenance practices or materials that are detrimental to the specified materials. Submit the manufacturer's installation instructions.

.2 Submit to the Consultant, and to Authorities Having Jurisdiction as required, documents listed in the Contract Documents to be submitted for review. Submit with reasonable promptness and in an orderly sequence so as not to cause any delay in the Work. Failure to submit documents with ample time for review is not considered sufficient reason for an extension of Contract Time or extra costs and no claim for an extension of Contract Time or increase to Contract Price by reason of such default shall be allowed. Final approval of Authorities Having Jurisdiction, where required, shall be obtained prior to submitting Shop Drawings or other documentation to the Consultant.

.3 Prior to submission to the Consultant, the Contractor shall review all Submittals. Submittals that are not stamped, signed, dated and identified as to the specific Contract will be returned without being examined and shall be considered rejected. Verify field measurements and ensure that the affected adjacent work is coordinated. Confirm and correlate information pertaining to fabrication processes, quantities, techniques of construction and installation and similar information.

1.13 SHOP DRAWINGS

.1 Conform to GC 3.10 SHOP DRAWINGS AND OTHER SUBMITTALS of the General Conditions of the Contract. Conform to any other Shop Drawing submission requirements described in the Specifications, including those related to the Mechanical Divisions as described in Section 20 05 05.

.2 Fabrication: Do not fabricate until Shop Drawings are indicated as "REVIEWED FOR GENERAL DESIGN" or "REVIEWED AS NOTED".

.3 Consultant's Shop Drawings Review:

.1 The Consultant's review of Shop Drawings is for ascertaining conformance with the general design concept and general arrangement only. The Consultant's and does not constitute the approval of items which remain the Contractor's responsibility.

.2 Without limitation, among other things, the Contractor remains responsible for:

.1 detail design inherent in Shop Drawings;.

.2 errors and omissions in Shop Drawings;
.3 meeting the requirements of the Contract Documents.
.4 confirmed and correlated Site dimensions;
.5 information that pertains solely to fabrication processes, techniques of construction and installation including without limitations securement, fastening and anchoring requirements; and
.6 co-ordination of the work of all trades.

.4 **Shop Drawing Requirements:**

.1 Indicate the following minimum requirements, as applicable:

.1 plans, sections and details;
.2 verified Site dimensions;
.3 materials thicknesses and finishes;
.4 methods of setting and sealing;
.5 methods of securing, fastening and anchoring including field connections.

.2 Do not make Product substitutions or alterations on Shop Drawings without the Consultant's written acceptance in accordance with Product substitution proposal process. Replace unaccepted Product substitutions and complete the Work in accordance with Contract Documents.

.3 Determine which Shop Drawings the building department of the City of Newmarket will require for their approval and submit two (2) final copies of each Shop Drawing to the building department. Obtain approval and pay the associated charges and fees.

.5 **Shop Drawing Procedures:**

.1 Execute the following, prior to submitting the Shop Drawings to the Consultant:

.1 review, check and mark-up shop drawings with comments and revisions;
.2 stamp each Shop Drawing;
.3 insert applicable Specification Section reference (for example "10 28 00" for Section 10 28 00, Accessories);
.4 insert next consecutive Shop Drawing number within that Section (for example, "002" for second drawing within Section 10 28 00); and
.5 insert Contractor's review date and signature of Contractor's reviewer.

.2 At the Consultant’s discretion, an electronic Shop Drawings review process may be instituted for some or all documents. In this case, no hard copies will be returned to the Contractor. An electronic Shop Drawings procedure does not release the Contractor from providing hard copies of As-Built Drawings and maintenance and operations manuals as specified in the Contract Documents.

.3 Re-productions of the Consultant’s Contract Documents are not acceptable as Shop Drawings.

.4 Shop Drawings not conforming to above criteria will be automatically returned to the Contractor without review. Any resulting delays will be the Contractor's responsibility.

.5 Shop Drawings submitted without specified professional engineer design and stamp will be automatically returned to the Contractor without review. Any resulting delays will be the Contractor's responsibility.

.6 Do not resubmit Shop Drawings indicated as "REVIEWED FOR GENERAL DESIGN" and "REVIEWED AS NOTED".

.7 Resubmit Shop Drawings indicated as "REVISE AND RESUBMIT" with required changes and comments addressed. Insert the letter "R" after shop drawing number on resubmitted

shop drawings, re-date and re-sign. Identify revisions from earlier submissions graphically and other additions or revisions on revised shop drawings;

.8 Provide all Shop Drawings required by the Contract Documents.

1.14 ACCESS PANELS AND ACCESS DOORS

.1 Before commencing mechanical or electrical work, prepare a set of ceiling plan drawings indicating the exact locations and sizes of access panels and doors.

.2 Submit drawings to Consultant for review. Allow the Consultant to revise layout or quantity of access doors and panels, by relocating related building services a maximum of 2000 mm (6' - 7"), at no extra cost to the Owner.

.3 Finish access panels and doors to match adjacent wall and/or ceiling finish unless otherwise specified or indicated in the Contract Documents.

1.15 INTERFERENCE DRAWINGS

.1 Installation shall proceed in accordance with final approved interference drawings. Any work carried out without final approved interference drawings and which does not meet design requirements and specified ceiling heights shall be removed, re-coordinated and re-installed at no cost to the Owner.

.2 Prepare drawings indicating the relationship between new and existing and/or unforeseen conditions at all areas in new construction prior to the commencement of any work in the area.

.3 For all locations, before commencing installation, prepare drawings showing relationship of, but not limited to: structure, electrical, cable trays, communication system, duct work, conduit, piping, sprinklers, ceiling supports and framing.

.4 Indicate locations of visible items such as air handling outlets, light fixtures, smoke detectors, sprinkler heads, communication grilles and access panels occurring at these locations. Do not proceed with work until interferences in the area are resolved. Do not lower ceiling heights in area without the Consultant’s review and approval.

.5 Ensure interference drawings are initialed by a responsible person of each Subcontractor involved and by the Contractor. Submit the drawings to the Consultant for review and record purposes.

.6 Be responsible for the preparation and coordination of interference drawings. Obtain input from all Subcontractors involved.

1.16 COLOURS

.1 The Consultant will select colours and gloss values. Obtain direction on colours and gloss values in advance. If requested, submit samples for colour and gloss selection. Follow the colour schedule to be provided by the Consultant and use the colours and glosses designated.

1.17 SAMPLES

.1 Prior to fabrication or the supply of Products, submit samples to the Consultant for review. Remove and discard Products of which samples have not been reviewed and accepted by Consultant.

.2 Provide samples required by the Contract Documents.

1.18 WORKPLACE HAZARDOUS MATERIALS INFORMATION SYSTEM (WHIMIS) REQUIRMENTS

.1 Comply with Workplace Hazardous Materials Information System (WHMIS) in accordance with the *Occupational Health and Safety Act* (Ontario) (OHSA) requirements.

.2 Provide, before commencement of the Work and maintain for the duration of the Contract, a list with current Material Safety Data Sheets (MSDSs) of all hazardous materials proposed for use on the Contract Work.

.3 Provide detailed procedures for safe handling storage and use of hazardous materials. List special precautions and safe clean up and disposal procedures. Conform to the requirements of the *Environmental Protection Act* (Ontario) and other requirements of Authorities Having Jurisdiction for disposal and clean up requirements.

.4 Obtain from Owner, where applicable, a list and MSDSs of hazardous materials that may be handled, stored or used by the Owner's employees and/or Other Contractors retained by the Owner at the Place of the Work.

.5 Ensure those who handle or are likely to handle or be exposed to hazardous materials are fully instructed and trained in accordance with WHMIS requirements.

1.19 RECORD DRAWINGS AND SPECIFICATIONS

.1 Keep one set of printed Drawings and Specifications on Site for use in maintaining record information. Ensure these Drawings and Specifications are kept on Site at all times and available for review by Owner and/or Consultant at any given time.

.2 Accurately and neatly record deviations from Contract Documents, including addenda, Supplemental Instructions and Change Orders, caused by Site conditions.

.3 Record information concurrently with construction progress. Do not conceal actual work until the required information is recorded.

.4 Legibly indicate each item to record the actual construction, including field changes of dimensions and details, and details or information not on the original Drawings.

.5 Catalogue field review reports and cross reference to the relevant trade, building area and component. Submit inspection and testing reports in accordance with the requirements of the Specifications. Unsatisfactory inspection and testing results shall be highlighted and Supplemental Instructions shall be issued by the Consultant.

.6 Identify Drawings as "Project Record Copy", maintained and available for inspection on Site by the Consultant.

.7 Prior to applying for the Certificate of Substantial Performance, submit record drawings and Specifications to the Consultant in paper and electronic format.

1.20 AS-BUILT DRAWINGS AND SPECIFICATIONS

.1 Refer to Section 01 77 00 - Closeout Procedures for specified requirements.

1.21 OPERATION AND MAINTENANCE DATA

.1 Refer to Section 01 77 00 - Closeout Procedures for specified requirements.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 78 00 — Closeout Submittals

1.2 REFERENCE STANDARDS

.1 Not Used

1.3 ADMINISTRATIVE

.1 Submit to Consultant submittals listed for review. Submit promptly and in an orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for the extension of Contract Time and no claim for extension by reason of such default will be allowed.

.2 Do not proceed with Work affected by submittal until review is complete.

.3 Present shop drawings, product data, samples and mock-ups in SI Metric units.

.4 Where items or information is not produced in SI Metric units converted values are acceptable.

.5 Review submittals prior to submission to the Consultant. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.

.6 Notify Consultant, in writing at the time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.

.7 Verify field measurements and affected adjacent Work are coordinated.

.8 The contractor's responsibility for errors and omissions in submission is not relieved by the Consultant’s review of submittals.

.9 The contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by the Consultant review.

.10 Keep one reviewed copy of each submission on site.

1.4 SHOP DRAWINGS AND PRODUCT DATA

.1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by the Contractor to illustrate details of a portion of Work.

.2 Submit drawings stamped and signed by a professional engineer registered or licensed in the Province of Ontario, Canada.

.3 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for the completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been coordinated, regardless of the Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.

.4 Allow 3 days for the Consultant's review of each submission.

.5 Adjustments made on shop drawings by the Consultant are not intended to change the Contract Price. If adjustments affect the value of Work, state such in writing to the Consultant prior to proceeding with Work.

.6 Make changes in shop drawings as the Consultant may require, consistent with Contract Documents. When resubmitting, notify the Consultant in writing of revisions other than those requested.

.7 Accompany submissions with transmittal letter containing:

- .1 Date.
- .2 Project title and number.
- .3 Contractor's name and address.
- .4 Identification and quantity of each shop drawing, product data and sample.

.8 Submissions include:

- .1 Date and revision dates.
- .2 Project title and number.
- .3 Name and address of:
  - .1 Subcontractor.
  - .2 Supplier.
  - .3 Manufacturer.
- .4 Contractor's stamp, signed by the Contractor's authorized representative certifying the approval of submissions, verification of field measurements and compliance with Contract Documents.
- .5 Details of appropriate portions of Work as applicable:
  - .1 Fabrication.
  - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
  - .3 Setting or erection details.
  - .4 Capacities.
  - .5 Performance characteristics.
  - .6 Standards.
  - .7 Operating weight.
  - .8 Wiring diagrams.

.9 Single line and schematic diagrams.

.10 Relationship to adjacent work.

.9 After the Consultant's review, distribute copies.

.10 Submit an electronic copy of shop drawings for each requirement requested in specification Sections and as the Consultant reasonably requests.

.11 Submit electronic copies of product data sheets or brochures for requirements requested in specification Sections and as requested by the Consultant where shop drawings will not be prepared due to the standardized manufacture of the product.

.12 Submit electronic copies of test reports for requirements requested in specification Sections and as requested by the Consultant.

.1 Report signed by an authorized official of the testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.

.2 Testing must have been within 3 years of the date of contract award for the project.

.13 Submit electronic copies of certificates for requirements requested in specification Sections and as requested by the Consultant.

.1 Statements printed on the manufacturer's letterhead and signed by responsible officials of the manufacturer of product, system or material attesting that product, system or material meets specification requirements.

.2 Certificates must be dated after the award of the project contract complete with the project name.

.14 Submit electronic copies of the manufacturer's instructions for requirements requested in specification Sections and as requested by the Consultant.

.1 Pre-printed material describing the installation of product, system or material, including special notices and Safety Data Sheets concerning impedances, hazards and safety precautions.

.15 Submit electronic copies of the Manufacturer's Field Reports for requirements requested in specification Sections and as requested by the Consultant.

.16 Documentation of the testing and verification actions taken by the manufacturer's representative to confirm compliance with the manufacturer's standards or instructions.

.17 Submit electronic copies of Operation and Maintenance Data for requirements requested in specification Sections and as requested by the Consultant.

.18 Delete information not applicable to the project.

.19 Supplement standard information to provide details applicable to the project.

.20 If upon review by the Consultant, no errors or omissions are discovered or if only minor corrections are made, copies will be returned and fabrication and

installation of Work may proceed. If shop drawings are rejected, a noted copy will be returned and resubmission of corrected shop drawings, through the same procedure indicated above, must be performed before fabrication and installation of Work may proceed.

.21 The review of shop drawings by the Consultant is for the sole purpose of ascertaining conformance with the general concept.

.1 This review shall not mean that the Consultant approves detailed design inherent in shop drawings, responsibility for which shall remain with the Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of construction and Contract Documents.

.2 Without restricting the generality of the foregoing, the Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or techniques of construction and installation and for co-ordination of Work of sub-trades.

1.5 PHOTOGRAPHIC DOCUMENTATION

.1 Submit an electronic copy in the colour of jpg format and fine as directed by the Consultant.

.2 Project identification: name and number of project and date of exposure indicated.

.3 Number of viewpoints: Not Applicable

.1 Viewpoints and their location as determined by the Consultant.

.4 Frequency of photographic documentation: as directed by the Consultant.

.1 Not Used

1.6 CERTIFICATES AND TRANSCRIPTS

.1 Immediately after the award of the Contract, submit the Workers' Compensation Board status.

.2 Submit transcription of insurance immediately after the award of the Contract.

END OF SECTION

PART 1 - GENERAL

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL INSTRUCTIONS

.1 Read and conform to:

.1 the General Conditions and Supplementary Conditions of the Contract.

.2 Division 1 requirements and documents referred to therein.

1.3 ENVIRONMENTAL PRACTICES

.1 Implement environmentally sound practices by incorporating Products that lessen the burden on environment in production, use and final disposition. Support the implementation of reduction, reuse and recycling strategies and use of environmentally sound Products. Promote the use of environmentally responsible packaging practices by reducing and/or eliminating Products with excessive packaging in this Project.

.2 Employ environmentally sound Products which are made, used and disposed of in a manner that significantly reduces harm to environment. Product selection criteria shall be based on the requirements of CSA Z760 and CSA Z762. Use Products which improve energy efficiency in its production and use, reduces hazardous by-products, uses recycled material, and/or the Product itself can be recycled or reused and/or is in some way environmentally benign.

1.4 PROTECTION OF NATURAL ENVIRONMENT

.1 Submit to the Consultant an environmental plan including a sketch showing areas proposed to be used for construction storage, hoarding locations and types, silt fence locations and types, tree protection and areas for implementation of site separation of construction waste, and dimensions of such areas and location and size of trees within and adjacent to these areas.

1.5 SITE REVIEW

.1 The Ministry of the Environment and other Authorities Having Jurisdiction may visit the Site periodically during construction. Where the Work does not comply with environmental protection requirements, said authorities have the power to issue a stop work order. The Consultant's acceptance of the Work may be withheld until the Ministry of the Environment or other Authorities Having Jurisdiction have issued their approval of the Work.

1.6 SURFACE DRAINAGE AND WATERCOURSES

.1 Maintain surface water drainage of the Site and external properties during construction. The Contractor shall be responsible for any damage to Site or external properties due to negligence.

.2 Incorporate appropriate retention, detention and settling ponds, or similar methods reviewed by the Consultant, to control surface water run-off to adjacent ditches or other watercourses and to prevent oil, sediment or de-icing materials being carried into such ditches and/or watercourses. The tested quality of water discharged to ditches and/or watercourses shall not be of worse quality than that present in ditches and/or watercourses prior to any discharge of Site surface

water. Monitor and test discharge water at least weekly and provide copies of the test results to the Consultant.

.3 Locate and protect stockpiles of semi-permanent nature to satisfaction of Authorities Having Jurisdiction to ensure minimum environmental interference.

1.7 NOISE CONTROL

.1 Comply with municipal noise by-laws, verify with local Authorities Having Jurisdiction and in addition, to hours restricted for noisy work to avoid the disruption of normal activities.

.2 Noise levels shall not exceed following values:

.1 Pneumatic jackhammers: 90 dB.

.2 Machinery and compressors: 70 dB.

.3 Trucks, cranes, bulldozers: 70 dB.

.4 Other noise sources: 70 dB.

.3 Equip vehicles and equipment with efficient noise attenuation devices (mufflers), sound deflectors as required to minimize and maintain noise levels in vicinity of the Site below the preceding limits measured 3 m (10') from the source.

.4 Where necessary, place noise attenuation devices (barriers) around stationery pumps and compressors.

1.8 SITE DUST CONTROL

.1 Undertake control measures to prevent nuisances due to dust in any phase of construction. Execute the Work using methods that minimize the raising of dust from construction operations.

.2 Provide positive means to prevent airborne dust from dispersing into the atmosphere. Use water misting for dust and particulate control.

.3 Prevent dust from spreading to adjacent property sites.

.4 If Contractor’s dust and particulate control measures are not sufficient to the Authorities Having Jurisdiction for controlling dust particulate into atmosphere, shut down the Work activities at no expense to Owner and only continue the Work after resolving inadequacies with procedures acceptable to Authorities Having Jurisdiction. Make the necessary changes to operations prior to resuming any excavation, handling, processing or any other related Work that may cause the release of dust or particulates.

.5 Keep the application of calcium chloride to a minimum. Frequent applications of water are the preferred method when in close proximity to watercourses. The use of chemicals for dust control will not be permitted.

1.9 WASTE MANAGEMENT PRACTICES

.1 Prepare and submit to the Consultant, prior to commencing the Work, a Waste Audit Report and Waste Reduction Plan in accordance with the Ministry of Environment and O. Reg. 102/94 Waste Audits and Waste Reduction Work Plans and O. Reg. 103/94 Industrial, Commercial and Institutional Source Separation Programs made under the *Environmental Protection Act* (Ontario).

.2 Apply waste management activities of reduction, reuse and recycling of waste materials during the Work.

.3 Ensure that source separation is executed in accordance with O. Reg. 103/94, for purposes of recycling the following materials:

.1 corrugated cardboard;

.2 wood waste (i.e. non-treated dimensional lumber, manufactured wood);

.3 non-painted gypsum board;

.4 ferrous metals;

.5 concrete; and

.6 brick.

1.10 WASTE DISPOSAL

.1 Do not burn rubbish on Site. Obtain approval from the Consultant and use the following off-Site disposal alternatives, depending upon materials involved: burying, composting, recycling, municipal collection, or local dump or sanitary landfill site.

.2 Handle hazardous materials in accordance with the requirements of the Authorities Having Jurisdiction.

.1 Designate areas for storage of chemicals and hazardous wastes with security of access.

.2 Plan and provide for the prevention and containment of spills from entering drains.

1.11 EQUIPMENT FUELLING, MAINTENANCE AND STORAGE

.1 Obtain acceptance of the refueling areas from the Authorities Having Jurisdiction.

.2 Submit procedures to the Consultant for interception, rapid clean-up and disposal of fuel spillages for review prior to starting the Work.

.3 Ensure materials required for clean-up of fuel spillages are readily accessible on Site at all times.

.4 Carry out the refueling of equipment at refueling areas acceptable to the Consultant and the Authorities Having Jurisdiction.

.5 Ensure water used for cleaning of equipment does not drain into streams, lakes or watercourses. Do not empty fuel, lubricants and/or pesticides into any watercourse, or on ground.

.6 Clean construction equipment prior to entering public roadways to prevent littering. Debris from cleaning equipment shall not be permitted into storm sewers or watercourses.

.7 Store equipment and materials in and orderly manner and in location acceptable to the Owner.

1.12 SPILL REPORTING

.1 In event of spill or other emission of pollutant into natural environment, notify:

.1 The local office of the Ministry of the Environment and Spill Action Centre (SAC);

.2 The Local Municipality within the boundaries of which the spill occurred;

.3 The person having control of pollutant, if known, of spill, of circumstances surrounding the spill and of any action taken or intended to be taken; and

.4 The Owner’s representative.

.2 Comply with the requirements set out in GC 9.7 – Spills Reporting of the General Conditions of the Contract.

1.13 CONTINGENCY PLAN FOR CONTROL AND CLEAN-UP OF SPILL

.1 Prior to commencing the Work, prepare and submit a contingency plan to the Consultant for control and clean-up of spills. Include, at a minimum, the following in the contingency plan:

- .1 names and telephone numbers of persons in local municipalities and Ministry of the Environment to be notified forthwith of spill;
- .2 names and telephone numbers of representatives of fire, police and health departments of local municipalities who are responsible to respond to emergency situation;
- .3 names and telephone numbers of companies experienced in control and clean-up of hazardous materials that would be called upon in emergency involving spill;
- .4 provisions for spills of hazardous or unknown materials (for example, puncturing an unmarked drain during excavation); and
- .5 proposal for immediate containment and control of spill, clean up procedures to be initiated immediately and any other action to be taken to mitigate the potential environmental damage while awaiting additional assistance.

.2 Be responsible for preparing, implementing, directing and supervising the contingency plan.

END OF SECTION

PART 1 - GENERAL

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL

.1 Read and conform to:

.1 the General Conditions and Supplementary Conditions of the Contract.

.2 Division 1 requirements and documents referred to therein.

1.3 SUMMARY

.1 Quality Requirements shall include, but not be limited to the following:

.1 Regulations requirements;

.2 Quality assurance:

.1 Professional Engineer's service;
.2 Ontario land surveyor's service;
.3 welder's qualifications;
.4 building science requirements;

.3 Design integrity and architectural requirements:

.1 air/vapour barrier integrity;
.2 continuity of fire separations;
.3 acoustic partitions /ceilings/steel doors;

.4 Quality Control:

.1 quality control system protocol;
.2 testing and inspection services;
.3 source quality control;
.4 field quality control;
.5 project mockups.

1.4 REGULATIONS REQUIREMENTS

.1 Where the Contract Documents do not cover a particular requirement which is covered by the Ontario Building Code (the "OBC" or "Code"), comply with the OBC and by-laws of other Authorities Having Jurisdiction, including latest amendments thereto. Where the OBC or the Contract Documents do not cover a particular requirement which is covered by the National Building Code, 2015 (hereinafter referred to as "NBC"), as amended, conform to the requirements of NBC including its related supplements. Where the requirements of the Contract Documents exceed Code requirements, satisfy such additional requirements in the Contract Documents.

.2 Conform to NFPA 101, Life Safety Code for exit requirements as applicable.

.3 Conform to the Ontario Fire Code - Ontario Regulation 213/07 (Fire Protection and Prevention Act, 1997 (Ontario) enacted under The Ministry of Community, Safety and Correctional Services, Office of the Fire Marshal's, including latest amendments.

.4 Where material is designated in the Contract Documents for certain application, unless otherwise specified in the Contract Documents, that material shall conform to the standards designated in the OBC and in absence of more restrictive requirements, comply with "Housing and Small Buildings Part 9" of the OBC. Similarly, unless otherwise specified in the Contract Documents and the OBC, installation methods and standards of workmanship shall conform to the standards of Part 9 of the OBC. Where specific requirements for a material are not specified for certain use in the Contract Documents, select from the choice offered in Part 9 of the OBC.

.5 Unless otherwise indicated in the Contract Documents, obtain and pay for all other permits, licences and certificates of inspection. Ensure permits, licenses and certificates included under specific Sections are provided as specified in the Contract Documents. Forward copies of all permits to the Consultant and Owner before commencing the Work that is related to such permits.

.6 Conform to the hours of Work, rates of wages paid, terms of employment and working conditions in accordance with Ontario Fair Wage Program - Labour Conditions for Industrial, Commercial and Institutional Sector Construction Contract. Comply with all requirements of the *Workplace Safety and Insurance Act, 1997* (Ontario), including payments due thereunder.

.7 Apply the *Trades Qualification and Apprenticeship Act, 1997* (Ontario) including latest amendments and regulations, to the performance of this Contract.

1.5 QUALITY ASSURANCE

.1 Study and be aware of principles discussed in above documents in order to understand their significance to the Contract Documents.

.2 **Professional Engineer's Service**:

.1 Generally, Drawings give information on specific shape and dimensions required and in certain cases with load imposed. Provide steel supports and anchorage for the general design indicated, sized to suit specific requirements. Provide bracing as may be required to counter lateral loads and dynamic stresses where the vibration of support equipment may occur.

.2 Comply with the *Building Code Act,* (Ontario), as amended, the OBC, as amended and regulations and by-laws of other Authorities Having Jurisdiction, for the design of all stressed members.

.3 Obtain full time engineering service from a professional engineer licensed to practice in Province of Ontario in the applicable discipline carrying a minimum of $2,000,000.00 professional liability insurance. Employ a structural Professional Engineer to design components with structural elements.

.4 Be responsible for determining sizes, joint spacing to allow thermal movement and loading of components, maximum deflection of individual members.

.5 The responsibilities of the Professional Engineer include, but are not limited to, the following:

.1 production and review of Shop Drawings;
.2 inspection of work during fabrication and erection;
.3 checking that welding conforms to design requirements;
.4 checking fabricated and erected members against specified member shapes;
.5 visual inspection of welded connections including sample checking of joint preparation and fit-up;
.6 sample checking of screwed and bolted joints; sample checking of connections to building structures;
.7 sample checking of stiffeners and bridging;

.8 sample checking that tolerances are not exceeded;
.9 additional inspection and testing of welded connections as required by CSA W59;
.10 general inspection of field cutting and alterations required by other trades;
.11 submission of reports to the Consultant, Contractor and Authorities Having Jurisdiction covering work inspected with details of deficiencies discovered;
.12 stamping and signing of each Shop Drawing; and
.13 Field reviews and contract administration of the specific portion of the Work designed by the Professional Engineer during construction.

.6 The Professional Engineer shall also submit field review reports, in accordance with the requirements of the OBC, for systems designed by a professional engineer retained by the Contractor within three (3) Days of any Site visit. At commencement of the Work, submit "Confirmation of Commitment" forms for the respective discipline satisfactory to the local Authority Having Jurisdiction. The Owner will provide all necessary authorizations for submittal of such forms to local Authority Having Jurisdiction.

.3 **Ontario Land Surveyor's Service**

.1 Engage a registered Ontario land surveyor to lay out the building, to determine unconfirmed dimensions and elevations, to perform other construction work and to provide an as-built survey identifying permanent bench marks. Establish on Site grades, lines, levels, dimensions, and location of existing roads, sidewalks, buried utilities and other similar features on Site. Carefully preserve bench marks, reference points and other reference marks. Submit to the Consultant three (3) certified copies of the as-built survey showing work performed and recorded data.

.4 **Welder's Qualifications**

.1 The Contractor shall execute welding and employ welding firm(s) certified in accordance with CSA W47.1 Division 1 or 2.1 and submit copies of certificates to Consultant prior to start of the Work. The Contractor shall:

.1 Ensure welding operators employed on the Work are qualified in accordance with CSA W47.1 for work as required by Contract and submit copies of certificates to the Consultant prior to the commencement of the Work.
.2 Ensure the inspection/testing company and welding inspector and supervisors meet qualifications in accordance with CSA W178.1 and CSA W178.2 and are certified by the Canadian Welding Bureau in Category (a), Buildings.
.3 Have welding undertaken by companies and welders fully approved under CSA W47.1, Certification of Companies for Fusion Welding of Steel Structures and CSA W59-M, Welded Steel Construction (Metal-Arc Welding) and carry proof of certification while on Site.
.4 Operators shall be qualified "Class O" in accordance with CSA W47.1.

.5 **Building Science Requirements**

.1 Procedures, Sequences and Coordination of Construction:

.1 Employ procedures, sequences and coordination of construction to install the Work in accordance with principles of building science and the requirements listed below.
.2 Provide a continuous, unbroken and non-perforated air and vapour seal to totally enclose the building envelope and to separate the interior and exterior environments. Give particular attention to exterior wall systems, roofing system, junctions of walls and roofs and seals at openings such as doors and windows.
.3 Comply with additional building science requirements as identified in other Specification Sections.
.4 Apply special care at sealed junctions of different Products which make up an airseal system to ensure lasting continuity.

.5 Verify the compatibility of fasteners and adhesives with surfaces to which they are applied.
.6 Fasten and adhere Products making up the airseal system to withstand wind loads required of the exterior cladding system.
.7 Provide airseals and firestopping at miscellaneous penetrations, including mechanical and electrical service penetrations. Accommodate for vibration and thermal movement.
.8 Provide exterior rainscreen assemblies in accordance with building science principles and in accordance with OBC requirements. Compartmentalize rainscreens to reduce air pressure differentials across assemblies.
.9 Provide thermal insulation to the exterior of the vapour barrier. Note that an air/vapour barrier is the same as an airseal system. Eliminate air pockets, channels and other discontinuities.
.10 Minimize thermal bridges.
.11 Apply building science principles to building interior spaces with differing environments, e.g. differing temperature and humidity conditions.
.12 Perform work in a neat and careful manner to retain components plumb, square and straight.
.13 Ensure work is properly related to form close joints and appropriately aligned junctions, edges and surfaces and is free of warp, twist, wind, wave or other irregularities.
.14 Have the manufacturer, supplier or accredited agent inspect the work which incorporates their Products.
.15 Do not permit materials to come in contact with other materials whether in presence of moisture, or otherwise, if conditions will result in corrosion, stain or discolouration or deterioration of the completed work. Provide compatible, durable separators where such contact is unavoidable.

.6 **Air/Vapour Barrier Integrity:**

.1 This Contract incorporates design principles of positive air and vapour leakage control at the building enclosure line. Drawing details illustrate continuity of the air/vapour barrier at penetrating elements such as door, window and louver frames. The barrier system is designed to allow air permeance to leak from the interior of the building to the exterior or to pressure-equalized cavity as specified herein. The Contractor shall:

.1 Provide a continuous, unbroken and non-perforated air and vapour seal to totally enclose building envelope and to separate interior and exterior environments. Provide particular attention to following areas:

.1 Exterior wall systems.
.2 Roofing systems.
.3 Junctions of walls and roofs.
.4 Seals at openings such as doors, windows.

.2 Air/vapour membrane shall have an air permeance of less than 0.02 L/s/m² (0.06 cfm/sq ft) under a pressure differential of 75 Pa (1.56 psf).
.3 Air/vapour membrane shall be able to withstand 2 kPa (42 psf) air pressure from either direction, with no increase in ELA (Equivalent Leakage Air).
.4 Barrier extends nominally from foundation line, vertically along exterior walls and to positive contact with roof air/vapour barrier or roofing membrane as applicable. Continuity also extends to waterproofing at podia areas. Continuity also extends to inner surface of glazing units.
.5 In order to maintain continuity of the envelope, interfacing of various building elements requires close coordination by all trades involved with exterior building elements. Positive mechanical connections and seal of transition medium extending

from primary wall air/vapour barrier to theoretical "insulation line" of window or door frame shall be made with proper construction sequencing established by the Contractor to ensure such interfacing. All such transition installations shall be inspected by the inspection and testing company selected by the Owner prior to concealing with subsequent construction. The testing work shall be paid as a cash allowance item in accordance with Section 01 21 00 - Allowances.

.6 Manufacturers of window and door frames shall ensure correctly designed and positioned metallic legs, extensions or recesses are provided at thermal break line to facilitate connections of rigid or flexible transition medium prior to setting such elements in their allotted openings.

.7 **Continuity of Fire Separations**:

.1 Conform to the following requirements to maintain the continuity of fire separations:

.1 Fire separations may be pierced by openings for electrical and similar service outlets provided such boxes are noncombustible and are tightly fitted.

.2 Where a fire separation is required to be of noncombustible construction terminates at an exterior wall, an underside of a floor, a ceiling or roof structure, or at a floor, , the opening shall be fire stopped with an approved listed material referenced in Section 01 60 00 - Product Requirements.

.2 Combustible members, fastenings and like shall not be used to anchor fixtures to fire separations.

.8 Design Requirements for Post Disaster Buildings:

.1 All new construction associated with this Project is designated under the OBC as "Post-Disaster".

.2 Provide all fitments, restraints and attachment to meet post-disaster design requirements in accordance with OBC for designated seismic category for location of Project as determined by:

.1 OBC (Supplementary Standard SB-1, Climate and Seismic Data);
.2 CAN/CSA S832 requirements.

.3 Seismic Performance:

.1 Design work of this Project (including, without limitation, all appendages, connections, bracings and total structural integrity including foundations) to ensure for safe resistance to withstand seismic motions and other load effects;
.2 Design masonry and stone cladding connections with additional anchorage to structural components in accordance with CSA A371 and CSA S304 requirements
.3 For changes to existing buildings, review existing connections and structural integrity to ensure safe resistance to seismic and other load effects.

.4 Retain a Professional Engineer to establish design criteria for Project based on:

.1 Anticipated ground motion;
.2 Soil type in specific geographic area;
.3 Occupancy category.

.5 Coordinate installation and cooperate with Mechanical Contractors and Electrical Contractors, to accommodate mechanical and electrical items, or any other work required to be incorporated in or coordinated with operational and functional components.

1.6 QUALITY CONTROL

.1 Manufacturer’s, fabricator’s and installer’s qualifications shall conform to the requirements specified under the respective trade Section of the Specifications, as applicable. Where

applicable, the Contractor shall obtain the manufacturer's field services as specified under the respective trade Section.

.2 **Quality Control System Protocol:**

.1 Prior to commencement of the Work, establish quality control system protocols, rules, related chains of command and commitment to provide quality work as intended in Contract Documents for the Work.

.2 Retain services of quality control staff and shop and field supervisors complete with the required skills, knowledge, duties, and responsibilities. Upon request, provide to the Consultant a full resume of the supervisors showing their qualifications.

.3 **Source Quality Control:**

.1 Refer to the respective trade Sections for source quality control requirements.

.4 **Field Quality Control:**

.1 The Contractor shall perform all inspections and testing required by the OBC or Authorities Having Jurisdiction, the Contract Documents and as required to clearly demonstrate compatibility of the materials, integrity of systems and quality of Work performance. Inspections and testing may apply, without limitation, to geotechnical work, compaction tests, cast-in-place concrete, concrete Products, waterproofing, structural steel, welding, building envelope, roofing, thermography, thermal bridging and air leaks and other requirements of the Contract. Cooperate and coordinate testing and inspection requirements with the applicable testing agency for designated requirements. Retain a copy of the geotechnical report referenced in paragraph 12 of the Request for Tenders on Site. Fully cooperate with the testing company by providing assistance on Site as well submitting samples of fill materials.

.2 Refer to the respective trade Sections for field quality control requirements.

.5 **Project Mock-ups:**

.1 Arrange with the Consultant to assist in preparing a schedule fixing the dates for mock-up review.

.2 Modify mock-ups in accordance with the Consultant's review at no additional cost to the Owner.

.3 Mock-ups shall serve as the standard for remaining parts of the Work.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL

.1 Read and conform to:

.1 the General Conditions and Supplementary Conditions of the Contract;

.2 Division 1 requirements and documents referred to therein.

1.2 IMPERIAL/INTERNATIONAL SYSTEM OF UNITS (SI)

.1 Submit all measurements in International System of Units (SI).

.2 Submittals containing measurements of any kind shall have measurements in language of International System of Units (SI) conforming to following standards:

.1 CAN3-A31-M75: Series of Standards for Metric Dimensional Coordination in Building

.2 CSA Z234.1: Metric Practice Guide

1.3 REFERENCES

.1 Where reference is made to the Code, Specification standards, manuals, Contract forms, installation, application and maintenance instructions, produced by various organizations, conform to the edition of standards specified or, if not specified, to the latest edition as amended and revised as of the date of the Contract.

.2 Amendments to reference documents after the date of the Contract affecting Contract Price shall be dealt with in accordance with Part 6 – Changes in the Work of the General Conditions of the Contract. If requested provide copy on Site of such standard(s).

.3 Where standards designate authorities such as "Engineer", "Owner" "Purchaser" or such similar designation, these designations shall be taken to mean "Consultant".

PART 2 - LIST OF ABBREVIATIONS AND ACRONYMS

2.1 ACRONYMS

.1 Following acronyms are used in Contract Documents:

.1 AA: Aluminum Association (USA)

.2 AAMA: American Architectural Manufacturers Association

.3 AATCC: American Association Of Textile Chemists And Colorists

.4 ABS: Acrylonitrile Butadiene Styrene

.5 ACI: American Concrete Institute

.6 ACT: Acoustic Ceiling Tile

.7 ADA: Americans With Disabilities Act

.8 ADAAG: ADA Accessibility Guidelines

.9 AHA: American Hospital Association

.10 AIEE: American Institute of Electrical Engineers

.11 AISC: American Institute of Steel Construction

.12 AISI: American Iron And Steel Institute

.13 AMCA: Air Movement And Control Association

.14 AMP: National Association Of Architectural Metal Manufacturers - Architectural Metal Products

.15 ANSI: American National Standards Institute

.16 AODA: Accessibility for Ontarians with Disabilities Act

.17 APA: American Plywood Association

.18 API: American Petroleum Institute

.19 ASHE: American Society for Healthcare Engineering

.20 ASHRAE: American Society of Heating, Refrigeration and Air-conditioning Engineers

.21 ASME: American Society of Mechanical Engineers

.22 ASTM: American Society for Testing and Materials

.23 AWI/AWMAC: American Woodwork Institute/Architectural Woodwork Manufacturers Association of Canada

.24 AWI: American Woodwork Institute

.25 AWMA: American Woodwork Manufacturers Association

.26 AWMAC: Architectural Woodwork Manufacturer's Association of Canada

.27 AWS: American Woodwork Standards

.28 AWWA: American Water Works Association

.29 BCA: Building Commissioning Association

.30 BCLMA: British Columbia Lumber Manufacturer's Association

.31 BHMA: Building Hardware Manufacturer's Association

.32 BMEC: Building Materials Evaluation Commission

.33 BCF: Bulk Continuous Filament

.34 CAC: Ceiling Attenuation Class

.35 CAGBC: Canadian Green Building Council

.36 CAN: National Standards of Canada

.37 CCA: Canadian Construction Association

.38 CCA: Chromated Copper Arsenate

.39 CCDC: Canadian Construction Documents Committee

.40 CCMC: Canadian Construction Materials Centre

.41 CEC: Canadian Electrical Code (published by CSA)

.42 CFR: Code Of Federal Regulations

.43 CGA: Canadian Gas Association

.44 CGSB: Canadian General Standards Board

.45 CISC: Canadian Institute of Steel Construction

.46 CLA: Canadian Lumbermen's Association

.47 CLS: Canadian Lumber Standard

.48 CMHC: Canadian Mortgage and Housing Corporation

.49 CNC: Computer Numerical Control

.50 COFI: Council of Forest Industries of British Columbia

.51 CPCI: Canadian Prestressed Concrete Institute

.52 CPMA: Canadian Paint Manufacturer's Association

.53 CRCA: Canadian Roofing Contractor's Association

.54 CRF: Condensation Resistance Factor

.55 CRI: Carpet And Rug Institute

.56 CSA: Canadian Standards Association

.57 CSC: Construction Specifications Canada

.58 CSDMA: Canadian Sheet Door Manufacturers Association

.59 CSP: Concrete Surface Profile

.60 CSPI: Corrugated Steel Pipe Institute

.61 CSSBI: Canadian Sheet Steel Building Institute

.62 CTC: Canadian Transport Commission

.63 CUFCA: Canadian Urethane Foam Contractors Association

.64 CWC: Canadian Wood Council

.65 DND: Department of National Defence, Construction Material Board

.66 DFO: Department of Fisheries and Oceans

.67 DFT: Dry Film Thickness

.68 DHI: Door and Hardware Institute

.69 EEMAC: Electrical and Electronic Manufacturers Association of Canada

.70 ECP: Environmental Choice Program

.71 EPA: Environmental Protection Agency

.72 ESA: Electrical Safety Authority

.73 EPDM: Ethylene Propylene Diene Monomer

.74 FDA: US Food And Drug Administration

.75 FM: Factory Mutual

.76 FSC: Forestry Stewardship council

.77 GANA: Glass Association of North America

.78 HCFC: Hydrochlorofluorocarbon

.79 HPDL: High Pressure Decorative Laminate

.80 HPVA: Hardwood Plywood And Veneer Association

.81 HST: Harmonized Sales Tax

.82 HSS: Hollow Structural Steel

.83 HMMA: Hollow Metal Manufacturers Association

.84 ICRI: International Concrete Repair Institute

.85 IEEE: Institute of Electrical and Electronic Engineers

.86 IGMA: Insulating Glass Manufacturer's Alliance

.87 IGMAC: Insulating Glass Manufacturers Association Of Canada

.88 IPA: Isopropyl Alcohol

.89 ISO: International Organization for Standardization

.90 LEED: Leadership in Energy and Environmental Design

.91 LSGASM: Laminators Safety Glass Association - Standards Manual

.92 LSRCA: Lake Simcoe Regional Conservation Authority

.93 MEK: Methyl Ethyl Ketone

.94 MNR: Ministry of Natural Resources

.95 MOE: Ministry of Environment

.96 MPI: Master Painters Institute

.97 MTO: Ministry of Transportation, Province of Ontario

.98 NAAMM: National Association of Architectural Metal Manufacturers

.99 NBC: National Building Code of Canada

.100 NBFU: National Board of Fire Underwriters (USA)

.101 NCMA: National Concrete Masonry Association

.102 NEMA: National Electrical Manufacturer's Association (USA)

.103 NFPA: National Fire Protection Association

.104 NFRC: National Fenestration Rating Council

.105 NHLA: National Hardwood Lumber Association

.106 NLGA: National Lumber Grades Authority

.107 NLGA: National Lumber Grades Authority

.108 NPDES: National Pollutant Discharge Elimination System

.109 NRC: National Research Council of Canada

.110 NRC: Noise Reduction Coefficient
.111 NRCC: National Research Council Of Canada
.112 NSC: National Standards of Canada
.113 NSF: National Sanitation Foundation

.114 OAA: Ontario Association of Architects
.115 OBC: Ontario Building Code 2012 (Ontario Regulation 332/12)
.116 OCPA: Ontario Concrete Pipe Association
.117 OFC: Ontario Fire Code
.118 OFM: Ontario Fire Marshall
.119 OGCA: Ontario General Contractors Association
.120 OHSA: Occupational Health and Safety Act
.121 OIRCA: Ontario Industrial Roofing Contractor's Association
.122 OLS: Ontario Land Surveyors
.123 OMCA: Ontario Masonry Contractors' Association
.124 OMCA: Ontario Masonry Contractors’ Association
.125 OPCA: Ontario Painting Contractors Association
.126 OPSS: Ontario Provincial Standard Specification
.127 ORD: Other Recognized Document

.128 PCB: Polychlorinated Biphenyl
.129 PDCA: Painting And Decorating Contractors Of America
.130 PEO: Professional Engineers of Ontario
.131 PVC: Polyvinyl Chloride

.132 RSIC Reinforcing Steel Institute of Canada

.133 SDI: Steel Door Institute
.134 SCAQMD: South Coast Air Quality Management District
.135 SJI: Steel Joist Institute
.136 SSPC: Society For Protective Coatings
.137 STC: Sound Transmission Class

.138 TSSA: Technical Standards & Safety Authority
.139 TPO: Thermoplastic Olefin
.140 TTMAC: Terrazzo Tile And Marble Association of Canada

.141 ULC: Underwriters' Laboratories of Canada

.142 UL: Underwriters' Laboratories Incorporated (USA)

.143 cUL: Underwriter's Laboratories Incorporated (USA) Product with this mark have been evaluated to Canadian safety requirements, which may be somewhat different from U.S. safety requirements.

.144 VOC: Volatile Organic Compound

.145 WCMA: Window Covering Manufacturers Association

.146 WDMA: Window And Door Manufacturers Association

.147 WHPS Warnock Hersey Professional Services

2.2 ABBREVIATIONS

.1 Following abbreviations are used in Contract Documents:

∠	angle
o	degree (angles)
µm	micrometre
#	number (before numerals)
A	ampere
AB	air barrier
A/C	air conditioning
AC	alternating current
ACP	acoustic ceiling panel
ACT	acoustic ceiling tile
AD	access door
ADJ	adjustable
AFF	above finished floor
AFL	access flooring
AHC	architectural hardware consultant
ALUM	aluminum
ANOD	anodized
AP	alarm panel
APPROX	approximate
ARCH	architectural
ARGB	gypsum board - abuse resistant
ASM	air seal membrane
ASPH	asphalt paving
AVB	air vapour barrier
AWG	American wire gauge
AWP	acoustic wall panel
BAS	building automation system
BCS	baby change station
BD	board
BH	bore hole
	BL bed locator
BLDG	building

BLKG	blocking
BM	beam
BMK	bench mark
BN	bull nose
BOL	bollard
B-RLG	bumper railing
B-ROD	backer rod
BS	both sides
BSMT	basement
BULK	bulkhead
BUR	built up roof
BKH	Backer Sheet – Horizontal
BKV	Backer Sheet – Vertical
BMS	Building Maintenance System
BOL	Bollard
CABT	cabinet
CB	catch basin
CC	Contractor or supplied, Contractor installed.
CCTV	closed circuit television
C/C	Centre to Centre.
CCTR	cubicle curtain track
CEM	cement
CEM-PL	cement plaster
cfm	cubic feet per minute
CG	corner guard
CGL	clear glass
CH	coat hook
CHK-BD	chalk board
CHK-PL	checkered plate
CH-S	clothing hook safety
CI	cast iron
CJ	control joint
CL	centreline
CLG	ceiling
CLR	clear finish
CLT	cleat
CMU	concrete masonry unit
CMU-A	architectural concrete masonry unit
CMU-Ac	acoustic concrete masonry unit
CO	clean out
COL	column
CONC	concrete
CONC-C	coloured concrete
CONC-H	hardened concrete
CONC-P	precast concrete
CONC-ST	stained hardened concrete
CONSTR	construction
CONT	continuous
CORR	corridor
CPT	carpet
C-RLG	chair railing

CSK	countersunk
CST	chemical surface treatment
CT	Current Transformer
cu ft	cubic feet
CUPBD	cupboard
C/W	complete with
CW	curtain wall
DB	decibel
dBA	A weighted decibels
deg C	degree celsius
deg F	degree fahrenheit
DEPT	department
DET	detail
DF	drinking fountain
dft	dry film thickness
DG	double glazed
DIA	diameter
DIM	dimension
DIV	division
DK	deck
DN	down
DP	dampproof
DPC	dampproof course
DWG	Drawing
EC	epoxy coating
ECR	epoxy coating reinforced
EHD	electric hand dryer
EIFS	exterior insulation and finish system
EJ	expansion joint
EJC	expansion joint cover
ELA	Equivalent Leakage Air
ELEC	electric
ELEV	elevation
EMERG	emergency
EMT	electro metallic tubing
ENAM	enamel
ENCL	enclosure
ENT	entry
EP	electrical panel
EQUIP	equipment
EXIST	existing
EXP	exposed structure
EXT	exterior
FA	fire alarm
FBD	fibreboard
FC	flexible coating
FD	floor drain
FEC	fire extinguishing cabinet
FG	foot grille
FHC	fire hose cabinet

FIN	finished
FIXT	fixture
FL	floor
FOB	freight on board
FP	fireproofing
fpm	feet per minute
FRGB	Fibre reinforced gypsum board
FRP	fibreglass reinforced panel
FRSS	flushing rim service sink
FS	firestopping
(ft)(')	foot
FTG	footing
FWP	fiberglass wall protection
FXD	fixed
g	gram
ga	gauge
gal	gallon (imperial measure)
GALV	galvanized
GASK	gasket
GB	gypsum board
GBH	glove box holder
GCB	glazed concrete block
GFI	ground fault interrupter
GFRG	glass fibre reinforced gypsum
GL	glass/glazing
GL-BLK	glass block
GRAN-A	granular a
GRAN-B	granular b
GRB	grab bar
GRD	ground
GRL	grille
GRT	grout
GT	glass tile
GWG	georgian wired glass
ha	hectare
HB	hose bib
HC	hollow core
HCH	handicapped clothing hook
H-CONV	heating convector
HDBD	hardboard
HGS	horizontal general purpose high pressure decorative laminate
HM	hollow metal
HORIZ	horizontal
hp	horsepower
HP	hydro pole
hr	hour
HGP	Horizontal Post-forming High Pressure Decorative Laminate
HGS	Horizontal General Purpose High Pressure Decorative Laminate

H-RLG	hand railing
HSD	hand sanitizer dispenser
HSS	hollow structural section
HT	height
HU	heating unit
HVAC	heating ventilating and air conditioning
HWB	hand wash basin
HWP	hygienic wall panels
Hz	hertz
ID	inside diameter
(in.)(")	inch
INCL	including
INSUL	insulation
INS	insulation
INT	interior
INV	invert
I/O	input/output
IPC	isolated power panel
IPS	Infection Prevention Society
JAN	janitor's closet
JST	joist
JT	joint
JU	janitorial unit
KD	knocked down
kg	kilogram
km	kilometre
kN	kilonewton
KO	knock out
kPa	kilopascal
kV	kilovolt
kVA	kilovolt ampere
kW	kilowatt
KWh	kilowatt hour
l	litre
l/s	litre per second
LAB	laboratory
LAV	lavatory
lb	pound
lb/ft	pound per foot
LCD	liquid crystal display
LED	light emitting diode
LEV	level
LGL	laminated glass
LH	left hand
LHR	left hand reverse
lin ft	linear foot
LINO	linoleum
LL	lead lined

LMC	linear metal ceiling
LS	light standard
LSSJ	long span steel joist
LUM	luminous
m	metre
m^2	square metre
m^3	cubic metre
MACP	metal acoustic ceiling panel
MARV	minimum average roll value
MAT'L	material
max	maximum
MCC	motor control centre
MCT	marble composite tile
MDF	medium density fiberboard
MECH	mechanical
MERV	minimum efficiency reporting value
MET	metal
MEZZ	mezzanine
MH	maintenance hole
Mhd	medium hard drawn
min	minimum
MIR	mirror
MIR-S	mirror - safety
MIR-SH	mirror with shelf.
MIR-T	mirror - tilting
misc	miscellaneous
ML	metal lath
ML&PL	metal lath and plaster
mm	millimeter
MO	masonry opening
MP	metal panel
MPa	megapascal
MPI	Master Painters Institute
MRGB	gypsum board - moisture resistant
MRW	mechanical room waterproofing
MS	metal screen or metal stair
MSDS	Material Safety Data Sheet
MTE	match to existing
MRGB	moisture resistant gypsum board
MVER	moisture vapour emission rate
ND	napkin disposal unit
NIC	not in Contract
NO.	number
NOM	nominal
NTS	not to scale
NVU	napkin vending unit
NRP	non removable pins
O/A	overall

o.c.	on centre
O/H	overhead
OBC	Ontario Building Code 2012
OC	Owner supplied Contractor installed
OD	outside diameter
OESC	Ontario Electrical Safety Code
O&M	Operation and Maintenance
OO	Owner supplied Owner installed
OPNG	opening
OPP	opposite
OWSJ	open web steel joist
P	partition
P&D	plumbing and drainage
PA	public address system
PCB	Polychlorinated Biphenyls
PE	porcelain enamel
PERP	perpendicular
PL	plate
PLAM	plastic laminate
PLAS	plaster
PLYWD	plywood
PM	pressed metal
PNL	panel
PR	pair
PREFAB	prefabricated
PREFIN	prefinished
PRV	pressure reducing valves
PS	pressed steel
psf	pounds per square foot
psi	pounds per square inch
PSS	patient service strip
PT	paint
PT	Potential transformer
PTD	paper towel dispenser
PTDD	paper towel dispenser & disposal
PT-E	paint - epoxy
PVC	polyvinyl chloride
R	riser
RB	resilient base
RBL	roller blinds
RD	roof drain
REC	recessed
REFURB	refurbish
REINF	reinforced
REQ'D	required
rev	revision
RFI	request for information
RH	right hand
RHR	right hand reverse
RM	room
rpm	revolutions per minute

RS	reducing strip
RSI	R-Value – SI Units
RSF	resilient strip flooring
RT	rubber tile
RTR	rubber tread
RUB	sheet rubber
RWL	rain water leader
RWP	rigid wall protection
SAN	sanitary
SB	sand blast
SBS	styrene butadiene styrene
SC	solid core
SCG	side coiling grille
SCRN	screen
SCTR	shower track and curtain
SD	soap dispenser
SDS	soap dispenser with shelf
SGL	security glazing
SH	sheet membrane
SHF	shelf
SH-ST	shower seat
SH-ROD/C	shower rod with curtain
SHV	sheet vinyl
SHV-C	sheet vinyl - conductive
SHV-S	sheet vinyl - safety
SHV-SD	sheet vinyl - static dissipative
SHV-WG	sheet vinyl - wood grain
SIM	similar
SLR	sealer (concrete)
SLT	slate tile
SMAC	security metal acoustic ceiling
SMAC	security metal acoustic ceiling
SN	stair nosing
SND	sanitary napkin disposal
SPC	special coating
SPD	soap dish
SPEC	specification
SPF	sports flooring
SPGL	spandrel glass
SPR	sprinkler
SPS	solid polymer surface
sq ft	square feet
sq mi	square mile
sq yd	square yard
SQ	square
SR	seamless resin
SS	stainless steel
SSCG	corner guard - stainless steel
SSPC	security steel plate ceiling
ST	street
STL	steel

STN	stain finish
STONE	stone
STRUCT	structural
SUSP	suspended
SV	stone veneer
t	tonne
T&G	tongue & groove
TB	tack board
TBR	to be removed
TCP	Transmission Control Protocol
TDD	towel dispenser/disposal
TDL	towel disposal
TDT	traffic deck topping
TEFC	totally enclosed fan-cooled
TEL	telephone
TEMP	temporary
TERR-C	terrazzo - concrete
TERR-E	terrazzo - epoxy
TERR-P	terrazzo - precast
TGL	tempered glass
TH	towel hook
TTD	toilet tissue dispenser
TTD-S	toilet tissue dispenser – safety
TRR	temperature rise rated.
TWB	towel bar
TYP	typical
U/C	under cut
U/G	under ground
UNO	unless noted otherwise
UPS	uninterrupted power supply
U/S	under side
UTP	unshielded twisted pair
V	volt
VAC	voltage alternating current
VB	vapour barrier
VBX	view box
VCT	vinyl composite tile
VERT	vertical
VEST	vestibule
VFD	variable frequency drive
VGP	Vertical General Purpose High Pressure Decorative Laminate
VGS	Vertical Post-forming High Pressure Decorative Laminate
VOC	volatile organic compound
VWC	vinyl wall covering
VWP	vinyl wall protection
W	watt
WB	white board
WC	water closet
W-CAB	writing cabinet

WD	wood
WF	wide flange
WFGB	gypsum board - wood fiber reinforced
WGL	wired glass
WHC	wheel chair
WI	wrought iron
WM	wire mesh
WP	waterproofing
WP-C	cementitious waterproofing
WPM	waterproof membrane
WR	washroom
WSC	wood slat ceiling.
WVP	wood veneer paneling
WWF	welded wide flange
WWF	welded wire fabric.
WWM	welded wire mesh
yd	yard
Z	zinc
ZCS	zinc coated steel
ZVB	zone valve box

PART 3 - REFERENCE ARCHITECTURAL STANDARDS

3.1 AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

.1 ASTM A36/A36M: Standard Specification for Carbon Structural Steel

.2 ASTM A53/A53M: Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

.3 ASTM A123/A123M: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

.4 ASTM A153/A153M: Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

.5 ASTM A167: Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

.6 ASTM A185/A185M: Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete

.7 ASTM A240/A240M: Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications

.8 ASTM A276: Standard Specification for Stainless Steel Bars and Shapes

.9 ASTM A307: Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength

.10 ASTM A312/A312M: Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes

.11 ASTM A325M: Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength [Metric]

.12 ASTM A500/A500M: Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

.13 ASTM A510/A510M: Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel, and Alloy

.14 ASTM A554: Standard Specification for Welded Stainless Steel Mechanical Tubing

.15 ASTM A568M: Standard Specification for Steel, Sheet, Carbon, Structural, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for

.16 ASTM A580/A580M: Standard Specification for Stainless Steel Wire

.17 ASTM A645/A645M: Standard Specification for Pressure Vessel Plates, Five Percent Nickel Alloy Steel, Specially Heat Treated

.18 ASTM A653/A653M: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

.19 ASTM A666: Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar

.20 ASTM A743/A743M: Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application

.21 ASTM A792/A792M: Standard Specification for Steel Sheet, 55 % Aluminum-Zinc Alloy-Coated by the Hot-Dip Process

.22 ASTM A821/A821M: Standard Specification for Steel Wire, Hard Drawn for Prestressing Concrete Tanks

.23 ASTM A1003/A1003M: Standard Specification for Steel Sheet, Carbon, Metallic and Nonmetallic Coated for Cold Formed Framing Members

.24 ASTM A1008/A1008M: Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable

.25 ASTM A1011/A1011M: Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength

.26 ASTM B26/B26M: Standard Specification for Aluminum-Alloy Sand Castings

.27 ASTM B117: Standard Practice for Operating Salt Spray (Fog) Apparatus

.28 ASTM B209: Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

.29 ASTM B209M: Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]

.30 ASTM B210: Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes

.31 ASTM B211M1: Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold-Finished Bar, Rod, and Wire [Metric]

.32 ASTM B221: Standard Specification for Aluminum and Aluminum-Alloy Extruded Bar, Rod, Wire, Profiles, and Tubes

.33 ASTM B221M: Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric]

.34 ASTM B247M: Standard Specification for Aluminum and Aluminum-Alloy Die Forgings, Hand Forgings, and Rolled Ring Forgings [Metric]

.35 ASTM B429/B429M1: Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube

.36 ASTM B4561: Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium

.37 ASTM B793: Standard Specification for Zinc Casting Alloy Ingot for Sheet Metal Forming Dies and Plastic Injection Molds

.38 ASTM A633/A633M: Standard Specification for Normalized High-Strength Low-Alloy Structural Steel Plates

.39 ASTM C39/C39M: Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens

.40 ASTM C67: Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile

.41 ASTM C90: Standard Specification for Loadbearing Concrete Masonry Units

.42 ASTM C97/C97M: Standard Test Methods for Absorption and Bulk Specific Gravity of Dimension Stone

.43 ASTM C119: Standard Terminology Relating to Dimension Stone

.44 ASTM C129: Standard Specification for Nonloadbearing Concrete Masonry Units

.45 ASTM C144: Standard Specification for Aggregate for Masonry Mortar

.46 ASTM C165: Standard Test Method for Measuring Compressive Properties of Thermal Insulations

.47 ASTM C170/C170M: Standard Test Method for Compressive Strength of Dimension Stone

.48 ASTM C177: Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus

.49 ASTM C192/C192M: Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory

.50 ASTM C207: Standard Specification for Hydrated Lime for Masonry Purposes

.51 ASTM C208: Standard Specification for Cellulosic Fiber Insulating Board

.52 ASTM C216: Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale)

.53 ASTM C267: Standard Test Methods for Chemical Resistance of Mortars, Grouts, and Monolithic Surfacing’s and Polymer Concretes

.54 ASTM C297/C297M: Standard Test Method for Flatwise Tensile Strength of Sandwich Constructions

.55 ASTM C305: Standard Practice for Mechanical Mixing of Hydraulic Cement Pastes and Mortars of Plastic Consistency

.56 ASTM C307: Standard Test Method for Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacing’s

.57 ASTM C309: Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete

.58 ASTM C373: Standard Test Method for Water Absorption, Bulk Density, Apparent Porosity, and Apparent Specific Gravity of Fired Whiteware Products

.59 ASTM C413: Standard Test Method for Absorption of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing's, and Polymer Concretes

.60 ASTM C423: Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method

.61 ASTM C475/C475M: Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board

.62 ASTM C482: Standard Test Method for Bond Strength of Ceramic Tile to Portland Cement Paste

.63 ASTM C510(11): Standard Test Method for Staining and Color Change of Single- or Multicomponent Joint Sealants

.64 ASTM C518: Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus

.65 ASTM C553: Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications

.66 ASTM C568/C568: Standard Specification for Limestone Dimension Stone

.67 ASTM C579: Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing's, and Polymer Concretes

.68 ASTM C580: Standard Test Method for Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing's, and Polymer Concretes

.69 ASTM C595/C595M: Standard Specification for Blended Hydraulic Cements

.70 ASTM C609: Standard Test Method for Measurement of Light Reflectance Value and Small Color Differences Between Pieces of Ceramic Tile

.71 ASTM C615/C615M: Standard Specification for Granite Dimension Stone

.72 ASTM C616/C616M: Standard Specification for Quartz-Based Dimension Stone

.73 ASTM C627: Standard Test Method for Evaluating Ceramic Floor Tile Installation Systems Using the Robinson-Type Floor Tester

.74 ASTM C629/C629M: Standard Specification for Slate Dimension Stone

.75 ASTM C630: Standard Specification for Water-Resistant Gypsum Backing Board

.76 ASTM C635/C635M: Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings

.77 ASTM C636/C636M: Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels

.78 ASTM C645: Standard Specification for Nonstructural Steel Framing Members

.79 ASTM C648: Standard Test Method for Breaking Strength of Ceramic Tile

.80 ASTM C661: Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer

.81 ASTM C665: Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing

.82 ASTM C719: Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle)

.83 ASTM C754: Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products

.84 ASTM C794: Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants

.85 ASTM C834: Standard Specification for Latex Sealants

.86 ASTM C840: Standard Specification for Application and Finishing of Gypsum Board

.87 ASTM C882/C882M: Standard Test Method for Bond Strength of Epoxy-Resin Systems Used With Concrete By Slant Shear

.88 ASTM C920: Standard Specification for Elastomeric Joint Sealants

.89 ASTM C954: Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness

.90 ASTM C957/C957M: Standard Specification for High-Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane With Integral Wearing Surface

.91 ASTM C979/C979M: Standard Specification for Pigments for Integrally Colored Concrete

.92 ASTM C1021: Standard Practice for Laboratories Engaged in Testing of Building Sealants

.93 ASTM C1027: Standard Test Method for Determining Visible Abrasion Resistance of Glazed Ceramic Tile

.94 ASTM C10281: Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method

.95 ASTM C10361: Standard Specification for Flat Glass

.96 ASTM C1047: Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base

.97 ASTM C10481: Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass

.98 ASTM C1087: Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems

.99 ASTM C1093: Standard Practice for Accreditation of Testing Agencies for Masonry

.100 ASTM C1116/C1116M: Standard Specification for Fiber-Reinforced Concrete

.101 ASTM C11721: Standard Specification for Laminated Architectural Flat Glass

.102 ASTM C1177/C1177M: Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing

.103 ASTM C1184: Standard Specification for Structural Silicone Sealants

.104 ASTM C1185: Standard Test Methods for Sampling and Testing Non-Asbestos Fiber-Cement Flat Sheet, Roofing and Siding Shingles, and Clapboards

.105 ASTM C1186: Standard Specification for Flat Fiber-Cement Sheets

.106 ASTM C1248: Standard Test Method for Staining of Porous Substrate by Joint Sealants

.107 ASTM C1289: Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board

.108 ASTM C1338: Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings

.109 ASTM C1396/C1396M: Standard Specification for Gypsum Board

.110 ASTM C1401: Standard Guide for Structural Sealant Glazing

.111 ASTM C1629/C1629M: Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fibre-Reinforced Cement Panels

.112 ASTM C1658/C1658M: Standard Specification for Glass Mat Gypsum Panels

.113 ASTM D226/D226M: Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing

.114 ASTM D245: Standard Practice for Establishing Structural Grades and Related Allowable Properties for Visually Graded Lumber

.115 ASTM D256: Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics

.116 ASTM D368: Standard Test Method for Specific Gravity of Creosote and Oil-Type Preservatives

.117 ASTM D412e2: Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers – Tension

.118 ASTM D471: Standard Test Method for Rubber Property—Effect of Liquids

.119 ASTM D523: Standard Test Method for Specular Gloss

.120 ASTM D543: Standard Practices for Evaluating the Resistance of Plastic to Chemical Reagents

.121 ASTM D570e1: Standard Test Method for Water Absorption of Plastics

.122 ASTM D624: Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers

.123 ASTM D635: Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position

.124 ASTM D638: Standard Test Method for Tensile Properties of Plastics

.125 ASTM C642: Standard Test Method for Density, Absorption, and Voids in Hardened Concrete

.126 ASTM D695: Standard Test Method for Compressive Properties of Rigid Plastics

.127 ASTM D696: Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30°C and 30°C With a Vitreous Silica Dilatometer

.128 ASTM D732: Standard Test Method for Shear Strength of Plastics by Punch Tool

.129 ASTM D785: Standard Test Method for Rockwell Hardness of Plastics and Electrical Insulating Materials

.130 ASTM D790: Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials

.131 ASTM D792: Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement

.132 ASTM D816: Standard Test Methods for Rubber Cements

.133 ASTM D1002: Standard Test Method for Apparent Shear Strength of Single-Lap-Joint Adhesively Bonded Metal Specimens by Tension Loading (Metal-to-Metal)

.134 ASTM D1037 : Standard Test Methods for Evaluating Properties of Wood-Base Fiber and Particle Panel Materials

.135 ASTM D1044 - 08e1 Standard Test Method for Resistance of Transparent Plastics to Surface Abrasion

.136 ASTM D1056: Standard Specification for Flexible Cellular Materials Sponge or Expanded Rubber

.137 ASTM D1149: Standard Test Methods for Rubber Deterioration-Cracking in an Ozone Controlled Environment

.138 ASTM D1204: Standard Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature

.139 ASTM D1308: Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes

.140 ASTM D1499 - 13 Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Plastics

.141 ASTM D1621: Standard Test Method for Compressive Properties Of Rigid Cellular Plastics

.142 ASTM D1622: Standard Test Method for Apparent Density of Rigid Cellular Plastics

.143 ASTM D1654: Standard Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments

.144 ASTM D1709: Standard Test Methods for Impact Resistance of Plastic Film by the Free-Falling Dart Method

.145 ASTM D1730: Standard Practices for Preparation of Aluminum and Aluminum-Alloy Surfaces for Painting

.146 ASTM D1781: Standard Test Method for Climbing Drum Peel for Adhesives

.147 ASTM D1863/D1863Me1: Standard Specification for Mineral Aggregate Used on Built-Up Roofs

.148 ASTM D1929: Standard Test Method for Determining Ignition Temperature of Plastics

.149 ASTM D2000: Standard Classification System for Rubber Products in Automotive Applications

.150 ASTM D2047: Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine

.151 ASTM D2137: Standard Test Methods for Rubber Property—Brittleness Point of Flexible Polymers and Coated Fabrics

.152 ASTM D2240: Standard Test Method for Rubber Property—Durometer Hardness

.153 ASTM D2244: Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates

.154 ASTM D2247: Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity

.155 ASTM D2395e1: Standard Test Methods for Specific Gravity of Wood and Wood-Based Materials

.156 ASTM D2583: Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor

.157 ASTM D2794: Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)

.158 ASTM D2843: Standard Test Method for Density of Smoke from the Burning or Decomposition of Plastics

.159 ASTM D3273: Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber

.160 ASTM D3363e2: Standard Test Method for Film Hardness by Pencil Test

.161 ASTM D3389: Standard Test Method for Coated Fabrics Abrasion Resistance (Rotary Platform Abrader)

.162 ASTM D37631: Standard Test Method for High Speed Puncture Properties of Plastic Using Load and Displacement Sensors

.163 ASTM D4060: Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser

.164 ASTM D4434/D4434M: Standard Specification for Poly(Vinyl Chloride) Sheet Roofing

.165 ASTM D4442: Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials

.166 ASTM D4491(09): Standard Test Methods for Water Permeability of Geotextiles by Permittivity

.167 ASTM D45411: Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers

.168 ASTM D4812: Standard Test Method for Unnotched Cantilever Beam Impact Resistance of Plastics

.169 ASTM D5456: Standard Specification for Evaluation of Structural Composite Lumber Products

.170 ASTM D5456: Standard Specification for Evaluation of Structural Composite Lumber Products

.171 ASTM D6207: Standard Test Method for Dimensional Stability of Fabrics to Changes in Humidity and Temperature

.172 ASTM E72: Standard Test Methods of Conducting Strength Tests of Panels for Building Construction

.173 ASTM E84: Standard Test Method for Surface Burning Characteristics of Building Materials

.174 ASTM E90: Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements

.175 ASTM E96/E96M: Standard Test Methods for Water Vapor Transmission of Materials

.176 ASTM E108: Standard Test Methods for Fire Tests of Roof Coverings

.177 ASTM E119: Standard Test Methods for Fire Tests of Building Construction and Materials

.178 ASTM E136: Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C

.179 ASTM E154: Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover

.180 ASTM E283: Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen

.181 ASTM E329: Standard Specification for Agencies Engaged in Construction Inspection, Testing or Special Inspection

.182 ASTM E330: Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference

.183 ASTM E331: Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference

.184 ASTM E336: Standard Test Method for Measurement of Airborne Sound Attenuation between Rooms in Buildings

.185 ASTM E413: Classification for Rating Sound Insulation

.186 ASTM E488/E488M: Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements

.187 ASTM E514/E514M: Standard Test Method for Water Penetration and Leakage Through Masonry

.188 ASTM D543: Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents

.189 ASTM E547: Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Cyclic Static Air Pressure Difference

.190 ASTM E557: Standard Guide for Architectural Design and Installation Practices for Sound Isolation between Spaces Separated by Operable Partitions

.191 ASTM E605: Standard Test Methods for Thickness and Density of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members

.192 ASTM E6481: Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source

.193 ASTM E662: Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials

.194 ASTM E699: Standard Practice for Evaluation of Agencies Involved in Testing, Quality Assurance, and Evaluating of Building Components

.195 ASTM E736: Standard Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members

.196 ASTM E759: Standard Test Method for Effect of Deflection on Sprayed Fire-Resistive Material Applied to Structural Members

.197 ASTM E760: Standard Test Method for Effect of Impact on Bonding of Sprayed Fire-Resistive Material Applied to Structural Members

.198 ASTM E761: Standard Test Method for Compressive Strength of Sprayed Fire-Resistive Material Applied to Structural Members

.199 ASTM E779: Standard Test Method for Determining Air Leakage Rate by Fan Pressurization

.200 ASTM E783: Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors

.201 ASTM E795: Standard Practices for Mounting Test Specimens During Sound Absorption Tests

.202 ASTM E814: Standard Test Method for Fire Tests of Penetration Firestop Systems

.203 ASTM E859: Standard Test Method for Air Erosion of Sprayed Fire-Resistive Materials (SFRMs) Applied to Structural Members

.204 ASTM E894: Standard Test Method for Anchorage of Permanent Metal Railing Systems and Rails for Buildings

.205 ASTM E935: Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings

.206 ASTM E937: Standard Test Method for Corrosion of Steel by Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members

.207 ASTM E985: Standard Specification for Permanent Metal Railing Systems and Rails for Buildings

.208 ASTM E1105: Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference

.209 ASTM E1155: Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers

.210 ASTM E1186: Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems

.211 ASTM E12641: Standard Classification for Acoustical Ceiling Products

.212 ASTM E1300e1: Standard Practice for Determining Load Resistance of Glass in Buildings

.213 ASTM E1332: Standard Classification for Rating Outdoor-Indoor Sound Attenuation

.214 ASTM E1333: Standard Test Method for Determining Formaldehyde Concentrations in Air and Emission Rates from Wood Products Using a Large Chamber

.215 ASTM E1414/E1414M: Standard Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum

.216 ASTM E1513: Standard Practice for Application of Sprayed Fire-Resistive Materials (SFRMs)

.217 ASTM E1745: Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs

.218 ASTM E1966: Standard Test Method for Fire-Resistive Joint Systems

.219 ASTM E2174e1: Standard Practice for On-Site Inspection of Installed Fire Stops

.220 ASTM E2179: Standard Test Method for Laboratory Measurement of the Effectiveness of Floor Coverings in Reducing Impact Sound Transmission Through Concrete Floors

.221 ASTM E2307: Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-story Test Apparatus

.222 ASTM E2353: Standard Test Methods for Performance of Glass in Permanent Glass Railing Systems, Guards, and Balustrades

.223 ASTM E2357: Standard Test Method for Determining Air Leakage of Air Barrier Assemblies

.224 ASTM E2393: Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers

.225 ASTM F836M: Standard Specification for Style 1 Stainless Steel Metric Nuts

.226 ASTM F1249: Standard Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor

.227 ASTM F710: Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring

.228 ASTM F436M: Standard Specification for Hardened Steel Washers [Metric]

.229 ASTM F476: Standard Test Methods for Security of Swinging Door Assemblies

.230 ASTM F588: Standard Test Methods for Measuring the Forced Entry Resistance of Window Assemblies, Excluding Glazing Impact

.231 ASTM F738M: Standard Specification for Stainless Steel Metric Bolts, Screws, and Studs

.232 ASTM F793: Standard Classification of Wall Covering by Use Characteristics

.233 ASTM F842: Standard Test Methods for Measuring the Forced Entry Resistance of Sliding Door Assemblies, Excluding Glazing Impact

.234 ASTM F844: Standard Specification for Washers, Steel, Plain (Flat), Unhardened for General Use

.235 ASTM F925: Standard Test Method for Resistance to Chemicals of Resilient Flooring

.236 ASTM F970:Standard Test Method for Static Load Limit

.237 ASTM F1233: Standard Test Method for Security Glazing Materials And Systems

.238 ASTM F1249: Standard Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor

.239 ASTM F1344: Standard Specification for Rubber Floor Tile

.240 ASTM F1514: Standard Test Method for Measuring Heat Stability of Resilient Flooring by Colour Change

.241 ASTM F1859: Standard Specification for Rubber Sheet Floor Covering Without Backing

.242 ASTM F1860: Standard Specification for Rubber Sheet Floor Covering With Backing

.243 ASTM F1861e1: Standard Specification for Resilient Wall Base

.244 ASTM F1869: Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride

.245 ASTM F2169: Standard Specification for Resilient Stair Treads

.246 ASTM F2170: Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes

.247 ASTM G21: Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi

3.2 CANADIAN STANDARDS ASSOCIATION (CSA)

.1 CAN3-A82.2-M78(R2003): Methods of Sampling and Testing Brick

.2 CAN/CSA A23.1/A23.2: Concrete Materials and Methods of Concrete Construction /Methods of Test for Concrete

.3 CAN/CSA A23.3: Design of Concrete Structures

.4 CAN/CSA A82.1-M89: Burned Clay Brick (Solid Masonry Units Made from Clay or Shale)

.5 CAN/CSA A82.27-M91: Gypsum Board

.6 CAN/CSA A179: Mortar and Grout for Unit Masonry

.7 CAN/CSA A371: Masonry Construction for Buildings

.8 CAN/CSA A440/A440.1: Windows/Special Publication A440.1, User Selection Guide to CSA Standard CAN/CSA-A440, Windows

.9 CAN/CSA A3000: Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005)

.10 CAN/CSA G40.20/ G40.21: General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steels

.11 CAN/CSA G164 M92(03): Hot Dip Galvanizing of Irregularly Shaped Articles

.12 CAN/CSA O80 Series: Wood Preservation

.13 CAN/CSA O132.2.0: General Requirements for Flush Wood Doors

.14 CAN/CSA O132.2: Wood Doors

.15 CAN/CSA O141 - Softwood Lumber

.16 CSA S16: Design of Steel Structures

.17 CAN/CSA S136: North American Specification for the Design of Cold-Formed Steel Structural Members

.18 CAN/CSA S157/S157.1: Strength Design in Aluminum

.19 CAN/CSA Z91: Health and Safety Code for Suspended Equipment Operations

.20 CSA A23.1/A23.2: Concrete materials and methods of concrete construction/Test methods and standard practices for concrete

.21 CSA A82.56-M76(03): Aggregate for Masonry Mortar

.22 CSA A123.3: Asphalt Saturated Organic Roofing Felt

.23 CSA A165 Series: Standards on Concrete Masonry Units (Consists of A165.1, A165.2 and A165.3)

.24 CSA A231.1/A231.2: Precast Concrete Paving Slabs/Precast Concrete Pavers

.25 CSA A370: Connectors for Masonry

.26 CAN/CSA A3000: Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005)

.27 CSA B111: Wire Nails, Spikes and Staples

.28 CSA B651: Accessible Design for the Built Environment

.29 CSA B651: Accessible Design for the Built Environment

.30 CSA C22.1: Canadian Electrical Code, Part I (22nd Edition), Safety Standard for Electrical installations

.31 CSA G30.3-M83(98): Cold-Drawn Steel Wire for Concrete Reinforcement

.32 CSA G30.5-M83(98): Welded Steel Wire Fabric for Concrete Reinforcement

.33 CSA G30.18: Carbon steel bars for concrete reinforcement

.34 CSA G40.20/G40.21: General Requirements for Rolled or Welded Structural Quality Steel/ Structural Quality Steel

.35 CSA O121: Douglas Fir Plywood

.36 CSA O141: Softwood Lumber

.37 CSA O151: Canadian Softwood Plywood

.38 CSA O153: Poplar Plywood

.39 CSA S16.1: “Steel Structures for Buildings”.

.40 CSA S136.1: - Commentary on North American specification for the design of cold-formed steel structural members

.41 CSA S304.1: Design of Masonry Structures

.42 CSA S478: Guideline on Durability in Buildings

.43 CSA W47.1: Certification of Companies for Fusion Welding of Steel

.44 CSA W47.2:Certification of Companies for Fusion Welding of Aluminum

.45 CSA W48: Filler Metals and Allied Materials for Metal Arc Welding

.46 CSA W48.1: Carbon Steel Covered Electrodes for Shielded Metal Arc Welding

.47 CSA W55.3: Certification of Companies for Resistance Welding of Steel and Aluminum

.48 CSA W59: Welded Steel Construction (Metal Arc Welding)

.49 CSA W59.2: Welded Aluminum Construction

.50 CSA W117.2: Safety in Welding, Cutting and Allied Processes

.51 CSA W178.2: Certification of Welding Inspectors.

3.3 AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

.1 ANSI A14.3: American National Standards for Ladders - Fixed - Safety Requirements

.2 ANSI A108/A118/A136.1: American National Standards for the Installation of Ceramic Tile

.3 ANSI A115: Hardware Preparations for Steel Doors and Frames

.4 ANSI A115-IG 94: Installation Guide for Doors and Hardware

.5 ANSI A117.1: Tactile Surface

.6 ANSI A117: Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People

.7 ANSI A118.1: Specifications for Dry-Set Portland Cement Mortar

.8 ANSI A118.3: Specification for Chemical Resistant, Water Cleanable Tile Setting and Grouting Epoxy and Water Cleanable Tile Setting Epoxy Adhesive

.9 ANSI A118.4: Specification for Latex-Portland Cement Mortar

.10 ANSI A118.6: Specification for Ceramic Tile Grouts

.11 ANSI A118.7: Polymer modified cement grouts for tile Installation

.12 ANSI A118.8: American National Standard Specifications for Modified Epoxy Emulsion Mortar Grout.

.13 ANSI A136.1: Specification for Organic Adhesives for the Installation of Ceramic Tile

.14 ANSI A137.1: American National Standards Specifications for Ceramic Tile

.15 ANSI A137.2: American National Standard Specifications for Glass Tile

.16 ANSI A208.1: Standard for Particleboard

.17 ANSI A208.2: Standard for Medium Density Fiberboard (MDF)

.18 ANSI A224.1: Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames

.19 ANSI A250.4: Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors and Hardware Reinforcing

.20 ANSI A250.10: Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames

.21 ANSI H35.1/H35.1M: Alloy and Temper Designation Systems for Aluminum

.22 ANSI Z97.1: Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test

.23 ANSI Z124.3: Plastic Lavatories - Solid Surface

.24 ANSI Z124.6: Plastic Sinks - Solid Surface

.25 ANSI/ASHRAE/IESNA 90.1: Energy Standard for Buildings Except Low-Rise Residential Buildings, I-P Edition

.26 ANSI/BHMA A156.3: Exit Devices

.27 ANSI/BHMA A156.5: Auxiliary Locks and Associated Products

.28 ANSI/BHMA A156.10: Power Operated Pedestrian Doors

.29 ANSI/BHMA A156.19: Power Assist and Low Energy Power Operated Doors

.30 ANSI/BHMA A156.115: Hardware Preparation in Steel Doors and Steel Frames

.31 ANSI/DHI A115.IG: Installation Guide for Doors and Hardware

.32 ANSI/HPVA HP-1: American National Standard for Hardwood and Decorative Plywood

.33 ANSI/NEMA LD 3: High-Pressure Decorative Laminates

.34 ANSI/UL 263: Fire Tests of Building Construction and Materials

.35 ANSI/UL 325: Door, Drapery, Gate, Louver, and Window Operators and Systems

.36 ANSI/UL 1479: Fire Tests Of Through-Penetration Firestops

.37 ANSI/UL 2079: Tests for Fire Resistance of Building Joint Systems

.38 ANSI/WDMA I.S. 1A: Industry Standard for Architectural Wood Flush Doors

.39 IAPMO/ANSI Z124.3: Plastic Lavatories

.40 IAPMO/ANSI Z124.6: Plastic Sinks

.41 ICC/ANSI A117.1: Accessible and Useable Buildings and Facilities

3.4 AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

.1 AAMA 501.1: Standard Test Method for Water Penetration of Windows, Curtain Walls and Doors Using Dynamic Pressure

.2 AAMA 501.2: Quality Assurance and Diasnostic Water Leakage Field Check of Installed Storefronts, Curtain Wallsm and Sloped Glazing Systems

.3 AAMA 611: Voluntary Standards for Anodized Architectural Aluminum

.4 AAMA 701/702:Combined Voluntary Specification for Pile Weatherstrip (701) and Replaceable Fenestration Weatherseals (702)

.5 AAMA 920: specification for Operating Cycle Performance of Side-Hinger Exterior Door Systems

.6 AAMA 1303.5: Voluntary Specifications for Forced-Entry Resistant Aluminum Sliding Glass Doors

.7 AAMA 1503: Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections

.8 AAMA 1801: Voluntary specification for the Acoustical Rating of Windows, Doors, Skylights and Glazed Wall Sections

.9 AAMA 2603: Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels

.10 AAMA 2604: Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels

.11 AAMA 2605: Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels

3.5 CANADIAN GENERAL STANDARDS BOARD (CGSB)

.1 CAN2-51.32-M77: Sheating, Membrane, Breather Type CPL

.2 CAN/CGSB 1.5-M91: Low Flash Petroleum Spirits Thinner

.3 CAN/CGSB 1.40-97: Anticorrosive Structural Steel Alkyd Primer

.4 CAN/CGSB 1.59-97: Alkyd Exterior Gloss Enamel

.5 CAN/CGSB 1.74-01: Alkyd Traffic Paint

.6 CAN/CGSB 1.81-M90: Air Drying and Baking Alkyd Primer for Vehicles and Equipment

.7 CAN/CGSB 1.88-92: Gloss Alkyd Enamel, Air Drying and Baking

.8 CAN/CGSB 1.104-M91: Semigloss Alkyd Air Drying and Baking Enamel

.9 CAN/CGSB 1.105-M91: Quick-Drying Primer

.10 CAN/CGSB 1.108-M89: Bituminous Solvent Type Paint

.11 CAN/CGSB 1.132-M90: Zinc Chromate Primer, Low Moisture Sensitivity

.12 CAN/CGSB-1.140-M89: Oil-Alkyd Type Red Lead, Iron Oxide Primer

.13 CAN/CGSB 1.146-99: Cold Cured, Gloss Epoxy Coating

.14 CAN/CGSB 1.153-00: High Build, Gloss, Epoxy Coating

.15 CAN/CGSB-1.159-92: Acrylic Cellulose Notrate Gloss Lacquer

.16 CAN/CGSB 1.165-04: Cold Curing Epoxy Primer

.17 CAN/CGSB 1.171-98: Inorganic Zinc Coating

.18 CAN/CGSB 1.181-99: Ready-Mixed Organic Zinc-Rich Coating

.19 CAN/CGSB 1.183-99: Zinc-Rich Epoxy Coating

.20 CAN/CGSB 1.186-M89: High Performance Glazed Coating System, Interior

.21 CAN/CGSB 1.189-00: Exterior Alkyd Primer for Wood

.22 CAN/CGSB 1.198-00: Exterior Alkyd Primer for Wood

.23 CAN/CGSB 1.213-04: Etch Primer (Pretreatment Coating or Tie Coat) for Steel and Aluminum

.24 CAN/CGSB 1.40-97: Anticorrosive Structural Steel Alkyd Primer

.25 CAN/CGSB 1.500-75:Methods of Test for Toxic Trace Elements in Protective Coatings

.26 CAN/CGSB 4.2-M87: Textile Test Methods

.27 CAN/CGSB 4.129-93: Carpet for Commercial Use

.28 CAN/CGSB 4.162-M80: Hospital Textiles - Flammability Performance Requirements

.29 CAN/CGSB 7.1-98: Lightweight Steel Wall Framing Components

.30 CAN/CGSB 12.1-M90: Tempered or Laminated Safety Glass

.31 CAN/CGSB 12.3-M91 : Flat, Clear Float Glass

.32 CAN/CGSB 12.4-M91 : Heat Absorbing Glass

.33 CAN/CGSB 12.5-M86: Mirrors, Silvered

.34 CAN/CGSB 12.8-97: Insulating Glass Units

.35 CAN/CGSB 12.9-M91: Spandrel Glass

.36 CAN/CGSB 12.10-M76: Glass, Light and Heat Reflecting

.37 CAN/CGSB 12.11-M90: Wired Safety Glass

.38 CAN/CGSB 12.12-M90: Plastic Safety Glazing Sheets

.39 CAN/CGSB 12.13-M91: Patterned Glass

.40 CAN/CGSB 12.20-M89: Structural Design of Glass for Buildings

.41 CAN/CGSB 19.13-M87: Sealing Compound, One-Component, Elastomeric, Chemical Curing

.42 CAN/CGSB 19.17-M90: One-Component Acrylic Emulsion Base Sealing Compound

.43 CAN/CGSB 19.24-M90: Multicomponent, Chemical-Curing Sealing Compound

.44 CAN/CGSB 25.20-95: Surface Sealer for Floors

.45 CAN/CGSB 31.116-M90: Pretreatment Solution for Galvanized Steel

.46 CAN/CGSB 37-GP-9Ma: Primer, Asphalt, Unfilled, for Asphalt Roofing, Dampproofing and Waterproofing

.47 CAN/CGSB 37.2-M88: Emulsified Asphalt, Mineral-Colloid Type, Unfilled, for Dampproofing and Waterproofing and for Roof Coatings

.48 CAN/CGSB 37.3-M89: Application of Emulsified Asphalts for Dampproofing or Waterproofing

.49 CAN/CGSB 37.4-M89: Fibrated, Cutback Asphalt, Lap Cement for Asphalt Roofing

.50 CAN/CGSB 37.5-M89: Cutback Asphalt Plastic, Cement

.51 CAN/CGSB 37.16-M89: Filled, Cutback Asphalt for Dampproofing and Waterproofing

.52 CAN/CGSB 37.27-M89: Chemical Emulsifier Type, Emulsified Asphalt for Mastic Flooring

.53 CAN/CGSB 37.29-M89: Rubber Asphalt Sealing Compound

.54 CAN/CGSB 37.50-M89: Hot Applied, Rubberized Asphalt for Roofing and Waterproofing

.55 CAN/CGSB 37.51-M90: Application for Hot-Applied Rubberized Asphalt for Roofing and Waterproofing

.56 CAN/CGSB 37.54-95: Membrane, Modified, Bituminous, Prefabricated, and Reinforced for Roofing

.57 CAN/CGSB 37.54-95: Polyvinyl Chloride Roofing and Waterproofing Membrane

.58 CAN/CGSB 37.58-M86: Membrane, Elastomeric, Cold-Applied Liquid, for Non-Exposed Use in Roofing and Waterproofing

.59 CAN/CGSB 51-GPP: Manual for Installers of Spray Urethane Foam Thermal Insulation

.60 CAN/CGSB 51.20-M87: Thermal Insulation, Polystyrene, Boards and Pipe Covering

.61 CAN/CGSB 51.23-92: Spray-Applied Rigid Polyurethane Cellular Plastic Thermal Insulation

.62 CAN/CGSB 51.26-M: Thermal Insulation, Urethane and Isocyanurate, Boards, Faced.

.63 CAN/CGSB 51.32-M77: Sheathing, Membrane, Breather Type

.64 CAN/CGSB 51.33-M89: Vapour Barrier Sheet, Excluding Polyethylene, for Use in Building Construction

.65 CAN/CGSB 51.34-M86: Vapour Barrier, Polyethylene Sheet for Use in Building Construction

.66 CAN/CGSB 63.14-M89: Plastic Skylights

.67 CAN/CGSB 69.17/ANSI/BHMA A156.2-03: Bored and Preassembled Locks and Latches

.68 CAN/CGSB 69.18/ANSI/BHMA A156.1-06: Butts and Hinges

.69 CAN/CGSB 69.20/ANSI/BHMA A156.4-00: Door Controls (Closers)

.70 CAN/CGSB 69.21/ANSI/BHMA A156.5-01: Auxiliary Locks and Associated Products

.71 CAN/CGSB 69.22/ANSI/BHMA A156.6-05: Architectural Door Trim

.72 CAN/CGSB 69.23/ANSI/BHMA A156.7-03: Template Hinge Dimensions

.73 CAN/CGSB 69.24/ANSI/BHMA A156.8-05: Door Controls - Overhead Holders

.74 CAN/CGSB 69.26-96: Power Operated Pedestrian Doors

.75 CAN/CGSB 69.28/ANSI/BHMA A156.12-05: Interconnected Locks and Latches

.76 CAN/CGSB 69.29/ANSI/BHMA A156.13-05: Mortise Locks and Latches

.77 CAN/CGSB 69.31/ANSI/BHMA A156.15-06: Closer/Holder Release Device

.78 CAN/CGSB 69.32/ANSI/BHMA A156.16-02: Auxiliary Hardware

.79 CAN/CGSB 69.34/ANSI/BHMA A156.18-06: Materials and Finishes

.80 CAN/CGSB 71.20-M88: Adhesive, Contact, Brushable

.81 CAN/CGSB 75.1-M88: Tile, Ceramic

.82 CAN/CGSB 79.1-M91: Insect Screens

.83 CAN/CGSB 82.5-M88: Insulated Steel Doors

.84 CAN/CGSB 85.10-99: Protective Coatings for Metals

.85 CAN/CGSB 92.1-M89 : Sound Absorptive Prefabricated Acoustical Units

.86 CAN/CGSB 138.1-96: Fabric for Chain Link Fence

.87 CAN/CGSB 138.2-96: Steel Framework for Chain Link Fence

.88 CAN/CGSB 138.3-96: Installation of Chain Link Fence

.89 CAN/CGSB 138.4-96: Gates for Chain Link Fence

.90 CAN/CGSB 149.10-M86: Determination of the Airtightness of Building Envelopes by the Fan Depressurization Method

.91 CAN/CGSB 149.15-96: Determination of the Overall Envelope Airtightness of Buildings by the Fan Pressurization Method Using the Building's Air Handling Systems

.92 CGSB 1-GP-12 (Withdrawn): Replaced by Federal Specification 595B: Colors used in Government Procurement

.93 CGSB 1-GP-105M: Primer, Quick Drying

.94 CGSB 1-GP-121M: Coating, Vinyl, Pretreatment, for Metals (Vinyl Wash Primer)

.95 CGSB 1-GP-171: Inorganic zinc-rich primer and touch-up paint

.96 CGSB 19-GP: Sealing Compound, One-Component, Butyl-Polyisobutylene Polymer Base, Solvent Curing

.97 CGSB 31-GP-107Ma:Non-inhibited Phosphoric Acid Base Metal Conditioner and Rust Remover

.98 CGSB 37-GP-6Ma: Asphalt, Cutback, Unfilled, for Dampproofing

.99 CGSB 37-GP-9Ma: Primer, Asphalt, Unfilled, for Asphalt Roofing, Dampproofing and Waterproofing

.100 CGSB 37-GPa: Application of Asphalt Lap Cement

.101 CGSB 37-GPa: Application of Unfilled Cutback Asphalt for Dampproofing

.102 CGSB 37-GP: Application of Asphalt Primer for Asphalt Roofing, Dampproofing and Waterproofing

.103 CGSB 37-GP: Application of Filled Cutback Asphalts for Dampproofing and Waterproofing

.104 CGSB 37-GP: Roofing and Waterproofing Membrane, Sheet Applied, Elastomeric

.105 CGSB 37-GP: Roofing and Waterproofing Membrane, Sheet Applied, Flexible, Polyvinyl Chloride

.106 CGSB 37-GP: Membrane, Modified, Bituminous, Prefabricated, and Reinforced for Roofing

.107 CGSB 37-GP: Mat Reinforcing, Fibrous Glass for Membrane Waterproofing Systems and Built-Up Roofing

.108 CGSB 41-GPa: Rigid Vinyl Extrusions for Windows and Doors

.109 CGSB 41-GP: Pipe, Polyethylene, for the Transport of Liquids

.110 CGSB 51-GP-23-M: Thermal Insulation, Urethane, Spray in Place.

.111 CGSB 71-GP: Adhesive, Organic, for Installation of Ceramic Wall Tile

.112 CGSB 71-GP: Adhesive, Flexible, for Bonding Cellular Polystyrene Insulation

.113 CGSB 81-GP-4M: Flooring, Seamless, Decorative Epoxy, Troweled Finish

.114 CGSB 81-GP: Application of Seamless Flooring

.115 CGSB 149-GP-2MP: Manual for Thermographic Analysis of Building Enclosures

3.6 NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

.1 NFPA 30: Flammable and Combustible Liquids Code

.2 NFPA 45: Standard on Fire Protection for Laboratories Using Chemicals

.3 NFPA 70: National Electrical Code

.4 NFPA 75: Standard for the Protection of Information Technology Equipment

.5 NFPA 80: Standard for Fire Doors and Other Opening Protectives

.6 NFPA 101: Life Safety Code

.7 NFPA 252: Standard Methods of Fire Tests of Door Assemblies

.8 NFPA 253: Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source

.9 NFPA 255: Standard Method of Test of Surface Burning Characteristics of Building Materials

.10 NFPA 257: Standard on Fire Test for Window and Glass Block Assemblies

.11 NFPA 258 : Recommended Practice for Determining Smoke Generation of Solid Materials

.12 NFPA 265: Standard Methods of Fire Tests For Evaluating Room Fire Growth Contribution of Textile Coverings on Full Height Panels and Walls

.13 NFPA 268: Standard Test Method For Determining Ignitibility of Exterior Wall Assemblies Using a Radiant Heat Energy Source

.14 NFPA 286: Standard Methods of Dire Tests for Evaluatoing Contribution of Wall and ceiling Interior Finish to Room Fire Growth

.15 NFPA 701: Standard Methods of Fire Tests for Flame Propagation of Textiles and Films

.16 NFPA 704: Standard System for the Identification of the Hazards of Materials for Emergency Response

3.7 UNDERWRITERS' LABORATORIES/UNDERWRITERS' LABORATORIES OF CANADA (UL/ULC)

.1 CAN/ULC S101: Standard Methods of Fire Endurance Tests of Building Construction and Materials

.2 CAN/ULC S102: Standard Test Method for Surface Burning Characteristics of Building Materials

.3 CAN/ULC S102.2: Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies

.4 CAN/ULC S104: Standard Method for Fire Tests of Door Assemblies

.5 CAN/ULC S105: Standard Specification for Fire Door Frames Meeting The Performance Required by CAN/ULC-S104

.6 CAN/ULC S106: Fire Tests of Window Assemblies.

.7 CAN/ULC S107: Methods of Fire Tests of Roof Coverings

.8 CAN/ULC S109: Flame Tests of Flame Resistant Fabrics and Films

.9 CAN/ULC S113: Standard Specification for Wood Core Doors Meeting the Performance Required by CAN/ULC S104 for Twenty Minute Fire Rated Closure Assemblies

.10 CAN4/ULC S114: Standard Method of Test for Determination of Non-Combustibility in Building Materials

.11 CAN/ULC S115 : Standard Method of Fire Test of Firestop Systems

.12 CAN/ULC S124: Standard Method of Test For The Evaluation of Protective Coverings for Foamed Plastic

.13 CAN/ULC S126: Standard Method of Test for Fire Spread Under Roof-Deck Assemblies

.14 CAN/ULC S127: Standard Corner Wall Method of Test for Flammability Characteristics of Non-Melting Foam Plastic Building Materials

.15 CAN/ULC S134: Standard Method of Fire Test of Exterior Wall Assemblies

.16 CAN/ULC S138: Standard Method of Test for Fire Growth of Insulated Building Panels in a Full-Scale Room Configuration

.17 CAN/ULC S572: Standard for Photoluminescent and Self-Luminous Exit Signs and Path Marking Systems

.18 CAN/ULC S701: Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering

.19 CAN/ULC S702: Standard for Mineral Fibre Thermal Insulation for Buildings

.20 CAN/ULC S704: Standard for Thermal Insulation, Polyurethane and Polyisocyanurate, Boards, Faced

.21 CAN/ULC S705.1: Standard For Thermal Insulation-Spray Applied Rigid Polyurethane Foam, Medium Density, Material, Specification

.22 CAN/ULC S705.2: Standard for Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density, Installation

.23 CAN/ULC S710.1: Standard for Thermal Insulation - Bead - Applied One Component Polyurethane Air Sealant Foam, Part 1: Material Specification

.24 CAN/ULC S710.2: Standard For Thermal Insulation - Bead Applied One-Component Polyurethane Air Sealant Foam, Part 2: Application

.25 CAN/ULC S711.1: Standard for Thermal Insulation - Bead Applied Two-Component Polyurethane Air Sealant Foam, Part 1: Material Specification

.26 CAN/ULC S711.2: Standard for Thermal Insulation - Bead Applied Two-Component Polyurethane Air Sealant Foam, Part 2: Application

.27 CAN/ULC S770: Standard Test Method for Determination of Long-Term Thermal Resistance of Closed-Cell Thermal Insulating Foams

.28 UL 9: Standard for Fire Tests of Window Assemblies

.29 UL 10B: Standard for Fire Tests of Door Assemblies

.30 UL 94: Standard for Safety of Flammability of Plastic Materials for Parts in Devices and Appliances testing

.31 UL 181: Standard for Factory-Made Air Ducts and Air Connectors

.32 UL 183: Standard for Manufactured Wiring Systems

.33 UL 263: Standard for Fire Tests of Building Construction and Materials

.34 UL 325: Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems

.35 UL 410: Standard for Slip Resistance of Floor Surface Materials

.36 UL 437: Key Locks

.37 UL 723: Standard for Test for Surface Burning Characteristics of Building Materials

.38 UL 924: Standard for Emergency Lighting and Power Equipment

.39 UL 1012: Standard for Power Units Other Than Class 2

.40 UL 1034: Burglary-Resistant Electric Locking Mechanisms

.41 UL 1479: Standard for Fire Tests of Through-Penetration Firestops

.42 UL 2079: Standard for Tests for Fire Resistance of Building Joint SystemsULC Guide No. 40U19: Firestop Systems

.43 ULC Guide No. 40U19.13: Firestop Systems Components

.44 ULC S115: Standard Method of Fire Tests of Firestop Systems.

.45 ULC/ORD C376: Fire Growth of Foamed Plastic Insulated Building Panels in a Full-Sale Room Configuration

END OF SECTION

PART 1 - GENERAL

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL INSTRUCTIONS

.1 Read and conform to:

.1 the General Conditions and Supplementary Conditions of the Contract.

.2 Division 1 requirements and documents referred to therein.

1.3 GENERAL

.1 Be informed of procedures to be followed on the Contract and the degree of testing and inspection to be expected during course of the Work. Coordinate testing and inspection work and furnish labour and materials as necessary to accommodate the work described under this Section.

1.4 APPOINTMENT OF TESTING AND INSPECTION COMPANIES

.1 From time to time during progress of the Work, the Owner may require that testing be performed to determine that materials provided for the Work meet specified requirements, installation of specified materials is in compliance with approved methods, and final resulting assemblies meet specified performance requirements.

.2 The Owner will, with recommendations from the Consultant, appoint testing and inspection companies, representing, reporting and responsible to the Owner through the Consultant, except the following, which must be included in the Contract Price:

.1 Inspection and testing required by laws, ordinances, rules, regulations or orders of public authorities and Authorities Having Jurisdiction.

.2 Inspection and testing performed exclusively for Contractor's convenience.

.3 Testing, adjustment and balancing of conveying systems, mechanical and electrical equipment and systems.

.4 Mill tests and certificates of compliance.

.5 Tests specified in the Contract Documents to be carried out by Contractor under supervision of Consultant.

.6 Inspections and tests specifically indicated to be Contractor’s responsibility in Divisions 02 – 49 of the Project Manual.

.3 Where tests or inspections by designated testing laboratory reveal Work not in accordance with the Contract requirements, pay costs for additional tests or inspections as required by Consultant to verify acceptability of corrected work.

1.5 PAYMENT FOR TESTING AND INSPECTION SERVICES

.1 The cost of testing and inspection will be authorized as a cash allowance item under the price and payment procedures set out in Section 01 29 00 – Payment Procedures.

.1 Testing and inspection companies shall submit monthly invoice original to the Consultant and a copy to the Owner for review, relating invoices to tests and inspection reports. Provide original receipts for all disbursements.

.2 When approved for payment, invoices will be forwarded by the Consultant to the Contractor for inclusion in the Contractor's next progress payment application.

1.6 INSPECTION AND TESTING REQUIRED BY CONTRACT DOCUMENTS:

.1 Appoint and pay independent inspection and testing company to verify the requirements of the Contract Documents. Be responsible for quality control. Employ quality control staff, supervisors and implement quality control procedures.

.2 Inspection and testing required by Contract Documents, codes, regulations, plan approval authority, other legally constituted authorities and/or Authorities Having Jurisdiction shall be the Contractor’s responsibility and paid for by the Contractor.

.3 Additional testing required as a result of changes in materials, proportions of mixes requested by Contractor and Subcontractors as well as any extra testing of materials occasioned by lack of identification or by their failure to meet Specification requirements or testing of structure or elements including load testing, shall be carried out at the Contractor's expense.

.4 A review by the Consultant and/or other consultants does not relieve the Contractor of its responsibility for performance of the Work in accordance with the Contract Documents. The Contractor shall be responsible for the care and control of the Work and is solely responsible for quality control and shall implement supervisory and quality control procedures. Inspection or testing performed exclusively for the Contractor's convenience shall be the sole responsibility of the Contractor.

1.7 INSPECTION AND TESTING REQUIRED BY CONSULTANT:

.1 In addition to the inspection and testing specified to be provided as part of the Work or provided by the Contractor for its own verification of the Work, the Consultant may appoint separate inspection and testing companies for certain work where specifically stated in the Contract Documents or where the Consultant may later require. Wherever documents state that inspection and testing companies may be appointed by the Owner or Consultant, give adequate notice prior to commencement of this portion of the Work to the Consultant to determine if such inspection and testing companies will be appointed.

.2 Services performed by inspection and testing companies and other consultants serve to assist the Consultant and do not to replace the Contractor's responsibility for conforming to the requirements of the Contract Documents. The Contractor is responsible for continuous checking and inspections of the Work to ensure the Work is in accordance with the Contract Documents it proceeds. In such cases, the following will apply:

.1 The Owner will pay costs of such additional inspection and testing; except where such additional tests or inspections reveal Work not in accordance with Contract, the Contractor shall bear cost of such tests and further tests as required to verify the acceptability of corrected Work;

.2 The Consultant will advise the Contractor of work to be inspected and companies appointed and will provide the testing companies with necessary Drawings and Specifications;

.3 The Contractor will advise and coordinate with the Consultant and applicable inspection and testing companies a minimum of five (5) Working Days prior to commencement of the work to be inspected or tested and ensure proper facilities and coordination are provided. Do not perform any work without the required inspection and testing.

.3 Establish a schedule of testing, number of testing reports and submission and distribution of testing reports. Provide to the Consultant all pertinent data regarding Site conditions, dates, test references, product identification, procedures and description, instructions and recommendations and other relevant information. Identify clearly the Product and system not meeting the requirements of the Contract Documents and submit measures and recommendations for correcting the situation. Advise the Consultant promptly when a Product or system fails to meet the applicable standards.

.4 Materials and work not in accordance with the requirements of the Contract Documents will be rejected at any time during the progress of the Work. Defective material and work, whenever found prior to Total Performance of the Work, may be rejected regardless of previous inspection or testing.

.5 Any inspection shall not constitute a relief of the Contractor's responsibility under the Contract, but shall serve as a precaution against oversight or errors.

.6 Where evidence exists that defective work has occurred or that work has been carried out incorporating defective materials, the Owner, through the Consultant, reserves the right to have tests, inspections or surveys performed and analytical calculations of structural strength (and the like) made in order to help determine the extent of the defect and whether work must be replaced. Tests, inspections or surveys carried out under these circumstances will be made at the Contractor's expense, regardless of the test results.

1.8 TESTING AGENCY QUALIFICATIONS

.1 Conduct testing in accordance with the requirements of the OBC unless advised otherwise in the Contract Documents or by the Consultant. Obtain certification where required by the applicable codes and standards. The Contractor shall also:

.1 Ensure the testing agency is an independent testing agency with experience and capability to conduct the relevant testing, as documented according to ASTM E548-94e1 Standard Guide for General Criteria Used for Evaluating Laboratory Competence

.2 Quality assurance protocols and capability of testing agencies to perform designated tests on construction materials shall be evaluated in accordance with the following:

.1 ASTM E329-11: Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection
.2 ASTM E699-09: Standard Practice for Evaluation of Agencies Involved in Testing, Quality Assurance, and Evaluating of Building Components

.2 Qualifications of Inspectors: Submit a list of inspectors to be employed on the Work and obtain the Consultant's approval.

.3 Perform all testing and inspection using qualified inspectors and/or technologists certified by a professional engineer or performed directly by a professional engineer registered to practice in the Province of Ontario in conformance with applicable codes and certification programs.

1.9 QUALITY ASSURANCE

.1 Qualifications of Inspectors: Inspectors for this Work shall be as recommended by the Consultant, subject to approval of the Owner.

.2 All work of the testing and inspection agency shall be performed by qualified and/or certified personnel under professional supervision or performed directly by a professional engineer registered to practice in the Province of Ontario in conformance with all applicable codes and certification programs.

.3 Ensure inspectors and personnel are qualified to perform the type of inspection or testing required and meet, as applicable, the requirements of the following standards:

.1 ASTM E329: Standard Specification for Agencies Engaged in Construction Inspection and/or Testing;

.2 ASTM C1077: Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation;

.3 ASTM C1093 Practice for Accreditation of Testing Agencies for Masonry;

.4 ASTM D3666: Specification for Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials;

.5 ASTM E2174: Practice for On-Site Inspection of Installed Fire Stops;

.6 ASTM E 2393: Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers;

.4 Perform concrete testing using a testing company that conforms to the requirements of CSA A283. The inspection report format and distribution requirements will be established by the Consultant.

.5 The testing and inspection company performing concrete testing shall be certified under CSA A283, Qualification Code for Concrete Testing Laboratories, for Category 1 Certification.

.6 Concrete testing shall be performed by a testing company conforming to the requirements of the CSA A283 as required for this Contract. The inspection report format and distribution requirements will be established by the Consultant.

.7 Welder's qualifications shall be in accordance with Section 01 40 00 – Quality Requirements.

.8 Requirements of Regulatory Agencies:

.1 All testing shall be conducted in accordance with the requirements of the OBC, except where this would, in the Consultant's opinion, cause undue delay or give results that are not representative of the rejected material in place. In such a case, tests shall be conducted in accordance with the standards given by the Consultant.

.2 Obtain certification where required by applicable codes and standards.

.3 Refer to GC 2.3 – Review and Inspection of the Work of the General Conditions of the Contract for further details regarding rejected work.

1.10 COOPERATION WITH TESTING AND INSPECTION COMPANIES

.1 Representatives of the testing laboratories shall have access to the Work at all times; provide facilities for such access in order that the laboratories may properly perform its function.

.2 Cooperate with testing and inspection companies and give adequate notice to the Consultant of any changes in source of supply, additional work shifts and any other proposed changes.

.3 Prior to commencing significant segments of the Work, give appropriate notification to the Consultant and independent testing and inspection agencies so as to afford them reasonable opportunity to review work previously completed. Failure to meet this requirement may be cause for the Consultant to classify the work as defective.

.4 Install no Product before it is tested when a test is specified in the Contract Documents. Do not execute any work where a test or inspection is required and the inspectors cannot attend.

.5 Cooperate in permitting access for inspection to all places where the Work is being done or material is stored prior to shipping.

.6 Allow free access to testing agencies and supply necessary sampling materials for tests. Supply additional labour required to assist the testing and inspection companies in making tests.

.7 The testing and inspection service does not relieve the Contractor of its responsibility for normal shop inspection, quality control of production and for errors made by them. The testing and inspection also does not constitute the Owner's acceptance of any of the Work.

1.11 REPORTS AND DOCUMENTS

.1 The Contractor shall ensure that the testing and inspection company will submit shop inspection and Site inspection reports within 5 Working Days of each inspection.

.2 Distribute reports as follows:

.1 Owner, 1 copy;

.2 Consultant, 2 copies;

.3 Contractor, 2 copies (1 for Data Manual); and

.4 Engineering Consultants, 1 copy each;

.3 The Contractor shall ensure that the inspectors will provide a written report on each inspection or test, including in the report: all pertinent data as to Site conditions, dates, test references, actual product identification, procedures and descriptions, Site instructions given, recommendations and any other information required by standards applicable to the reporting of tests and inspections;

.1 The reports shall clearly indicate any failure of Products or procedures to meet the applicable standards. Give recommendations for retesting or correction. The Contractor shall contact the Consultant immediately when product or procedure fails to meet applicable standards.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 GENERAL

.1 The following list of testing and inspection services listed in Part 3 of this Section serves to illustrate a non-exhaustive scope of independent inspection and testing services that may be required by the Owner or Consultant. When such services are required, and unless they are indicated to be included in the Contract Price, they shall be paid for through cash allowance as specified in this Section.

.2 Give total cooperation to the Owner's testing agency during testing and inspection of designated items.

3.2 DEWATERING

.1 Monitor dewatering techniques, pumping quantities and actual infiltration into excavations at both vertical and horizontal planes.

.2 Take periodic samples of water being discharged from settlement ponds to determine acceptability of water under the bylaws of the Local Municipalities.

3.3 EXCAVATING, BACKFILLING AND COMPACTING

.1 Review and be familiar with the geotechnical report referred to in paragraph 12 of the Request for Tenders.

.2 Perform founding strata tests, inspections and measurements to:

.1 prove bearing capacity of soil before placement of concrete and asphalt,

.2 determine actual level established at excavation and

.3 determine acceptable founding elevations.

.3 Perform periodical tests and inspections to:

.1 determine the depth of existing soil which must be removed in order to provide a soil capable of supporting necessary founding work, fill, and paved areas without deleterious settlement;

.2 determine quality of fill and backfill material for use under floor slabs and exterior areas, including natural moisture content, optimum moisture and maximum density, quantity of water to be added or removed to produce correct moisture content for compaction and maximum density, proper placing and compaction in final location, moisture and density of compacted soil in place and compaction carried out to specified densities.

.4 If soil densities, upon testing, do not meet the requirements of this Specification, further tests and inspections will be requested by the Consultant and paid for by the Contractor.

3.4 ASPHALTIC CONCRETE

.1 Verify qualifications of source of materials, installer and proposed equipment to be used.

.2 Review asphaltic concrete mix designs and related laboratory tests on aggregates and asphaltic materials.

.3 Carry out field tests to determine conformance with the Specifications regarding asphaltic concrete density, bitumen content and type, and stone grading for each Day's work.

.4 Verify that the specified compaction has been obtained and correct pavement thickness is achieved for every 100 ft² or less of paved area for each lift of asphaltic concrete using nuclear densimeter.

.5 Verify that the specified thickness of pavement has been provided for every 100 ft² or less of paved area for each lift of asphaltic concrete.

3.5 STRUCTURAL CONCRETE

.1 Perform inspection work at the concrete supplier source with quality control in accordance with the procedures specified in CAN/CSA-A23.1, 2, and 3-00 and include:

.1 verification that the ready-mix supplier is qualified to supply concrete in accordance with the Specifications and has capacity to supply concrete as required by the Construction Schedule;

.2 review of proposed concrete mix designs; and

.3 sampling, testing and inspection of materials as may be required.

.2 Review production samples of aggregates and manufacturers' test results of cement and reinforcing steel to verify conformance to the Contract Documents.

.3 Cement from specified Canadian manufacturers will be accepted without additional tests, providing verification is given that cement type complies with the Specifications.

.4 Routinely test materials in accordance with the provisions of and procedures established in CAN/CSA-A23.1-M00 to determine the following:

.1 strength of concrete at 7 and 28 Days;

.2 insitu strength of concrete placed under "Cold Weather Requirements" at 7 Days;

.3 air content of air-entrained standard mass concrete; and

.4 slump of all concrete at the time of placing.

.5 Execute a concrete strength testing programme as follows:

.1 footings, columns, walls, grade beams, slabs-on-grade - 3 cylinders from each pour of 130 yd^3 or less placed in any 1 Day, with lab cured reports at 1 at 7 Days, 1 at 14 Days and 2 at 28 Days;

.2 suspended slabs and girders which are required to sustain construction loads:

.1 for work at or above 5°C, 4 cylinders from each pour of 130 yd^3 or less placed in any 1 Day; with lab cured reports at 1 at 7 Days, 1 at 14 Days and 2 at 28 Days;

.2 for work below 5°C, 6 cylinders from each pour of 130 yd^3 or less placed in any 1 day, with lab cured reports at 1 at 7 Days, 1 at 14 Days and 2 at 28 Days and job cured reports at 1 at 7 Days and 1 at 14 Days.

.3 Test air content of air-entrained standard density concrete making one test for each vibrated concrete batch. For exposure classifications F-1, C-1 and C-2, test at frequency in accordance with CAN/CSA-A23.1, Clause 17.4.1. Perform the first test before placing any concrete. After stable air content has been established, the frequency of tests will be determined by the Consultant. For exposure classifications F-2 and C-4, test at the time of obtaining strength test specimens.

.6 Test the air content and unit weight of light weight concrete by the volumetric method, with one test for each batch placed.

.7 In addition, for slabs-on-grade, obtain other necessary specimens for the determination of laboratory modulus of rupture. Modulus of rupture tests shall be taken at 90 Days.

.8 For concrete cylinder test reports, include the following:

.1 specific locations of concrete represented by sample;

.2 verification that test specimens are stored within an enclosure which is maintained at specified temperatures;

.3 design strength;

.4 unit weight of sample;

.5 exposure class;

.6 aggregate size and admixtures incorporated;

.7 date, hour and temperature at time sample was taken;

.8 percentage of air content;

.9 test strength of cylinder; and

.10 type of failure if test fails to meet Specifications.

.9 For reinforcing steel:

.1 identify and correlate reinforcing steel with mill test reports to assure conformance to the Contract Documents;

.2 conduct and pay for the testing of specimens for each grade and size of reinforcing steel contained in any 100 tonnes of steel shipped by means of a series of tests which include 2 bars for each test required of each size and grade of steel used;

.3 reinforcing steel tests shall be made in accordance with the requirements of applicable CSA G30 Series specified; and

.4 ensure that the mechanical splices of reinforcing bars and its installation comply with Specifications and perform tension tests to destruction on approximately 5% of mechanical splices.

.10 Verify tolerances as follows:

.1 confirm that concrete work meets tolerance requirements,

.2 use the elevation survey records of elevations of soffit form surfaces and finished concrete surfaces specified in Sections 03 10 00 – Concrete Forming and Section 03 30 00 – Cast-in-Place Concrete as the basis for judging compliance;

.3 use approved aluminum straightedge to judge compliance with specified slab finish tolerances except that dipstick equipment shall be used to measure F number tolerances.

.11 Perform the required standard tests for grout under baseplates.

3.6 CONCRETE SLAB FINISHING

.1 Verify the grading of underslab compacted granular base and ambient temperatures.

.2 Review of placement of slab reinforcement and construction joint.

.3 Pre-pour review of equipment, workers and techniques of casting slabs.

.4 Pre-pour review of equipment, workers and techniques of casting slabs.

.5 Perform saw-cuts before slab temperature starts to fall.

.6 Identify Products and monitoring procedures employed in the finishing and saw cutting of concrete floors.

.7 Observe the application of curing compounds and hardeners as applicable to sample slabs, recording the rates of application.

.8 Verify slab finishing tolerances using laser equipment. Where applicable and specified in the Contract Documents, super flat floor tolerances (F System) shall be verified.

.9 Perform testing in accordance with requirements of ASTM F1869 for moisture on concrete floors. Moisture emission from the concrete floor shall not exceed 1.5 kg/93 m² (3.5 lbs/1000 sq ft) in 24 hours.

.10 Perform relative humidity test in accordance with the requirements of ASTM F2170 using in situ probes and measure internal relative humidity of slab; concrete slab and air space above floor slab shall be at service temperature and relative humidity of area for 48 hours prior to measuring concrete relative humidity; conduct a minimum of three tests for first 1,000 sq.ft and one additional test for each 1,000 sq.ft.; conduct one test near centre and others around the perimeter of area; relative humidity probe test shall not exceed 75% unless recommended otherwise by flooring manufacturer(s). Do not proceed with installation until moisture problem has been corrected. Provide results to the Consultant prior to the commencement of installation.

.11 Conduct pH testing to ensure the alkali salt residue is within limits acceptable to the manufacturer and to avoid adhesive failure, discoloration, shrinkage and softening of floor covering. If pH results are higher than that which is acceptable to the manufacturer, neutralize the floor prior to beginning of installation by sanding, vacuuming and/or by water plus mild muriatic acidic application as recommended by the manufacturer. Retest to ensure that the pH has been neutralized.

.12 Prepare concrete slabs to receive resilient flooring in accordance with requirements of ASTM F210; areas to receive flooring finishes shall have no release agents, sealers, hardeners or curing compound. The concrete slab shall meet moisture and relative humidity of concrete slab and other requirements recommended by the flooring manufacturer. Do not proceed with the installation of finish flooring until moisture problem has been corrected.

.13 Slab Levelness:

.1 floors shall be measured in accordance with ASTM E1155M (Test Method for Determining Floor Flatness and Levelness Using the F-Number System), "F number" system (inch-pound units) shall be verified by an independent testing company;

.2 submit test reports to the Consultant for review; and

.3 prior to commencement of installation of partitions, ensure that the floor meets the requirements specified in this Section. If the floor does not meet required levelness, provide a leveling topping at no cost to the Owner.

3.7 MASONRY

.1 Verify that masonry units being supplied to Site conform to the Specifications.

.2 Verify mortar mix and grout designs. Check the source of grout. Test mortar and grout in accordance with CSA A179.

3.8 STRUCTURAL STEEL

.1 **Shop Inspection**

.1 Verify that fabrication is carried out in conformance to CAN3-S16.1 and the Contract Documents, using modern up-to-date shop practice suitable for the type of work under consideration.

.2 Conduct as many shop visits as necessary to establish that the steelwork is correctly fabricated.

.2 **Materials Inspection**

.1 Provide certified mill test reports for structural shapes and plates.

.2 Verify types of bolts, rivets and welding electrodes.

.3 Verify the manufacturers' data on shop paint and verify its conformance to the Contract Documents.

.4 Identify and correlate materials used for fabrication.

.5 Verify structural section, shape, size, weight and length as well as straightness, camber, twists out of square or out of parallel.

.3 Ensure reviewed detail Shop Drawings are used for fabrication.

.4 Inspect and check the quality of work and fabrication as follows:

.1 qualifications of fabricator and welders;

.2 correctness of procedures, materials and equipment;

.3 drilling and punching of holes, shearing and cutting of copes, weld preparation; cold or hot bending and forming;

.4 assembly of members, sequence, fit-up and tolerances of bolted, riveted and welded shop connections;

.5 straightness of assembled members within allowable tolerances;

.6 camber of members as specified;

.7 end bearing surfaces: smoothness of texture and correct angle cut;

.8 grinding or planing of surfaces or edges;

.9 shop rivets for size, grip and tightness; and

.10 1 in 10 shop bolts for size, grip, washer and tightness to be checked by torque wrench.

.5 Inspect and check welds as follows:

.1 check welds according to standards as approved by the Canadian Welding Bureau;

.2 inspection organization undertaking welding inspection shall be qualified in accordance with requirements of CSA W178.1, "Certification of Welding Inspection Organizations", and shall be approved by the Canadian Welding Bureau;

.3 examine for proper setting of amperage of welding machines;

.4 visually inspect root pass for cracking and penetration, back-up plates and clipping, pre-heating and distortions;

.5 ensure removal of slag between passes, check general quality of finished weld, size, length and spacing, and conduct special inspection of testing of shop welds other than visual inspection upon the specific instructions of the Consultant.

.6 begin by inspecting approximately 10% of welds. Where problems arise in this area, inspect as much as 100% of welds, with inspection beyond the first 10% to be performed at no additional cost to the Owner; and

.7 check on surface preparation and cleaning of material to be free of rust, dirt, slag and grease by chemical, blast or hand cleaning, as specified in the Contract Documents - one visual inspection per 50 tonne of steel.

.6 Inspect shop painting method of application whether by dipping, spraying or brushing, verifying mil thickness of primer for conformance to the Contract Documents, and that primer has been omitted in the designated locations shown on the Drawings.

.7 Review miscellaneous items including the following:

.1 identification of members for field erection;

.2 shop handling and storing of members during and after fabrication; and

.3 preparation of members for shipping such as strapping or binding in suitable sizes.

.8 Provide field inspection, including fit-up, placing, plumbing, leveling, temporary and permanent bracing, welded and bolted connections, and field touch-up of shop painting for conformance to the Contract Documents. Provide general inspection of field cutting and alterations, slag removal at welded joints, and instrument verification of erection tolerances.

3.9 AIR BARRIER/VAPOUR RETARDER

.1 Refer to Section 01 83 16 - Exterior Enclosure Performance and Testing.

3.10 INSPECTION OF WINDOW ASSEMBLIES

.1 Record weather conditions and temperatures of substrata and atmosphere.

.2 Check building structure for dimensions, deflections, plumbness and twist to ensure it is within the specified and detailed tolerances to accept the systems.

.3 Check concrete structure for opening sizes, tolerances, deflection, plumbness and exact plane to ensure it is within specified and detailed tolerances to accept the windows.

.4 Check anchorages to the building structure. Ensure they are installed satisfactorily at locations permitted by the design of the building structure. Do not interfere with other items to be installed that are secure and are made corrosion resistant.

.5 Check window systems to ensure true alignment horizontally and vertically.

.6 Check provisions to compensate for thermally induced expansion and contraction.

.7 Check to ensure thermal breaks are provided, properly located and continuous.

.8 Check that rain screen provisions have been included.

.9 Check that all concealed joints and screw heads and similar fasteners holding components together are made airtight and watertight.

.10 Check that metal air/vapour barriers and their sealants are installed and sealed airtight, free of perforations of any kind, that provisions to allow for expansion, contraction and deflection are provided and that units will not deflect and pop.

.11 Check that insulation is continuous, secure and has been installed to the required thickness.

.12 Check that glass is properly installed, with all lights in same planes and locations within glazing pockets, and that glazing gaskets, sealants and spacers are installed so no pumping of the glazing materials can occur.

.13 Check methods of substrate cleaning for the application of sealants to ensure the proper application of the sealants.

.14 Check that pressure plates are applied securely and in a manner that pressure on glass is equally applied and continuous so that no distortion to the glass occurs.

.15 Check that packing insulation is provided and installed to be thermally efficient and continuous.

.16 Check metal finishes for correct installations, uniformity of colour and for match to acceptable samples and mock-ups.

.17 Check glass for uniformity of colour with adjacent glass units.

.18 Check glass for distortion of image from any cause.

.19 Check interface of window systems with other building components for air, thermal and water tightness and material compatibility.

.20 Check that the system does not permit build-up of ice and hoar frost within components.

.21 Check compatibility of materials within curtain wall systems.

.22 Check windows for air movements within systems and at joints between systems and adjacent construction using artificial smoke devices.

.23 Check continuity and compression of firestopping.

.24 Check glass units for seal failures.

.25 Check edges of glass units for nicks, chips and other defects which could cause breaking due to thermally induced stresses.

.26 Check glass for obstructions to vision.

.27 Check glass bite within glazing pockets.

.28 Check quality of exposed metal work for quality of joints, flatness, distortions, rough edges and alignment.

.29 Check spandrel panels for compliance with accepted samples, mock-ups and with specified criteria. Check anchorages, alignment of joints, joint sizes, reveal sizes, panel sizes and tolerances in plane of panel faces, thicknesses, compatibility of sealants, staining, application of joint primer, flashings, grain direction, code markings with respect to location as indicated on reviewed Shop Drawings, quality of finish, epoxy bonds, drainage holes, exposed edge finish, edge damage and flaws.

.30 Check for compliance with Specifications, Drawings, samples, Site samples, on-Site accepted mock-ups and tested prototype.

.31 Check that no alkali run-off from building structure onto metal and glass surfaces occurs.

.32 Report immediately to the Consultant any items being installed contrary to the Contract Drawings and Specifications for the Consultant's decision and action.

3.11 TESTING AND INSPECTION OF MECHANICAL SYSTEMS

.1 In addition to testing procedures and Contractor's periodic field review during construction performed under Divisions 20, 21, 22 and 23, carry out certifications required by the Authority Having Jurisdiction.

.1 See the Mechanical Divisions noted above for further testing requirements.

3.12 TESTING AND INSPECTION OF ELECTRICAL SYSTEMS

.1 Refer to Division 26 - Electrical for further testing requirements.

END OF SECTION

PART 1 - GENERAL

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL INSTRUCTIONS

.1 Read and conform to

.1 and the General Conditions and Supplementary Conditions of the Contract.

.2 Division 1 requirements and documents referred to therein.

1.3 SUMMARY

.1 Work Included: General requirements for sound control and construction of airtight assemblies to prevent sound flanking and structure-borne sound transmission.

.2 Related Requirements: Specifications throughout entirety of Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them

1.4 REFERENCES

.1 Reference Standards: Latest published editions of reference standards (including any amendments thereto) listed in this Section in effect as of the closing date and time for the Request for Tenders that was issued for the Contract are applicable unless otherwise indicated.

1.5 PERFORMANCE

.1 Conform to CSAZ8000 for general design and construction requirements of health care facilities;

.2 Ensure construction of all assemblies is airtight. Responsibility for airtight construction falls on the Contractor. Employ pertinent details for airtightness and coordinate work between trades to ensure airtightness is achieved. Conform to requirements of ASTM E497.

.3 Representative details for airtight penetrations, recessed elements, edges and similar conditions requiring acoustic treatment are shown on Drawings. Specific materials and components to be used to accomplish airtight detailing are specified in the technical Specifications (Divisions 02 - 49). Bring to attention of Consultant any condition that may require special details or materials in order to achieve airtightness.

.4 Requirements specified in this Section are to be read in conjunction with other requirements stipulated in Contract Documents. They do not in any way negate or supersede other provisions stipulated elsewhere in Contract Documents.

.5 Carefully locate and treat ducts, grilles, diffusers, electrical outlets, boxes and other similar mechanical and electrical devices.

.6 Build and install all construction joints, structural penetrations, mechanical and electrical duct penetrations, pipe and conduit penetrations, electrical boxes and fixtures, cabinets, doors, access panels, windows, frames, supports and similar penetrations or openings in such manner as to prevent sound transmission and flanking.

.7 Provide lintels, extra frames, blocking, escutcheons, grouting, gaskets, packing, caulking, dense putties, taping, filling, and other filler materials as required to stop sound

transmission. Use flexible sealant or acoustical gasket to seal between assemblies and dissimilar surfaces.

.8 Extend construction to a minimum of 3 mm (1/8") and a maximum of 13 mm (1/2") of adjacent construction or penetrations to provide suitable space for packing and caulking.

.9 Do not locate recessed wall fixtures such as medicine cabinets, electrical, telephone, data outlets that penetrate assemblies back-to-back or in same cavity. Locate such boxes or outlets at least 250 mm (10") apart laterally and if interconnected, use flexible connections.

.10 Cut openings in construction accurately for electrical boxes, piping, ductwork and other penetrating elements. Leave enough space around such elements so they remain free of rigid connection with the surrounding construction.

.11 Prior to packing and caulking penetrations, verify that all penetrating elements such as piping and ductwork are free and clear of the opening to be packed and caulked.

.12 Where multiple layers of gypsum board are used, stagger all joints in adjacent layers for a minimum of 610 mm (24”).

.13 Apply all acoustical sealants and caulks in accordance with manufacturer's instructions and requirements of ASTM C919.

.14 Airtight construction requirements for the Project include, but are not limited to the following:

.1 Partition Bases: Provide continuous bead of acoustical sealant at all locations where gypsum board meets structural floor or roof (this includes all sides of partitions). Depth of sealant to be equal thickness of gypsum layer or layers.
.2 Partition Heads: Provide the same detail as for bases at flat structure. Refer to Drawings for details for other conditions.
.3 Partition or Ceiling Joints at Dissimilar Materials: Provide continuous bead of acoustical sealant at all locations where gypsum board meets dissimilar material. Depth of sealant to be equal thickness of gypsum layer or layers.
.4 Pipe, Duct, Conduit, or Structural Penetrations: In accordance with requirements of Division 21, 22, 23, 26 and 27.
.5 Electrical Boxes: Provide acoustical putty pad continuously around boxes. Refer to Divisions 26 and 27 for additional requirements.
.6 Electrical, Lighting, or Other Recessed Boxes Over 100 mm x 100 mm (4" x 4"): Provide one layer of 13 mm (5/8") gypsum board continuous around the back of such boxes. Caulk or tape all joints and caulk all conduit penetrations with acoustical sealant. Refer to Divisions 26 and 27 for additional requirements.

.15 Sound Isolation: Isolate mechanical equipment located on same floor or above patient rooms, offices, nurse stations and similar occupied space from floor.

.16 General STC ratings:

.1 Provide airtight partitions and ceilings in locations indicated to meet required minimum Sound Transmission Class (STC) ratings. Coordinate work of various Subcontractors to avoid “short circuiting” of the STC ratings. Refer to Drawings for STC ratings.
.2 If not stated otherwise in the Contract Documents, STC rating shall be those indicated in the OBC.

PART 2 - EXECUTION

2.1 NOISE AND VIBRATION MANAGEMENT (DURING CONSTRUCTION)

.1 Noise Control: Perform construction operations to minimize noise. Comply with municipal Noise By-Laws, requirements of Authorities Having Jurisdiction and Owner's facility procedures to avoid disruption of normal facility activities.

.1 Assess potential effects of construction noise on facility occupants in accordance with ASTM E1686.

.2 Monitor noise produced from construction operations in accordance with ASTM E1780.

.2 Perform noise- and vibration-producing work in less sensitive hours of the day or week as directed by the Owner. Refer to Section 01 10 00 for additional requirements.

.3 Repetitive and/or intermittent, high-level noise: permitted only during times indicated in Section 01 10 00. Do not allow sound levels to be more than 70 dBA for more than 12 minutes in any hour and/or more than 80 dBA for more than 3 minutes in any hour, measured at 3 m (10') from the source.

.4 Work deemed noisy or inducing excessive vibrations by the Owner may be restricted to Saturdays and Sundays or outside of normal weekday working hours (while still complying with municipal Noise By-Laws) without additional costs to the Owner. Refer to Section 01 10 00 for additional requirements.

.5 Maximum permissible construction equipment noise levels:

Equipment	dBA
Concrete Mixers	75
Concrete Pumps	75
Cranes	75
Derricks Impact	75
Pile Drivers	95
Jack Hammers	75
Rock Drills	80
Pneumatic Tools	80
Saws	75
Vibrators	75
Other noise sources:	70

.6 Equip vehicles and equipment with efficient noise attenuation devices (mufflers) and sound deflectors as required to minimize and maintain noise levels in vicinity of Site below the preceding limits measured 3 m (10') from the source.

.7 Where necessary place noise attenuation devices (barriers) around stationery pumps and compressors.

.8 Provide Owner with a minimum of 5 Days written notice of any construction activity that may cause excessive noise or vibration. Reschedule such construction activities if they interfere with Owner's sensitive procedures.

.9 Contractor may be required to temporarily halt operations involving excessive noise or vibration to accommodate emergency and/or sensitive activities without additional cost to the Owner. The Contract Price shall include and allow for such temporary shut downs.

END OF SECTION

Updated through ADD#8

PART 1 - GENERAL

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL

.1 Read and conform to:

.1 the General Conditions and Supplementary Conditions of the Contract.

.2 Division 1 requirements and documents referred to therein.

.2 Provide any permit necessary for temporary facilities and controls. Provide and maintain all temporary facilities and controls specified in the Contract Documents. Remove them when directed and/or when no longer required. Payment for temporary facilities and controls shall be made by the Contractor unless specified otherwise in the Contract Documents.

.3 Provide and maintain adequate temporary supports, structures, light, power and water in accordance with GC 3.1 – CONTROL OF THE WORK and GC 3.3 – TEMPORARY SUPPORTS, STRUCTURES AND FACILITIES of the General Conditions of the Contract, as required by all trades and to facilitate the Work to proceed without delay at all times of the year. The cost of temporary light, power and water shall be included in the Contract Price. The Contractor shall pay for installation, light, power and water used, its maintenance and removal.

1.3 TEMPORARY UTILITIES

.1 Temporary Water Supply:

.1 Arrange and pay for the supply of water required for construction purposes.

.2 Provide connections, piping and fittings for distribution of water and remove such temporary distribution upon completion of the Work.

.2 Temporary Power:

.1 Provide continuous temporary power and lighting service. If necessary, arrange and coordinate off-Site power source for continuous temporary power and lighting service. Arrange and pay for energy charges and include costs in the Contract Price for connection and provision of a separate meter.

.3 Temporary Heating, Ventilation and Air Conditioning:

.1 Provide temporary heating, ventilation and air conditioning for enclosed building until Substantial Performance of the Work to ensure adequate protection of the Work under way and of completed Work. Temporary heating, ventilation and air conditioning without limitation includes heating, cooling and desiccant de-humidification equipment, associated power cables, gas lines, temporary duct work and accessories.

.2 Provide also temporary heating, ventilation and air conditioning for portions of the Work where exposed to atmospheric elements during construction.

.4 Temporary Controlled Environment:

.1 Provide a controlled environment and dehumidifier for the drying and curing of construction Work to prevent the growth of mold and to speed up the drying of concrete to meet moisture emission levels required by finish flooring installation. Conform to the following performance

requirements, except where more stringent requirements are required by the work of other Sections and Contract Documents:

.1 Supply Air: Minimum 1 air change every 120 minutes.
.2 Filtration of out air - 100%.
.3 Temperatures - minimum between 15°C (59°F) and 27°C (80°F).
.4 Relative humidity - maintain at or below 50%.
.5 Ensure moisture content in wood and hardwood materials is stabilized to maximum percentage recommended by AWI/AWMAC requirements.
.6 Control condensation and maintain environmental conditions, including air and surface temperatures suitable for surface preparation, application and curing of paints and coatings.
.7 Conform to noise criteria requirements specified in the Contract Documents.

.2 Provide proper heating for drying out of new work. Maintain the minimum temperature specified in this Section. Uniformly distribute heat to avoid hot or cool areas or excessive drying. Protect concrete, masonry, excavations, backfilling and other work from frost during construction.

.3 Dehumidify interior spaces continuously during installation and curing periods required for moisture emitting work to maintain the required relative humidity levels, including without limitation work involving:

.1 joint compounds, skim coating, gypsum board work and plaster;
.2 cementitious materials;
.3 paints; and
.4 finish carpentry, casework, wood paneling, wood flooring and other millwork.

.4 As soon as construction is sufficiently advanced, and in order to prevent delays in the progress of the Work, enclose the building using necessary tarpaulins, plastic sheeting or glazing and temporary doors, with locks to doors.

.5 Construction heaters used inside the building must be vented to outside or be flameless type. Do not use direct fired space heaters and propane, salamander type heaters. Ventilate heated areas and keep the building free of exhaust and combustion gases.

.6 Maintain supervision of the operation of temporary heating and ventilation equipment. Maintain temporary climate control equipment in service until the completion of building commissioning or when use of the equipment is no longer required as directed by the Consultant.

.7 Remove climate control equipment from the Site after the successful commissioning of new HVAC equipment.

.8 Do not use any of the permanent facilities and controls without obtaining written permission from Consultant.

.5 Use of Building HVAC System:

.1 Before any portion of the heating system can be considered by the Consultant for use by Contractor, the Contractor shall verify the following requirements:

.1 equipment must be properly commissioned with safety and operating devices operational.
.2 proper electrical power requirements and equipment operating within nameplate ratings.
.3 flow rates of equipment verified to be within design tolerances.
.4 submission of operating and maintenance manuals.
.5 service and maintain systems and equipment in accordance with operating and maintenance manuals.

.2 On completion of the work for which permanent heating system was used, the Contractor shall replace filters, inspect and replace defective bearings and lubricate all bearings and clean strainer baskets. This includes, without limitations, painting of equipment if required, repacking of pumps, and cleaning out of ductwork (all as instructed by the Consultant).

.3 Warranties for the heating system shall not commence until the entire system is in as near original condition as possible and is so certified by the Consultant. Warranties shall not commence earlier than the date that Substantial Performance of the Work is achieved.

.4 Pay costs for providing and maintaining temporary heat.

.5 Be responsible for any damage to the Work due to failure in providing adequate heat and protection during construction.

.6 Temporary Drainage:

.1 Protect excavation, trenches and building from damage by rainwater, ground water, backing up of drains or sewers and other water, frost and other weather conditions. Provide sheeting, piling, shoring, pumps, equipment, temporary drainage, protective covering and enclosures. Provide necessary pumps including spare pump for keeping the Work free of water throughout the construction period.

.2 Keep Site properly and efficiently drained during construction and until completion. Be responsible for disturbances, dirt and damage which may be caused by or result from water backing up or flowing over, though, from or along any part of the Work or due to operations which may cause water to flow elsewhere. Drain water away from Site without causing any danger to public health.

.7 Temporary Protection:

.1 Provide and maintain the following temporary protection at all times:

.1 at window openings, provide translucent, weatherproof protection until windows and glazing are installed;
.2 for door openings, provide minimum wood doors, frames, hinges, locks and bolts to exterior and interior to existing areas;
.3 at air intakes, provide protection against infiltration of dirt, dust and other deleterious matter; and
.4 Provide temporary stair treads and landings.

.2 Provide scaffolding enclosures to enable the Work to continue during inclement weather and winter conditions.

.3 Notify the Fire Department and Consultant immediately should a fire of any nature occur regardless of whether the fire has been extinguished or not. Notify the Fire Department and Consultant of any fire alarm shutdowns and also provide notice once the fire alarm has been recertified and is operational.

.4 Establish a log book maintained by the Contractor which records all activity affecting the Owner’s fire alarm system. The log book shall record date, time, trade, worker's name, nature and location of work performed, zone or zones affected, status of system while work was performed, time and date of completion of operation, and status of system upon completion of work. At the end of each Working Day, Contractor shall review the log and sign indicating the system is fully operational, except as recorded otherwise in the log. Inform the Owner of the system status and which zones may be affected daily prior to commencement of any new operation that affects the fire alarm system.

1.4 CONSTRUCTION FACILITIES

.1 Temporary Support Structure and Facilities

.1 Design, erect, operate, maintain and remove temporary structural and other temporary facilities. Engage and pay professional engineers licensed to practice in Province of Ontario and skilled in the appropriate disciplines to perform these functions where required by law or by Contract Documents and in cases where such temporary facilities and their methods of construction are of such a nature that professional engineering skill is required to produce safe and satisfactory results.

.2 Design metal guards and walls-acting-as-guards in accordance with the requirements of the OBC, “Loads on Guards” and “Loads on Walls Acting as Guards”. Provide guards for the work of various trades such as masonry, structural steel stud framing system, metal siding system, curtain wall, and gypsum board, as applicable.

.3 Provide and maintain temporary ladders, ramps, walks and hand rails as necessary during construction in compliance with the requirements of the *Ontario Occupational Health and Safety Act* (Ontario), in particular paragraphs 4.1.10.1 and 4.1.10.3

.2 **Contractor's Field Offices and Sheds:**

.1 Provide Contractor's field offices and storage sheds within the Place of the Work only. Provide offices and sheds properly painted and maintained.

.2 Provide the following field office facilities:

.1 A room to accommodate 12 persons for Site conference and job meetings, heated and air conditioned to maintain a temperature of 21° C (70° F) ± 2° C (4° F);
.2 One photocopy machine;
.3 "No Smoking" signs; and
.4 Proper flammable and explosive materials storage.

.3 **Sanitary Facilities**

.1 Provide and maintain temporary facilities for use by workers in compliance with the *Occupational Health and Safety Act* (Ontario), and applicable by-laws. Provide portable, weatherproof toilets, serviced at least weekly.

.4 **Garbage Removal**

.1 Do not use institutional garbage bin facilities for the removal of construction rubbish and debris. Provide garbage bins and schedule the pick-up of garbage.

1.5 CONSTRUCTION HOISTS AND SCAFFOLDING

.1 Provide, maintain and locate where directed by the Consultant, the required hoisting equipment. Equipment shall be positioned so as not to interfere with the Work. Do not block public roads, or impede traffic during operation. If required to temporarily block traffic, control and flag person shall direct traffic in a manner acceptable to municipal authorities. The equipment shall be operated by a qualified hoist operator along with well-trained flag and signal persons. Coordinate and make required arrangements for the use of hoists by Subcontractors and Suppliers. Provide concrete pads for hoisting equipment and remove when no longer required. Restore area to its pre-construction condition.

1.6 VEHICULAR ACCESS AND PARKING

.1 Provide access roads as may be necessary to provide safe and adequate access for materials, Products and other supplies to the Site. Provide and maintain access sidewalks, roadways and similar facilities as may be required for access to the Work. Do not block public roads or impede traffic during the progress of the Work. If required to temporarily block traffic, provide a flag person to direct traffic in a manner acceptable to municipal authorities. Remove accumulations

of ice and snow from areas providing access to Site. Ensure access to Site is available for emergency vehicles and comply with the fire plan for vehicular traffic.

1.7 TEMPORARY BARRIERS AND ENCLOSURES

.1 **~~Hoarding and Boardwalk~~Enclosures:**

.1 Provide enclosures~~hoarding~~ and gates in accordance with the requirements of the Local Municipality, the *Occupational Health and Safety Act* (Ontario), Regulations for Construction Projects and applicable requirements of other Authorities Having Jurisdiction to:

.1 protect public, Owner's occupants, personnel and property from injury and damage; and

.2 exclude non-construction personnel and public from parts of the Place of the Work under construction.

~~.2 Framing, sheathing and decking shall be in accordance with the details indicated on the Contract Drawings and materials listed herein are minimum requirements which may be exceeded by the Contractor's design.~~

~~.3 Wood Hoarding and Boardwalk Framing: National Lumber Grades Authority No; 1 Grade SPF.~~

~~.4 Wire Mesh: 50 mm x 50 mm x 3.4 mm (2" x 2" x 1/8") galvanized.~~

~~.5~~.2 The limit of the Place of the Work shall be as indicated on the Contract Drawings.

~~.6~~.3 Prohibit the use of roads outside of the Place of the Work except for construction purposes and as required for access to the Place of the Work.

~~.7~~.4 Maintain ~~hoarding~~ enclosures in a clean condition, free of unauthorized bills, signs and defacement.

~~.8~~.5 Remove and dispose of ~~hoarding~~ enclosures upon completion of the parts of the Work.

.2 **Temporary Heated Enclosures**

.1 Conform to the requirements of the *Occupational Health and Safety Act* (Ontario).

.2 Take precautions and provide temporary protection to prevent damage to the Work affected by temperature, water, weather and other environmental conditions.

.3 Provide temporary heated enclosures in advance of cold weather to continue full operations through cold climatic temperature and weather throughout the Work.

.4 Provide heating to maintain the recommended Product storage, mixing, substrate, ambient air, placement, Product installation and curing temperatures recommended by the respective Product manufacturers.

.5 Provide temporary enclosures and heating as required by the Contract Documents.

.3 **Existing Trees:**

.1 Remove trees indicated to be removed on the Drawings in a manner to prevent hazard to persons and property. Employ an expert woodsmen for tree removal over 150 mm (6") caliper.

1.8 PROJECT IDENTIFICATION

.1 Provide a sign approved by the Consultant that identifies the Contract Work as detailed 2400 mm x 3600 mm (8'x12'), including wood frame support and minimum 19 mm (3/4") exterior grade plywood with reinforced resin facing and wood trim at the perimeter.

.1 Mount at location and height as directed by the Consultant.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Informational and warning devices.

.2 Protection and control of public traffic.

.3 Operational requirements.

1.2 RELATED SECTIONS

.1 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 REFERENCES

.1 Ontario Traffic Manual (OTM)- Book 7 - Temporary Conditions

.2 Town of East Gwillimbury and regulations are enforceable in the Place of Work.

1.4 ACCESS TO SITE

.1 Provide and maintain access roads, sidewalk crossings, ramps and construction runways as may be required for access to Work.

1.5 PUBLIC TRAFFIC FLOW

.1 Provide and maintain competent signal flag operators, traffic signals, barricades and flares, lights, or lanterns as required to perform Work and protect the public.

1.6 PROTECTION OF PUBLIC TRAFFIC

.1 Comply with requirements of Acts, Regulations and By-Laws in force for regulation of traffic or use of roadways upon or over which it is necessary to carry out Work or haul materials or equipment.

.2 When working on the travelled way:

.1 Place equipment in position to present a minimum of interference and hazard to the travelling public.

.2 Keep equipment units as close together as working conditions permit and preferably on the same side of the travelled way.

.3 Do not leave equipment on the travelled way overnight.

.3 Do not close any lanes of the road without the approval of the authority having jurisdiction and the Consultant. Before re-routing traffic erect suitable signs and devices in accordance with instructions contained in OTM Book 7.

.4 Keep the travelled way graded, free of potholes and of sufficient width for the required number of lanes of traffic.

.1 Provide a minimum seven (7) m wide temporary roadway for traffic in two-way sections through Work and on detours.

.2 Provide a minimum five (5) m wide temporary roadway for traffic in one-way sections through Work and on detours.

.5 Provide paved (or gravelled if first accepted by the authority having jurisdiction) detours or temporary roads to facilitate passage of traffic around restricted construction areas as shown on the provided plans.

.1 Do grading for detours.

.2 Place and compact granular sub-base.

.3 Place and compact granular base.

.4 Place and compact asphalt concrete pavement.

.5 Provide temporary line painting as required.

.6 Provide and maintain road access and egress to property fronting along Work under Contract and in other areas as indicated, unless other means of road access exist that meet the approval of the authority having jurisdiction.

1.7 INFORMATIONAL AND WARNING DEVICES

.1 Provide and maintain signs, flashing warning lights and other devices required to indicate construction activities or other temporary and unusual conditions resulting from the project work which requires road user response.

.2 Supply and erect signs, delineators, barricades and miscellaneous warning devices as specified in provincial and municipal guidelines.

.3 Place signs and other devices in locations recommended by OTM Book 7.

.4 Meet with the Consultant prior to commencement of Work to prepare

.1 a list of signs and other devices required for project. If the situation on site changes, revise the list to the approval of the Consultant.

.5 Continually maintain traffic control devices in use by:

.1 Checking signs daily for legibility, damage, suitability and location. Clean, repair or replace to ensure clarity and reflectance.

.2 Removing or covering signs which do not apply to conditions existing from day to day.

1.8 CONTROL OF PUBLIC TRAFFIC

.1 Provide competent flag persons, trained in accordance with, and properly equipped as specified in Provincial and municipal guidelines for the following situations:

.1 When public traffic is required to pass working vehicles or equipment which block all or part of the travelled roadway.

.2 When it is necessary to institute a one-way traffic system through a construction area or other blockage where traffic volumes are heavy, approach speeds are high and a traffic signal system is not in use.

.3 When workmen or equipment are employed on the travelled way over the brow of hills, around sharp curves or at other locations where oncoming traffic would not otherwise have adequate warning.

.4 Where temporary protection is required while other traffic control devices are being erected or taken down.

.5 For emergency protection when other traffic control devices are not readily available.

.6 In situations where complete protection for workers, working equipment and public traffic is not provided by other traffic control devices.

.7 At each end of restricted sections where pilot cars are required.

.8 Delays to public traffic due to contractor's operators: maximum 5 minutes.

.2 Provide pilot cars as required. Equip pilot cars with orange flashing lights and signs clearly designating vehicles as pilot cars.

.3 Where roadway carrying two-way traffic is to be restricted to one lane for twenty-four (24) hours each day, provide a portable traffic signal system.

.1 Adjust as necessary, and regularly maintain the system during the period of restriction.

.2 Signal system to requirements of OTM Book 7.

1.9 OPERATIONAL REQUIREMENTS

.1 Maintain existing conditions for traffic throughout the period of Contract except that, when required for construction under this Contract and when measures have been taken as specified and approved by Consultant to protect and control public traffic, existing conditions for traffic to be restricted as per Provincial standards.

.2 Maintain existing conditions for traffic crossing right-of-way.

.3 Maintain existing conditions for traffic crossing right-of-way except when required for construction. With the approval of the Consultant, existing conditions for cross traffic are to be restricted as per OTM Book 7.

1.10 FIRE ROUTES

.1 Maintain access to the property including overhead clearances for use by emergency response vehicles.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 55 26 - Traffic Control and Procedures

1.2 REFERENCE STANDARDS

.1 Canadian General Standards Board (CGSB)

.1 CGSB 1.59-97, Alkyd Exterior Gloss Enamel.

.2 CAN/CGSB 1.189-00, Exterior Alkyd Primer for Wood.

.2 Canadian Standards Association (CSA International)

.1 CSA-O121-M1978 (R2003), Douglas Fir Plywood.

1.3 INSTALLATION AND REMOVAL

.1 Provide temporary controls in order to execute the Work expeditiously.

.2 Remove from the site all such work after use.

1.4 HOARDING

.1 Erect temporary site enclosures using 38 x 89 mm construction grade lumber framing at 600 mm centres and 1200 x 2400 x 13mm exterior grade fir plywood to CSA O121.

.2 Apply plywood panels vertically as indicated.

.3 Provide two lockable truck entrance gates and at least one pedestrian door as directed and conforming to applicable traffic restrictions on adjacent streets. Equip gates with locks and keys.

.4 Erect and maintain pedestrian walkways including roof and side covers, complete with signs and electrical lighting as required by law.

.5 Paint the public side of the site enclosure in selected colours with one coat of primer to CAN/CGSB 1.189 and one coat of exterior paint to CGSB 1.59. Maintain the public side of the enclosure in clean condition.

.6 Erect temporary site enclosure using new 1.2m high snow fence wired to rolled steel "T" bar fence posts spaced at 2.4m on centre. Provide one lockable truck gate. Maintain fence in good repair.

.7 Provide barriers around trees and plants designated to remain. Protect from damage by equipment and construction procedures.

1.5 GUARD RAILS AND BARRICADES

.1 Provide secure, rigid guard rails and barricades around deep excavations, open shafts, open stairwells, and open edges of floors and roofs.

1.6 DUST TIGHT SCREENS

.1 Provide dust tight screens or partitions to localize dust generating activities, and for the protection of workers, finished areas of the Work and the public.

.2 Maintain and relocate protection until such work is complete.

1.7 ACCESS TO SITE

.1 Provide and maintain access roads, sidewalk crossings, ramps and construction runways as may be required for access to Work.

1.8 PUBLIC TRAFFIC FLOW

.1 Provide and maintain competent signal flag operators, traffic signals, barricades and flares, lights, or lanterns as required to perform Work and protect the public.

1.9 FIRE ROUTES

.1 Maintain access to the property including overhead clearances for use by emergency response vehicles.

1.10 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY

.1 Protect surrounding private and public property from damage during the performance of the Work.

.2 Be responsible for damage incurred.

END OF SECTION

Part 1 General

1.1 SCOPE AND PURPOSE

.1 This section covers the requirements for the erosion and sediment control (ESC) plan.

.2 The purpose is to prevent loss of soil during construction by stormwater runoff and wind erosion, protect stockpiled topsoil, prevent sedimentation of stormwater and receiving streams and prevent pollution of the air with dust and particulate matter.

1.2 RELATED SECTIONS

.1 Section 31 22 13- Rough Grading

.2 Section 31 22 19– Finish Grading

1.3 REFERENCES

.1 OPSS 805 Temporary Erosion and Sediment Control Measures

.2 OPSS 1860 Geotextiles

.3 Town of East Gwillimbury Engineering Standards and Design Criteria, Section 10.4

.4 The Erosion and Sediment Control Guidelines from Urban Construction," issued by the Greater Golden Horseshoe Area Conservation Authorities

.5 EPA 832/R-92-005 - Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices, September 1992.

1.4 DEFINITIONS

.1 Erosion: Deterioration, displacement, or transportation of land surface by wind or water, intensified by land-clearing practices related to construction activities.

.2 Rain or Rain Storm: An event defined as causing the pooling of water on the road or other impervious surfaces.

.3 Sediment: Particulate matter transported and deposited as a layer of solid particles within a body of water.

.4 Snow Melt: An event in snow conditions when the temperature is above 0 degrees C or when environmental conditions cause snow on the ground to melt.

1.5 SUBMITTALS

.1 Provide requested information specified in Section 01 33 00.

.2 Provide within 7 days of the commencement of work.

.3 Application for Payment: Concurrent with each application, provide the following Inspection Log information:

.1 Weekly inspection record.

.2 Report damages or deficiencies and maintenance of erosion and sediment control measures.

.3 Identify and address standing rainwater or snowmelt conditions.

Part 2 Products

2.1 SILT FENCING

.1 Posts: Posts to support wire-backed sediment fence barriers shall be metal T-posts. Metal ties shall be used to secure the sediment fence to the metal T-posts.

.2 Geotextile: Geotextile for berm barriers and rock flow check dams shall be woven, Class II geotextile according to OPSS 1860. The filtration opening size (FOS) shall be no greater than 300 µm

.3 Wire Fencing: The wire fence used in wire-backed sediment fence barrier shall be 1.63 mm diameter galvanized steel fence with a 5 cm by 10 cm weave and a 0.91 m height.

2.2 CATCH BASIN SEDIMENT CONTROLS

.1 During construction, all catch basins shall be provided with sediment control, in accordance with the following requirements.

- Sediment Traps within the site: Catch basin sediment traps shall be provided for unpaved areas draining 2 hectares or greater and less than 4 hectares and shall be constructed in accordance with OPSS 805 Temporary Erosion and Sediment Control Measures and as indicated on Sediment Control Notes and Plans prepared by the consultant.
- Roadway Catch Basin Sediment Control Devices: all roadside catch basins shall be provided with sediment protection in accordance with OPSS 805 Temporary Erosion and Sediment Control Measures and as indicated on Sediment Control Notes and Plans prepared by the consultant.

2.3 MUD MAT

.1 A mud mat shall be constructed at the site entrance and exit leading onto any existing road. The stone pad shall be a minimum of 300mm thick, 15m long and 10m wide. The first 10m from the entrance/exit shall be constructed with 50mm clear stone. The remaining 5m shall be constructed with 150mm rip rap. The mud mat must be maintained as required given the site conditions to ensure mud tracking is kept to a minimum.

.2 The mud mat shall be located as indicated on Sediment Control Notes and Plans prepared by the consultant.

.3

Part 3 Execution

.1 Prevent cleared topsoil and excavated earth stockpiled on site from being eroded by a rain storm, snow melt or wind.

.2 Install silt fencing and mud mat at the construction entrance. The sediment control fence shall be constructed in accordance with OPSS 805 Temporary Erosion and Sediment Control Measures.

.3 Maintain silt fencing at a height indicted on contract drawings.

.4 Extend geotextile filter fabric 150 mm below grade, and return 150 mm towards the opposite direction of flow.

.5 Space posts not further than 1.8m apart.

.6 Limit the operation of vehicles on site to paved surfaces or temporary gravel surfaces in order to avoid disturbing the soil.

.7 All erosion and sediment controls should comply with the requirement of “The Erosion and Sediment Control Guidelines from Urban Construction,” issued by the Greater Golden Horseshoe Area Conservation Authorities.

3.2 MUNICIPAL STORMWATER

.1 Protect catch basins, drains, culverts and other points of entry into municipal stormwater collection systems.

.2 Each Week: Inspect for erosion and sediment control measures, to ensure proper functions are not damaged.

3.3 REMOVAL

.1 Temporary sediment control shall be removed, and associated excavations backfilled and compacted when the area being protected has been completely stabilized by final cover placement. When the final cover is vegetated and placement could not be advanced to allow the establishment and stabilization of the site prior to Contract Completion, temporary sediment control shall be left in place.

END OF SECTION

PART 1 - GENERAL

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL

.1 Read and conform to:

.1 the General Conditions and Supplementary Conditions of the Contract.

.2 Division 1 requirements and documents referred to therein.

1.3 BASIC PRODUCT REQUIREMENTS

.1 Where Specification requirements include design of a Product or system and minimum material requirements are specified, the design of such Product or system shall employ the materials specified within the applicable Section. Where materials or components are not specified, the Contractor shall augment materials with those of its choice within the applicable Code limitations while maintaining integrity of design and architectural requirements.

.2 Defective Products, whenever identified by the Consultant or Owner prior to completion of the Work will be rejected, regardless of previous reviews by the Consultant or a testing company. The Consultant's and/or Owner's review shall not be considered to be complete in every detail or exhaustive and shall also not relieve any Contractor, Subcontractor, Supplier, manufacturer, fabricator, or other third party of responsibility for any deficiency that may exist or for any departures or deviations from the requirements of the Contract Documents or of the responsibility to co-ordinate the Work, or portion of the Work, of one trade with another. The Contractor shall remove and replace defective and/or damaged Products at its own expense and be responsible for delays and expenses caused by the rejection Products. In addition to the foregoing, the Contractor shall also comply with the requirements of GC 2.3 – REVIEW AND INSPECTION OF WORK and GC 2.4 DEFECTIVE WORK of the General Conditions of the Contract.

.2 **Material, Equipment and Fixtures**

.1 Products employed in the Work shall be those which affect indoor air quality as little as possible. Provide adequate ventilation during installation of finishing materials to avoid effects on indoor air quality.

.2 Unless otherwise indicated in the Contract Documents, maintain uniformity of Product and manufacturer for any like item, material, equipment or assembly.

.3 **Toxic or Hazardous Substances and Materials**

.1 Products, materials and substances employed in the Work shall be free of mould amplification. In addition to the requirements specified herein, take special care while handling, storing and installing materials such as, without limitation, particleboard, plywood, cellulose materials, wallpaper, ceiling panels, gypsum boards and insulation with kraft paper back up.

.2 Product with visible or invisible signs of mould amplification, whether installed or not, shall be considered defective and shall be removed at the Contractor's expense. Retain a qualified and experienced bio-contamination investigator acceptable to the Consultant to conduct sampling and laboratory analysis and other required assessment steps to

determine whether or not materials are impacted by mould amplification and follow up recommended contamination management method. The Contractor shall pay for sampling and assessment costs if the Contractor causes the mould amplification. As a minimum requirement, conform to the New York City Department of Health and Mental Hygiene November 2008, "Guidelines on Assessment and Remediation of Fungi in Indoor Environments", and appropriate levels of requirements for mould removal.

.3 Ensure construction workers are not exposed to amplified moulds. Take every reasonable precaution in the circumstances for the protection of workers, as air movement and handling of contaminated material can release spores into the atmosphere which can cause adverse health effects. Mould metabolites, including mycotoxins, when in contact with skin or inhaled may irritate skin, eyes, nose and throat resulting in allergy-like symptoms such as difficulty in breathing, runny nose, watery eyes, fatigue, headache, asthmatic attacks and general 'flu' like symptoms.

.4 Do not permit workers with weakened immune systems to work in mould amplified areas as they may experience an increased risk of fungal infection. Follow work practices set out by Health Canada in "Fungal Contamination of Public Buildings: Health Effects and Investigation Methods". Conform to "New York City Department of Health & Mental Hygiene Bureau of Environmental & Occupational Disease Epidemiology 2000, Guidelines on Assessment and Remediation of Fungi in Indoor Environments" and appropriate levels of requirements for mould removal.

.5 Be familiar with Mould Guidelines for the Canadian Construction Industry standard construction document CCA 82, 2004.

.6 Where odourless Products are not available, Products shall be chosen, where possible, so odours are minimized within a one month gas-off period following installation at normal occupancy ventilation levels. Ventilation levels during the construction period shall be set sufficiently high to encourage the gassing off of materials to their minimum levels prior to occupancy of the building.

.7 Select Products for installation, especially within the air-handling and distribution systems, to minimize the introduction of pollutants into the fresh air supply to the building.

.8 With respect to the material, plant, equipment and fixtures specified in the Contract Documents, where more than one brand or manufacturer is named in the Specifications or on the Drawings, the Contractor shall use one of the specified manufacturers or brands (or equivalent) provided that the requirements of Drawings and Specifications are met.

.9 Ensure materials, plant, equipment and fixtures are not damaged or defective and of the quality specified in the Contract Documents and compatible for its intended purpose. If requested by the Consultant, provide evidence as to type, source and quality of any material, plant, equipment or fixture. The Contractor shall remove and replace defective Products, at its own expense, regardless of previous reviews, and be responsible for delays and expenses caused thereby. Replace factory finished equipment, or parts thereof, whose paint finish is damaged and cannot be reasonably remedied by paint touch-up.

.10 When conflict occurs between specified technical description and manufacturer's standard model numbers and/or manufacturer's printed description of given model number, the technical description specified in the Contract Documents shall govern. Have manufacturers make necessary modifications in its manufacturing methods to meet the requirements specified in the Contract Documents.

.11 Do not expose trademarks, labels and nameplates, including applied labels, in finished Work. Remove visible trademarks and labels except those which are giving operating instructions, which are essential to obtain identification of mechanical and electrical equipment for maintenance and replacement purposes, and as required for mandatory fire ratings.

.12 The Owner retains the right to select all choices available within specified Products colours, finishes, and other options unless specified otherwise in the Contract Documents.

.4 **Availability**

.1 Immediately upon signing the Contract, review Product delivery requirements and anticipate foreseeable supply delays for any items. If delays in the supply of Products are likely or possible, or Products are no longer available, or a specified manufacturer is no longer in business, notify the Consultant of such in order that substitutions or other remedial action may be authorized in ample time to prevent delay in the performance of the Work.

.2 Utilize Products which are specified in the Contract Documents by its proprietary names, by part, or catalogue number. No substitutes for the Products specified by its proprietary names, part or catalogue number shall be permitted without the Consultant's acceptance in writing.

.3 In the event of failure to notify the Consultant of a specific Product's unavailability at the commencement of the Work and should it subsequently appear that Work may be delayed for such reason, the Consultant reserves the right to substitute more readily available Products of similar character, at no increase in the Contract Price.

.4 No substitution of materials will be allowed for Products with long delivery times.

.5 **Mechanical & Electrical Location Drawings**

.1 Mechanical and electrical drawings indicate the approximate locations of mechanical and electrical items diagrammatically. Prior to installation, request and obtain the final locations and arrangement drawings for mechanical and electrical items. Allow the Consultant to adjust final locations within a 1500 mm (5') radius from the diagrammatic position indicated, without change to the Contract Price.

.2 Align and cluster devices and fitments neatly in accordance with the mounting heights specified in the Contract Documents, properly aligned horizontally and vertically.

.6 **Fire Rating**

.1 Where material, component or assembly is required to be fire rated, fire rating shall be determined on the basis of results of tests conducted in conformance with CAN/ULC-S101-M by one of following testing authorities acceptable to the Authorities Having Jurisdiction:

.1 Underwriters' Laboratories of Canada (ULC); www.ulc.ca
.2 Underwriters' Laboratories Inc. (UL); www.ul.com
.3 FM Global; www.fmglobal.com http://www.allendale.com
.4 National Research Council of Canada; www.nrc.ca
.5 National Board of Fire Underwriters; www.fireunderwriters.ca
.6 Warnock Hersey -ITS; www.etlsmeko.com

.2 Where reference is made to only one testing authority, an equivalent fire rating as determined or listed by another of aforementioned testing authorities is acceptable if approved by Authorities Having Jurisdiction. Obtain and submit to the Consultant such approval of authorities, in writing, when requesting acceptance of a proposed equivalent rating or test design.

.7 **Manufacturers' Written Instructions**

.1 Unless specified otherwise in the Contract Documents, use each Product in accordance with manufacturers' published written instructions regarding handling, storage, preparation, methods of installation, protection and cleaning. Take into account Site conditions and provide ancillary Products or accessories.

.2 Conform to the manufacturers' recommended installation temperatures. If finishes are installed at temperatures different from operation or service temperatures, make provisions

for expansion and contraction in service in a manner acceptable to the manufacturer and Consultant. Repair the resulting damage should expansion provisions prove inadequate.

.3 Notify the Consultant, in writing, of conflicts between Contract Documents and manufacturers' instructions so the Consultant may establish the course of action to be taken. If requested by the Consultant, make a copy of those instructions available at the Site.

.4 Improper installation or erection of Products, due to failure to comply with these requirements, shall require removal and re-installation at no increase in the Contract Price.

.5 Whenever specific reference to following the manufacturers' directions or instructions is made in the Specifications, upon request from the Consultant, submit to the Consultant copies of such directions or instructions for review before commencing such work.

.8 **Anchors and Fasteners**

.1 Supply the appropriate anchors, fasteners, accessories and adhesives required for fabrication and erection of Work.

.2 Unless specified otherwise in the Contract Documents, use exposed metal fastenings and accessories of the same texture, colour and finish as the Product being fastened.

.3 Use metal fastenings of the same material as metal component being fastened, or of metal which will not generate electrolytic action and cause damage to fastening or metal component under moist conditions. In general, use stainless steel or hot dip galvanized steel anchors occurring on or in exterior wall, slab or other exterior locations, unless a higher standard is indicated or specified in the Contract Documents. If anchors or fasteners will be exposed, use stainless steel anchors and fasteners.

.4 Fastening devices or adhesives shall be of appropriate type, used in sufficient quantity and in such manner as to provide positive, permanent fastening which will not shift, work loose or fail during occupancy of building due to vibration or other causes resulting from normal use of the building. Install anchors at sufficient spacing to provide the required load/stress carrying capacity. Do not use wood plugs.

.5 Lay out fastenings neatly, evenly spaced and aligned. Keep exposed fastenings to a minimum.

.6 Supply adequate instructions and templates and, if necessary, supervise installation where fastenings or accessories for any Section are required to be built into work of other Sections.

.7 Do not use fastenings which will cause spalling, cracking, or deformation or deterioration of material to which, or adjacent to which, they are being fastened.

.8 Do not use powder actuated fastening devices which are used in tension, without approval by the Consultant. Take stringent safety precautions when using powder actuated fastenings. Use only low velocity plunger-type devices.

.9 Use the specified adhesives (or, if not specified, those recommended by the manufacturers of the materials involved) compatible with materials to be joined, and effective in forming permanent joint of adequate strength.

.10 Use screws, nails, staples and other similar, driven fasteners suitable to materials to be joined and to conditions under which they are installed and used. Ensure, in finished work, that fasteners are appropriately sized to take durable hold under stress to be encountered without damage to, or weakening of, elements secured together. Ensure fastenings will not corrode or cause staining of exposed surfaces.

.11 Braze and solder to form durable connections of strength adequate to resist stresses to be encountered without deformation of the elements joined. Prepare base metals and use

methods and materials to ensure clean joints and to prevent staining, corrosion, discolouration, deformation or other damage to finished work.

.12 Weld in accordance with CSA W59-M for steel and in accordance with CSA W59.2-M for aluminum, unless specified otherwise in the Contract Documents. Have welding performed by companies that are certified operatives in accordance with CSA W47.1 or CSA W47.2-M.

.13 Provide accessory items or materials required, such as brackets, cleats, connectors, sealants, lubricants, cleaners, protection and similar items, whether specified or not in the Contract Documents, so that the Work is complete and shall perform as required.

.9 **Built in Items**

.1 Provide and coordinate the location of chases, slots and reglets including frames, sleeves, inserts, anchors, fasteners and bolts, forms and templates.

.10 **Barrier Free Design Requirements:**

.1 Conform to the requirements of the OBC and CAN/CSA B651 - 12, Accessible Design for the Built Environment.

.2 Barrier shall mean anything that prevents a person with a disability from fully participating in all aspects of society because of his or her disability, including without limitation:

.1 information or communication barriers (e.g., a publication that is not available in large print, or unavailability of text telephones in most public buildings, or unavailability of sign language interpreters, or insufficient signage, etc.);
.2 attitudinal barriers (e.g., assuming people with a disability cannot perform a certain task when in fact they can); and
.3 technological barriers(e.g. traffic lights that change before a person with a disability has time to cross the intersection).

.3 Employ and install the following, as required, to remove potential barriers: high contrast signage, Braille, tactile (raised numbers, words) and/or audio output alternatives to all signage such as elevator numbers, room numbers and washrooms signs; detectable tactile surfaces approaching stairs or changes in grade and high contrast horizontal strips at edge of each tread in a stairway. Provide 50 mm (2”) wide colour-contrasted strips extending full width of tread; strips by www.ecoglo.ca (or equivalent);

.4 Install switches, telephones, fire-alarm pull stations, washroom accessories and other equipment and devices requiring accessibility by building staff and public, excluding mechanical and electrical room installations, to meet barrier-free requirements. If there is conflict between this requirement and any other OBC requirement, notify the Consultant prior to installation;

.5 Ensure countertops conform to the requirements of CAN/CSA B651 1-12, Accessible Design for Built Environment.

1.4 PRODUCT DELIVERY, HANDLING AND STORAGE

.1 Package, crate and brace Products to prevent damage during delivery, storage and handling.

.2 Provide protection to existing surfaces, finished surfaces and work of others to prevent damage during delivery, storage and handling.

.3 Store packaged materials in original, undamaged condition with manufacturers' labels and seals intact.

.4 Handle and store materials in accordance with the manufacturers' and suppliers' recommendations, in protected locations.

.5 Store materials susceptible to environmental damage in weather-tight enclosures, raised clear of the ground and protected from weather, dampness and deterioration.

.6 Store and mix paints in a single designated, heated and ventilated room. Remove oily rags and other combustible debris from the Place of the Work daily. Take every precaution necessary to prevent spontaneous combustion.

.7 Replace Products damaged during delivery to the Place of the Work, storage, handling or installation.

.8 Conform to written procedures for safe handling, storage and use of noxious and hazardous materials including special precaution, safe clean-up and disposal procedures. Conform to the environmental protection requirements under the OBC.

.9 **Flammable and Toxic Materials**

.1 Enforce and maintain fire prevention methods at the Site in accordance with the requirements of the Authorities Having Jurisdiction. Follow proper safety precautions when employing and storing flammable and toxic materials. Do not permit the accumulation of debris.

.2 Do not store flammable and toxic materials in the building. Take measures to prevent spontaneous combustion. Place clothes and other disposable materials which are fire hazards in closed metal containers and remove them from the building on a daily basis.

.3 Provide adequate ventilation where flammable and toxic materials are being applied; use only spark proof equipment during application; prohibit smoking and open flames during application.

.4 Do not dispose of volatile fluid wastes in storm or sanitary sewers or open drainage courses.

.5 Do not store materials on the roof which could be subject to falling or blowing off of the roof as result of wind which could cause damage to property and jeopardize public safety.

1.5 CONCEALMENT OF SERVICES

.1 Conceal pipes, service lines and ducts in chases, behind furring or above ceilings, except where they are indicated as being exposed to view on the Contract Drawings. Where no ceiling is provided, such items may be exposed but must be neatly and logically arranged.

END OF SECTION

PART 1 - GENERAL

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL

.1 Read and conform to:

.1 the General Conditions and Supplementary Conditions of the Contract.

.2 Division 1 requirements and documents referred to therein.

1.3 EXAMINATION

.1 **Mobilization**

.1 After the start-up meeting and before submitting the first billing application, submit a list of major Subcontractors and Suppliers and tentative construction progress schedules; establish submission schedules, long term delivery items and designation of responsible personnel.

.2 Verify and confirm the location of the Work, temporary office and storage areas with the Consultant.

.3 Verify the construction facilities, controls, temporary hoarding, dust partitions, parking, hours, noisy work, interruption of services, smoking, cell phone usage and construction aids.

.4 Verify temporary utilities, safety and first-aid procedure, security procedures, and housekeeping procedures.

.2 **Acceptance of Conditions**

.1 Examine the Site, at no cost or risk to the Owner, for all matters relating to the Work, extent of Work, means of access and egress, all obstacles, rights and interests of other parties which may be interfered with during execution of the Work, all conditions and limitations the Contractor ought reasonably to take into consideration in performing the Work, including obstructions, existing structures or facilities, local conditions, actual levels, character and nature of Project, and any other consideration which may affect performance of the Work.

.2 Examine existing Site conditions at no additional cost to Owner, surfaces and substrata upon which the Work depends. Drawings are, in part, diagrammatic and are intended to convey the scope of the Work and indicate general and approximate location, arrangement and sizes of fixtures, equipment, ducts, piping, conduit and outlets and similar items. Obtain more accurate information about locations, arrangement and sizes from study and coordination of Drawings, including Shop Drawings and manufacturers' literature and become familiar with conditions and spaces affecting these matters before proceeding with the Work.

.3 **Existing Services and Operations**

.1 Make necessary enquiries to determine the locations of existing services such as, but not limited to, hydro, telephone, water, natural gas, and sewer. Temporarily relocate, shore, underpin or in any way accommodate existing services which affect the Work.

.2 Should any piping, sewers, cables, or similar services be encountered during the Work that are not known from the Owner's and utilities companies' records, Contract Documents or tender documents, notify the Consultant and do not proceed with removal or cutting until directed to do so by the Consultant.

.3 Protect and maintain in operation all existing services and systems. When removing or altering existing services, make safe, secure and maintain seals as applicable for all lines affected.

1.4 PREPARATION

.1 General Preparation Requirements

.1 Provide shoring, bracing, and related supports to maintain the integrity of the structural components of the Work.

.2 Provide protection to adjacent work and obtain Consultant’s approval regarding adequacy and type of protection provided.

.3 Provide protection from ambient temperature and other elements where working outside and at building envelope items.

.2 Planning, Scheduling & Coordination Requirements

.1 Plan and schedule the Work to accommodate anticipated difficulties, indicated on and inferable from the Contract Documents.

.2 Co-ordinate the Work with Subcontractors and Other Contractors and proceed with the Work expeditiously.

.3 Existing Utility Services

.1 Before commencing the Work, establish the location and extent of existing services in the area of the Work and notify Consultant of any anomalies.

.2 If unknown services are encountered, immediately notify the Consultant and confirm findings in writing. Obtain the Consultant's written direction if such services require cutting, capping or relocation.

1.5 EXECUTION

.1 Existing Conditions

.1 Make good surfaces and finishes damaged or disturbed due to the Work to match the existing surfaces and finishes. Ensure that the materials used to repair damage are compatible with the existing work.

.2 Restore lands outside of limits of Work which are disturbed due to the Work, to its original condition.

.2 Installation

.1 Except if otherwise specified in the Contract Documents, use each Product in accordance with the manufacturers’ published or written instructions, Specifications or recommendations regarding handling, storage, preparation, Site conditions, ancillary Products or accessories, methods of installation, protection and cleaning. Submit a copy of such instructions to the Consultant and indicate if and where there is discrepancy between the instructions and requirements of the Specifications and obtain direction.

.2 Whenever specific reference to following the manufacturers’ directions or instructions is made in the Specification Sections, submit copies of such directions or instructions to the Consultant as requested thereof for review before commencing such work.

.3 Execute the Work in accordance with industry practice for the type of Work unless Contract Documents stipulate more precise requirements. Do not let unskilled or incompetent workers perform the Work.

.4 Execute the Work in a neat and careful manner to retain the Work plumb, square, and straight.

.5 Ensure the Work is properly related to form close joints and appropriately aligned junctions, edges and surfaces and is free of warp, twist, wind, wave or other irregularities.

.6 When required by the Specification Sections or manufacturers' recommendations, have the manufacturer, supplier or accredited agent, inspect their Products.

.7 Load no part of the structure during construction with a load greater than it is calculated to bear safely when completed. Make every temporary support as strong as the specified permanent support. Place no load on a concrete structure until it has sufficient strength to safely carry such load.

.8 Conceal pipes, ducts, conduits, tubing, wiring and other items requiring concealment in the floor, wall and ceiling construction of finished areas except where indicated or specified otherwise in the Contract Documents. If in doubt as to method of concealment, or intention of Contract Documents, request clarification from the Consultant before proceeding with the work in question.

.9 Install and arrange fixtures, equipment, ducts, piping and conduit to conserve as much headroom and space as possible, and avoid interference and obstruction of access. Observe good installation practice for safety, access, maintenance and follow the manufacturers' recommendations. The location of fixtures, access panels, outlets and mechanical and electrical components indicated on the Contract Drawings are approximate. Make changes to comply with these requirements at no additional cost to the Owner.

.10 If requested by the Consultant, and before their installation, relocate equipment, services, doors, openings, furring and other work at no additional cost to the Owner provided such relocation involves only reasonable minor adjustments and reasonable advance notice is given in writing by the Consultant. Ensure the identification of electrical and mechanical system installations and other automated systems or equipment is provided in accordance with the Contract Documents.

.11 Lay out mechanical and electrical work in advance of concrete placement and furring installation to allow for its proper concealment.

.12 Test and inspect service piping before applying covering and before work is concealed.

.3 **Snow Removal**

.1 Allow no accumulation of ice and snow on Site and on roof deck when roofing operations are scheduled to take place.

.2 Be responsible for general clearing of snow from access roads within the Site, Site circulation paths, at hoarding, Contractor's parking areas and elsewhere as required to permit access to the Work, parking and uninterrupted construction progress.

.3 Maintain trailer area, storage areas as well as the Work areas of this Contract free of ice and snow in order to maintain the progress of the Work. Place cleared snow in areas on Site as directed by the Consultant.

.4 Remove ice and snow from the Site and from the roof deck when roofing operations are in session.

.5 Be responsible to keep access road and circulation paths accessible during a snow fall. Remove snow as necessary to prevent the interruption of the Work in progress until completion of the Work.

1.6 SYSTEMS STARTING AND ADJUSTING

.1 **Trial Usage and Instructions**

.1 Thoroughly instruct the Owner's authorized representatives in the safe operation of systems and equipment after installation and prior to Substantial Performance of the Work. Coordinate with the Consultant and arrange schedule for instruction times. Ensure that operating and/or maintenance documents have been submitted to Consultant prior to demonstration. Submit a commissioning schedule to the Consultant a minimum of 4 weeks prior to the commissioning of each system.

.2 Arrange and pay for the services of qualified service engineers and manufacturers' representatives to instruct the Consultant on specialized portions of installation, such as refrigeration machines, boilers, automatic controls and water treatment.

.3 Submit a complete record of instructions as part of the maintenance instructions and data book to be given to the Consultant. For each instructional period, supply the following data:

.1 date;
.2 system or equipment involved;
.3 names of persons giving instructions;
.4 names of persons being instructed; and
.5 other persons present.

.4 Schedule instructional periods during a 30 Day period not more than 2 Days/week, unless otherwise agreed with the Consultant.

.5 Permit the Consultant trial usage of the systems or parts of systems for purpose of testing and learning operational procedures. Trial usage shall not affect warranties nor be construed as acceptance of the systems, and no claim for damage shall be made against the Consultant for any injury or breakage to any part or parts of systems due to the aforementioned tests, where such injuries or breakage are caused by a weakness or inadequacy of parts, or by defective materials or quality of performance of any kind.

.6 Obtain and submit to the Consultant a statement signed by the Owner's representatives stating they understand system and equipment installation, operation and maintenance requirements.

.7 Obtain and submit to the Consultant letters from the manufacturers of equipment and systems indicating that their technical representatives have inspected and tested systems and have approved methods of installation, connections and operation. Arrange all necessary inspections and approvals.

1.7 PROTECTING INSTALLED CONSTRUCTION

.1 Protection of Work During Construction

.1 Provide continuous protection to public, Work, Owner's property and adjacent property during construction. Protect the work of other trades from damage while performing subsequent work.

.2 Protect finished flooring from damage. Make special efforts and take measures when moving heavy loads or equipment over finished flooring. Keep floors free of oils, grime, grease or other materials likely to discolour the flooring or affect the bond of applied surfaces.

.3 Adequately protect floors and roofs from damage. Take special measures when moving heavy loads or equipment over them.

.4 Make good any damaged Work.

.5 Protect glass and other finishes against heat, slag and weld splatter using suitable protective shields or covers.

.6 Provide and maintain in working order, suitable underwriters' labelled fire extinguishers and locate in suitable positions, to the approval of Authorities Having Jurisdiction.

.7 Protect the public and those employed to perform the Work from injury. Equipment (mobile), when not in use, shall have keys removed and locked up in a secure location.

.8 Secure the Site, premises, and materials at all times.

.2 Correction after Completion: In conformance with the General Conditions of the Contract, make good any defects and deficiencies due to faulty materials or quality of performance that become apparent in the Work within 12 months from the date of the Certificate of Substantial Performance or for such longer period for certain Products as specified in the Contract Documents. Conform to the requirements of General Conditions of the Contract and provide a warranty for a 12 month period and for extended periods where applicable, in writing ,in an approved form acceptable to the Consultant and signed by an authorized official of the Contractor.

1.8 CLEANING

.1 Progress Cleaning:

.1 Keep access areas to the Work in a tidy condition, free from the accumulation of waste products and debris during construction and on completion of the Work, other than any waste or debris caused by the Owner’s crew or Other Contractors.

.2 Keep the Site and building, including concealed spaces, free from the accumulation of dirt, debris, garbage and excess material. Remove oily rags and waste from the premises at the close of each Working Day, or more often if required by the Consultant.

.3 Remove waste material and debris from the Site at the end of each Working Day. Remove from finished surfaces any deposits which could stain, harden, set or become difficult to remove.

.4 Remove rubbish and surplus materials promptly and dispose of in a legal manner. Do not allow scrap piles to accumulate. Do not permit fires.

.5 Lower waste materials in a controlled manner with minimum handling; do not drop or throw materials from heights. Schedule cleaning operations so dust and other contaminants resulting from the cleaning process will not fall on wet, newly painted surfaces. Sprinkle dusty debris with water.

.6 Sweep adjacent roads and sidewalks daily to remove dirt and clods of earth deposited on adjacent public and private properties by construction traffic.

.7 Vacuum-clean interior areas prior to the commencement of finishing work and maintain areas free of dust and other contaminants during finishing operations.

END OF SECTION

Part 1 - General

1.1 RELATED REQUIREMENTS

.1 Section 01 35 43 Environmental Procedures

.2 Section 31 00 99 Earthwork for Minor Work

1.2 REFERENCE STANDARDS

.1 Not Used

1.3 QUALIFICATIONS OF SURVEYOR

.1 Qualified registered land surveyor, licensed to practise in Place of Work, acceptable to the Consultant.

1.4 SURVEY REFERENCE POINTS

.1 Existing base horizontal and vertical control points are designated on drawings.

.2 Locate, confirm and protect control points prior to starting site work. Preserve permanent reference points during construction.

.3 Make no changes or relocations without prior written notice to the Consultant.

.4 Report to the Consultant. When reference point is lost or destroyed or requires relocation because of necessary changes in grades or locations.

.5 Require surveyor to replace control points in accordance with original survey control.

1.5 SURVEY REQUIREMENTS

.1 Establish two permanent bench marks on site, referenced to established bench marks by survey control points. Record locations, with horizontal and vertical data in Project Record Documents.

.2 Establish lines and levels, locate and lay out, by instrumentation.

.3 Stake for grading, fill and landscaping features.

.4 Stake slopes and berms.

.5 Establish pipe invert elevations.

.6 Stake batter boards for foundations.

.7 Establish foundation column locations and floor elevations.

.8 Establish lines and levels for mechanical and electrical work.

1.6 EXISTING SERVICES

.1 Before commencing work, establish location and extent of service lines in area of Work and notify the Consultant of findings.

.2 Remove abandoned service lines within 2m of structures. Cap or otherwise seal lines at cut-off points as directed by the Consultant.

1.7 LOCATION OF EQUIPMENT AND FIXTURES

.1 Location of equipment, fixtures and outlets indicated or specified are to be considered as approximate.

.2 Locate equipment, fixtures and distribution systems to provide minimum interference and maximum usable space and in accordance with manufacturer's recommendations for safety, access and maintenance.

.3 Inform the Consultant of impending installation and obtain approval for actual location.

.4 Submit field drawings to indicate relative position of various services and equipment when required by the Consultant.

1.8 RECORDS

.1 Maintain a complete, accurate log of control and survey work as it progresses.

.2 On completion of foundations and major site improvements, prepare a certified survey showing dimensions, locations, angles and elevations of Work.

.3 Record locations of maintained, re-routed and abandoned service lines.

1.9 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit name and address of Surveyor to the Consultant.

.2 On request of the Consultant, submit documentation to verify accuracy of field engineering work.

.3 Submit certificate signed by surveyor certifying and noting those elevations and locations of completed Work that conform and do not conform with Contract Documents.

1.10 SUBSURFACE CONDITIONS

.1 Promptly notify Consultant in writing if subsurface conditions at Place of Work differ materially from those indicated in Contract Documents, or a reasonable assumption of probable conditions based thereon.

.2 After prompt investigation, should Consultant determine that conditions do differ materially, instructions will be issued for changes in Work as provided in Changes and Change Orders.

END OF SECTION

PART 1 - GENERAL

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL

.1 Read and conform to:

.1 the General Conditions and Supplementary Conditions of the Contract.

.2 Division 1 requirements and documents referred to therein.

1.3 CLOSEOUT PROCEDURES

.1 The Consultant will perform a final review in accordance with GC 5.4 – SUBSTANTIAL PERFORMANCE OF THE WORK, GC 5.5 – PAYMENT OF HOLDBACK UPON SUBSTANTIAL PERFORMANCE OF THE WORK and GC 5.7 – FINAL PAYMENT of the General Conditions of the Contract. Conform to the *Construction Act* (Ontario) for the procedures related to the retention and release of the holdback funds.

.2 **Takeover Procedure**

.1 Conform to the requirements of the following conditions for take-over procedure:

.1 Comply with recommended takeover procedures contained in OAA/OGCA Document No. 100, except as modified by the Contract Documents.

.2 Provide a written notification to the Consultant for requesting review of the Work for confirmation that Substantial Performance of the Work has been achieved in accordance with the *Construction Act* and submit all required documents.

.3 Provide a written request to the Consultant for a deficiency review of the Work. Such request shall include a statement by the Contractor that Work has been completed in compliance with Contract Documents.

.3 **Defect and Deficiency**

.1 Neither the Owner's representatives nor the Consultant will be responsible for the issuance of deficiencies lists. The Contractor assumes the prime responsibility for ensuring items shown on the Drawings and described in Specifications are complete.

.2 Promptly correct the deficiencies noted by the Consultant. Do not proceed with the installation of subsequent parts of the Work until deficiencies have been corrected. Make good all defects and deficiencies prior to final inspection of the Work.

.3 During inspection, a decision will be made as to which elements must be completed at a later date due to uncontrollable circumstances such as weather, which defects must be rectified before the building can be accepted, and which defects are to be treated as warranty items.

.4 Advise the Consultant in writing upon the completion of rectification of deficiencies. Failure to provide such notification may be cause to withhold final payment.

.4 **Documents**

.1 Submit documents in accordance with the requirements of the Contract Documents.

.2 Submit the required documents along with the request for certification of Substantial Performance of the Work. The Consultant's inspection for Substantial Performance of the Work is not required until such submittal is received.

1.4 CLEANING

.1 Final Cleaning

.1 Prior to occupancy, clean the Place of the Work thoroughly, free of rubbish and surplus material. Dispose of rubbish and debris. Vacate the Place of the Work in a clean and tidy condition satisfactory to the Consultant.

.2 Prior to cleaning, submit to the Consultant a complete list of manufacturers' cleaning/ maintenance instructions for all components of the Work.

.3 Final finishing is in addition to and compatible with cleaning and finishing specified in the Specification Sections.

.4 Clean new and existing components in accordance with the manufacturers' recommendations.

.5 For tile flooring:

.1 Sweep floor free of debris, clean corners and base boards free of marks and dirt, scrub new flooring using appropriate solutions to remove factory installed protective coatings, apply two coats of sealer recommended by the manufacturer of flooring materials to new flooring and let the floor completely dry between coats, using Products approved by the Consultant.

.6 For carpet:

.1 Vacuum carpet flooring using power brush equipped vacuum cleaner, removing stains using stain removal methodology approved by the Consultant; and
.2 Where carpet is exposed to extensive dry wall dust and other fine dust particles, lift carpet pile using rotary pile lifting machine. In addition, carpet shall be cleaned using an extraction method approved by the manufacturer.

.7 Remove dust and all marks from:

.1 walls;
.2 ceilings;
.3 window coverings;
.4 doors;
.5 windows and frames;
.6 exposed interior and exterior glazed surfaces;
.7 hardware;
.8 mechanical and electrical fixtures and equipment; and
.9 all metals.

.8 At the Place of the Work, outside of the building envelope, remove debris, rake sod and sweep sidewalks and pavement.

.9 Use experienced professional cleaners for final cleaning. Use only cleaning materials recommended by the manufacturer of the surface to be cleaned.

.10 Final cleaning includes, without limitations, the requirements specified in this Section and the removal of surplus materials, tools, construction machinery and equipment from Site. Carry out final cleaning in accordance with the manufacturers' instructions for each material and in accordance with the applicable Specification Sections.

.11 Remove stains, spots, marks, dust and smudges caused by work within the Work areas of this Contract from decorative work, electrical and mechanical fixtures, furniture fitments, walls, ceiling and floors. Vacuum, clean and buff resilient flooring.

.12 Clean and polish interior and exterior glass, windows, entrances, skylights, mirrors, hardware, wall tile, stainless steel, chrome, porcelain, baked enamel, plastic laminate, mechanical, plumbing fixtures and electrical fixtures.

.13 Vacuum clean and dust building interiors, behind grilles, louvres and screens. Vacuum clean ducts, fans, blowers and coils if units were operated without filters during construction.

.14 Broom clean and wash interior as well as exterior walks, paved surfaces, concrete floors, steps and other similar surfaces.

.15 Replace broken, damaged, disfigured or scratched glass and mirrors, which are part of the Work.

.16 Close rooms and areas finished by cleaners, painters and decorators to all but authorized persons.

.17 Upon completion of final cleaning, remove cleaning equipment, excess materials and debris from building and Site.

1.5 CLOSEOUT SUBMITTALS

.1 **Certificate of Substantial Performance**

.1 Conform to the *Construction Act* (Ontario) and publish a copy of the Certificate of Substantial Performance, once, in a construction trade newspaper; and

.2 Promptly submit copies of the construction trade newspaper containing the publication of the copy of Certificate of Substantial Performance to the Consultant.

.2 As-Built Documents:

.1 Prior to applying for the Certificate of Substantial Performance, provide an electronic set of as-built Drawings to the Consultant. Submit final reviewed As-Built Drawings and Specifications on electronic disk, and in a set of white prints in the following formats:

.1 1 set in AutoCAD v. 2014 minimum format;
.2 1 set in PDF format; and,
.3 1 set of white prints of Drawings and Specifications.

.2 Electronic formats of Drawings and Specifications are to be submitted on USB flash drive.

.3 Electronic copies of the Contract Documents may be obtained from the Consultant if necessary. These Drawings may not include changes issued as Addenda, Supplemental Instructions or Change Orders. The Consultant assumes no responsibility for the completeness of the Drawings and inclusion of instructions and details issued during the construction period.

.4 Print lettering and numbers in size to match original. Lines may be drawn free hand provided they are neat and accurate. Add "AS-BUILT RECORD" at each drawing title block and on the title page of the Specification Sections.

.5 Be responsible for:

.1 maintaining As-Built Drawings during progress of the Work, in complete sets, at the Place of the Work;
.2 including additional changes over and above those included in any addenda, Supplemental Instructions and Change Orders;
.3 recording the following changes and deviations on As-Built Drawings:

.1 depths of various elements of foundation in relationship to first floor level;
.2 field changes of dimensions; and
.3 other significant deviations and changes which are concealed in construction and cannot be identified by visual inspection.

.4 showing the actual locations of the following on as-built Drawings:

.1 access doors and panels;
.2 inverts of services at key points within building, at points where entering and leaving building, and at property lines;
.3 services dimensions in relation to structure and building grid lines;
.4 duct work, piping, conduit, mechanical and electrical equipment and associated the Work; and
.5 concealed piping, conduit, equipment and conveying systems, including such items provided for future use.

.5 ensuring As-Built Drawings shall include construction, fixed equipment, and mechanical and electrical systems installed or built. Drawings shall include a life safety plan for each floor including, but not limited to, the following:

.1 exit signage;
.2 fire extinguishers;
.3 fire alarm devices;
.4 pull stations;
.5 sprinkled areas;
.6 conformance to NFPA 101 requirements;
.7 changes recorded in a manner consistent with original Drawings.
.8 removal of outline clouds and notations from Drawings; and
.9 incorporation of any review comments made by Consultant;

.6 ensuring printed copies of As-Built Drawings and Specification Sections are available for inspection at all times as the Work progresses.

.3 **Operation and Maintenance Data**

.1 Provide the Consultant with three sets of operating and maintenance instructions and data books, a minimum of 10 Days prior to advising the Consultant that the Work is substantially performed, including:

.1 complete listing of materials, Products and equipment including serial numbers, manufacturer's names and sources of supply;
.2 description of each system and of each major component of systems;
.3 operation and installation instructions for each assembly, component and system;
.4 complete cleaning and maintenance instructions for each finish, assembly, component and system, including warnings of harmful practices;
.5 lists of spare parts for each assembly, component and system complete with names, addresses and telephone numbers of Suppliers;
.6 operating curves of mechanical and electrical equipment;
.7 a lubrication schedule of all equipment;
.8 page-size valve tag schedule and flow diagrams;
.9 water treatment procedures and tests;
.10 final balancing reports for mechanical systems;
.11 installation manual or installation instructions for each mechanical, electrical or architectural item, stamped and signed by the Subcontractors submitting them;
.12 As-Built Drawings of mechanical, electrical and special installations;
.13 final reviewed Shop Drawings; and
.14 copies of all warranties, properly executed.

.2 Provide books consisting of 3-ring hard cover, loose-leaf binders, indexed as to contents and identified on binding edges as "Operation and Maintenance Data, for York Regional Police No. 1 District Headquarters" and include the following:

.1 title sheet, labelled " Operation and Maintenance Data ", containing Project name and completion date;
.2 list of contents;
.3 complete listing of installing Subcontractors' names, addresses and telephone numbers with notation as to which portions of the Contract have been provided by them for future repair or maintenance;
.4 schedule of finishes (as-built) listing paints, colours and fabrics provided.
.5 Refer to Divisions 21, 22, 23 and 26 for supplementary requirements.
.6 Provide maintenance instructions as required by the Contract Documents.
.7 Ensure binders contain the name of the Contractor and date of Substantial Performance of the Work.
.8 Submit all “Operation and Maintenance Data” in PDF format compatible with Adobe Acrobat 5.0 on DVD disc clearly marked and labeled accordingly.
.9 Organize and label contents into applicable categories of the Work, parallel to the Specification Sections and include a table of contents.
.10 Use consistent terminology in books.

.3 Submit maintenance and operation data which are the manufacturer's latest published editions at the date of submission. Include the following:

.1 data books and literature;
.2 instructions in plain English to guide the Owner in the proper operation and maintenance of building components;
.3 maintenance instructions, specifying warnings of any maintenance practice that may damage or disfigure specified Products;
.4 operational information on Products, cleaning and lubrication schedules, filters, overhaul and adjustment schedules and similar maintenance information;
.5 recommended maintenance materials; and

Organize the contents into applicable categories of the Work, numbered to match the Specification Section numbering system. Insert tabs between each Specification Section.

.4 Should any finish, Product or assembly be injured or damaged by faulty maintenance materials, practices not warned against in maintenance manual or by failure to deliver proper maintenance manuals in time, promptly rectify such damage or injury at no additional cost to the Owner.

1.6 DEMONSTRATIONS FOR OWNER’S PERSONNEL

.1 Provide qualified technicians to demonstrate operation and/or maintenance of systems to the Owner’s staff.

1.7 MISCELLANEOUS CLOSEOUT SUBMITTALS

.1 Submit:

.1 hard copies and PDF files of closeout documentation compatible with Adobe Acrobat 5.0 on USB flash drive to the Owner;

.2 keys, passwords, licenses, security tools;

.3 hydro certificate, Electrical Safety Authority (ESA) certificates and similar certifications;

.4 one valve directory, framed behind glass and installed in main mechanical room;

.5 electrical panel directories, inside panels;

.6 one electrical riser diagram, framed behind glass and mounted; and

.7 final certified survey by an Ontario land surveyor.

1.8 END OF WARRANTY PERIOD INSPECTION

.1 At the beginning of the 12th month after Substantial Performance of the Contract, in accordance with the Contract Documents, the Owner, Contractor and Consultant, along with key Subcontractors as designated by the Consultant, shall carry out a complete inspection of the building and its systems to determine which deficiencies are to be rectified under warranty.

1.9 WARRANTY PERIODS

.1 Where equipment includes extended warranty periods (e.g. 5 years) the first year of the warranty period is to be governed by terms and conditions of the standard one year warranty prescribed by the General Conditions of the Contract and the remaining years of the warranty period shall be administered directly by the equipment manufacturer and/or supplier. Submit signed and dated copies of extended warranties to the Consultant.

.2 Warranties are to include parts, labour, travel costs and living expenses incurred by manufacturer’s authorized technician to provide factory authorized on-site service.

.3 Repair and/or replace any defects that appear in the Work within the warranty period without additional expense to the Owner. Be responsible for costs incurred in Making Good defective work, including repair or replacement of building finishes, other materials, and damage to other equipment. Ordinary wear and tear and damage caused wilfully or due to carelessness of Owner’s staff or agents is exempted.

.4 Do not include Owner deductible amounts in warranties.

.5 It is understood that warranties are to commence from time of Substantial Performance of the Work, regardless of what is noted within following Sections of Specification. Be responsible for providing whatever "bridging" or additional extended warranty period is required from time that material is purchased until this time.

.6 Visit building during warranty period with Owner representatives. Owner to organize these visits. At these meetings, Owner representatives are to review performance of systems. If performance is satisfactory, then no further action needs to be taken. If unsatisfactory, then correct deficiencies, as directed by Owner representatives, to satisfaction of Owner's representatives. These site visits to occur:

.1 once during 1st month of building operation;

.2 once during 3rd month of building operation;

.3 once between 4th and 10th month in a season opposite to 1st and 3rd month visits.

END OF SECTION

Updated through ADD#8

PART 1 - GENERAL

1.1 PRICING

.1 All costs associated with the work required by this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL INSTRUCTIONS

.1 Read and conform to:

.1 the General Conditions and Supplementary Conditions of the Contract.

.2 Division 1 requirements and documents referred to therein.

1.3 SUMMARY

.1 Work Included: Provide labour, materials, products, equipment and services to complete the exterior enclosure performance and testing work specified herein. This includes, but is not necessarily limited, to:

.1 Below-grade construction, including foundation walls and slabs-on-grade.

.2 Above-grade construction, including:

.1 exterior opaque wall materials and assemblies;

.2 roofing systems, including steep-slope and low-slope roofing;

~~.3 outdoor plazas, planters and plaza paving systems and assemblies over occupied spaces; and~~

~~.4~~.3 openings and glazed assemblies including windows, doors, ~~curtain wall~~ and ~~sloped glazing systems~~skylights.

.3 Interface and penetration conditions (flashings, expansion joints and sealants) between each of the materials, components and systems that comprise the above and below-grade building exterior enclosure.

.2 This Section includes the general design and performance requirements for the work of Sections which comprise the building enclosure portion of the Work. The requirements specified in this Section shall be read in conjunction with other requirements specified in Contract Documents.

.3 This Section also outlines the process for independent, third-party verification that the installed performance of the building enclosure meets or exceeds the minimum performance requirements stipulated in the Contract Documents for this Project.

.1 Provision of inspection and testing services do not relieve Contractor of responsibility for compliance with Contract Document requirements.

.2 Specified inspections, tests, and related actions do not limit Contractor's quality-control procedures that facilitate compliance with Contract Document requirements.

.3 Use of testing to discover deficiencies will not be permitted where Contractor's quality-control procedures would make these tests unnecessary.

1.4 REFERENCES

.1 The following definitions apply to this Section:

.1 "Post-Disaster Building": means a building that is essential to provision of services in event of a disaster. This facility is classified as post disaster as defined in the OBC.

~~.2 "Operational and Functional Component" and "OFC": means components within building which are directly associated with the function and operation of the facility. OFCs consist of architectural components, building services components, and building contents. Items specified herein may be designated as OFCs and may need to be designed in accordance with performance requirements specified herein and in Section 13 48 50.~~

.3.2 "Building Envelope" and "Building Enclosure": means the part of the building that physically separates the exterior environment from the interior environment. It includes above-grade walls and openings, below-grade walls, roofs, and the various components and accessories used to achieve continuity and physical connections and transitions between various assemblies.

.4.3 "Air Barrier Assembly": means a collection of Air Barrier Materials (i.e. self-adhered sheet air barriers, liquid applied membranes, medium density sprayed polyurethane foam, mechanically fastened commercial building wraps and boardstock air barriers) and Air Barrier Accessories (i.e. sealants, tapes and transition membranes) assembled together to form a continuous barrier to air infiltration into the environmental separator.

~~.5 "Air Barrier Material": means a primary material that controls the movement of air into and out of a building.~~

~~.6 "Air Barrier Accessory": means the materials or products which are used to connect different Air Barrier Materials to form a continuous air barrier assembly.~~

~~.7 "Vapour Barrier": means material or system within the building construction assembly that impedes water vapour transmission to less than 72 ng/(s-sq.m-Pa) when tested in accordance with ASTM E96 to prevent the accumulation of moisture having potential to cause deterioration of the Building Enclosure.~~

.8.4 "Testing with Sealed Openings": means testing with intentional openings sealed means that mechanical openings are purposely closed off. Mechanical systems that are intended to be sealed with dampers are only be sealed by closing the damper, with no additional sealing provided. Windows and doors are left in the closed and locked position.

.9.5 "Enclosure-Only Testing": similar to sealed openings approach, except all mechanical penetrations are temporarily masked to completely prevent air leakage through them.

.2 Reference Standards: Latest published editions of reference standards listed in this Section in effect as of the closing date and time of the Request for Tenders for the Contract, including any amendments adopted, are applicable unless otherwise indicated.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meetings: arrange pre-installation meetings attended by third-party inspection and testing company, Consultant, and Subcontractors whose work is directly associated with or impacted by Building Enclosure activities prior to starting work on the Building Enclosure.

.1 Quality Management Plan: review Contractor's quality control plan, and confirm that approaches to quality control and quality assurance procedures are coordinated with third-party inspection and testing company monitoring and testing requirements.

.2 Document and Product Review: review Contract Documents and confirm compatibility between overlapping and adjacent components supplied and installed by multiple parties who are contributing different Products associated with the assembly of the Building Enclosure.

.2 Scheduling: Schedule construction of sample panels and mock-ups, and associated pre-construction testing thereof to account for site-specific installation conditions. Ensure sufficient time is accounted for to permit corrections to proposed construction methods without negatively impacting the Construction Schedule.

.3 Role of the Consultant: Consultant is the registered professional of record and is responsible for responding to the Owner's stated project requirements and providing statements of compliance to the Authorities Having Jurisdiction indicating that the objectives of building code functional statements for Building Enclosure performance are met.

.1 Consultant will rely on third-party inspection and testing company reports in conjunction with the Contractor's field quality control reports to provide opinion on Building Enclosure performance.

.4 Role of the third-party inspection and testing company: Owner will engage third-party inspection and testing company acceptable to Owner and Consultant that specializes in Building Enclosure testing, and that has documented experience with construction of similar extent and complexity as that required for the Project.

.1 Third-party inspection and testing company will schedule and arrange testing during construction of the Building Enclosure and provide observation during installation of Building Enclosure components in accordance with their contract with Owner.

.2 Third-party inspection and testing company must assist in establishing best-practice installation procedures for Products forming the Building Enclosure.

.3 Third-party inspection and testing company must assist in establishing methods for corrective action where site conditions or actual installation result in non-conforming Building Enclosure performance.

.4 Third-party inspection and testing company will perform testing as directed by the Owner and Consultant, and will schedule with Contractor mutually agreed timing for access to site and performance of their activities.

.1 Third-party inspection and testing company will make recommendations for correction to observed deficiencies to Consultant. Consultant will make final recommendation for any assembly modifications to Contractor.

.5 Role of the Contractor:

.1 Provision and coordination of trades, and sequence of construction to ensure total performance of Building Enclosure from substructure to walls and to roof, including proper insulation depths, continuity of air barrier system joints, junctures and transitions between materials, assemblies of materials, and products.

.2 Organize preconstruction meetings between trades involved in entire Building Enclosure system to discuss where each trade scope begins and ends, responsibility and sequence of installation for proper insulation, waterproofing, air-tight joints, junctures, and transitions between materials, products and assemblies of products specified in different sections.

.3 Build mock-ups satisfactory to Consultant and third-party inspection and testing company of each assembly type including, junctures, and transitions between products, materials and assemblies.

.4 Cooperate with agencies performing required inspections, tests, and similar services, and provide reasonable auxiliary services as requested. Notify third-party inspection and testing company sufficiently in advance of operations to permit assignment of personnel. Auxiliary services required include, but are not limited to, following:

.1 Provision of access to the Work.

.2 Provision of incidental labour and facilities necessary to facilitate inspections and tests.

.3 Provision of adequate quantities of representative samples of materials that require testing or assistance in taking samples.

.4 Delivery of samples to testing laboratories.

.5 Provision of security and protection of samples and test equipment at Project Site.

1.6 ACTION SUBMITTALS

.1 Product Data: Submit in accordance with Division 01 for the following:

.1 Submit manufacturer's instructions, printed product literature and data sheets for the exterior enclosure commissioning work and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Include recommendations for product application and use.

.3 Include test data substantiating that products comply with requirements.

.2 Shop Drawings: Submit Shop Drawings indicating material characteristics, details of construction, connections, and relationship with adjacent construction.

~~.1 Energy Simulation: Submit energy simulation data conforming to the following:~~

~~.1 Performance of Glazing: simulated using WINDOW (latest edition) software by Lawrence Berkley Laboratories ("LBL").~~

~~.2 Performance of Framing (opaque and glazed assemblies): simulated using THERM software by LBL.~~

~~.2 Simulations must be carried out by a qualified simulator and summary reports must bear seal of a Professional Engineer and clearly demonstrate materials used to reduce thermal bridging in the field and at the interfaces of Building Enclosure assemblies.~~

~~.3 Alternatively test results based on testing in accordance with AAMA 1503.1 may be submitted in lieu of energy simulation to verify performance.~~

1.7 INFORMATIONAL SUBMITTALS

.1 Contractor's Quality Control Plan: submit quality control plan before pre-construction conference, describing approach to maintaining material and installation quality including the following:

.1 Lists of third-party standards, guidelines or reference documents forming part of proposed construction best-practices used to achieve specified performance requirements;

.2 Substrate preparation and installation of air barrier and vapour retarding membranes;

.3 Treatment of transitions between Building Enclosure components and their penetrations (including doors, frames, glazing, flashings, louvers and other penetrations);

.4 Confirmation of compatibility between Building Enclosure components;

.5 Proposed list of observations and tests forming a part of Contractor's quality assurance and quality control activities;

.6 Methods for addressing corrective action plans and addressing deficient or incompatible installation procedures;

.7 Format and frequency of reports, records of pre-construction meetings and site modifications; and

.8 Proposed construction schedule indicating stages of Building Enclosure construction and potential dates for Consultant's, and third-party inspection and testing company's review activities.

.2 Manufacturer's Certificates: Submit third-party verification stating conformance with Project requirements, including any material compatibility or limitations specific to Project conditions.

.3 Test and Evaluation Reports: Submit reports indicating test methods and results, and stating specifically which attributes apply to the products supplied to the Project.

.4 Manufacturer's Installation Instructions: Submit written installation requirements stating required workmanship practices to achieve assembly performance required for the Project.

1.8 CLOSEOUT SUBMITTALS

.1 Maintenance Schedule: Submit summary table that indexes Building Enclosure components requiring maintenance and indicates frequency at which each component requires repair or replacement (i.e. replacement of sealants, gaskets, glazing units, paints or coatings and similar components).

.2 Operation and Maintenance Data: Submit operation and maintenance data for each component listed in aforementioned schedule including the following as a minimum:

.1 Product Data Sheets as specified in this Section.

.2 Extended Warranty Information: Include warranties for products, equipment, components, and sub-components whose duration exceeds one year. Include warranties on components with the system they are a part of. Reference all specific operation and maintenance procedures that must be performed to keep warranty valid.

.3 Sources of Material: Include reference to contact information where specific materials can be obtained.

.4 Installation and Maintenance Instructions: Submit information for each material, component or system.

1.9 QUALITY ASSURANCE

.1 Mock-Ups: Construct mock-ups of each assembly as specified in this Section, including junctures, transitions and interfaces to establish baseline quality for installation and workmanship, and to evaluate enclosure-related constructability and performance, with a specific emphasis on required coordination of Subcontractors and sequencing necessary to ensure that performance of enclosure materials, components, systems, assemblies, and interfaces meets or exceeds requirements of Contract Documents.

.1 Required Mock-ups: Provide “first installation” in-situ or on site mock-up (as determined by Consultant) of each major Building Enclosure system, including:

.1 Each below grade underslab and vertical waterproofing system.

.2 Each type of horizontal waterproofing system enclosing occupied space below.

.3 Each substantially different type of vertical enclosure assembly (including associated air barriers, insulation, and support materials) including, but not limited to precast concrete assemblies, masonry assemblies, curtain wall and glazed assemblies, and rain screen cladding assemblies.

.4 Each low-slope and each steep-slope roofing assembly.

.5 Each expansion joint assembly.

~~.2 Extent of Mock-ups: Ensure extent of each mock-up includes interface of various materials and systems, both between various major assemblies (e.g. foundation waterproofing connection to wall assembly) and between various materials in the same assembly (e.g. interface between window and wall).~~

~~.1 Wall mock-ups must be minimum of 10 sq. m (100 sq. ft.) and extend one full structural bay wide by one full story high plus additional height as required to connect to assemblies below and above. Ensure mock-up includes typical exterior wall-to-interior floor slab connection. In addition, conform to the following:~~

~~.1 Curtain Wall Systems, Entrances and Windows: minimum of one full sized unit within rough opening demonstrating installation of transition membranes, sealants and flashings.~~

~~.2 Masonry Unit Panels: assemble a test panel including placement of a single opening (window and/or door) demonstrating installation of joint sealants and flashings, and placement of vents and weeps.~~

~~.3 Air Barrier Membranes: apply air barrier membrane to minimum area of 36 sq.m (390 sq. ft), including placement of a single opening (window and/or door) demonstrating overlaps, adhesion to substrates, and compatibility with adjacent materials.~~

~~.4 Cladding Panels (each type): assemble a test panel including placement of a single opening (window and/or door) demonstrating progressive installation, attachment to substrate, installation of insulation, joint sealants, and placement of flashings and closure strips.~~

~~.2 Roof mock-ups must be minimum of 10 sq. m (100 sq. ft.) and include parapet or roof edge conditions, as well as typical pipe, supports, and similar penetrations.~~

~~.3 Horizontal below-grade waterproofing or slab-on-grade vapour retarder mock-ups must be minimum of 10 sq. m (100 sq. ft.) and include edge conditions and typical penetration details.~~

~~.4 Vertical below-grade waterproofing (foundation wall waterproofing) mock-ups must include typical edge, termination, and penetration details.~~

~~.3 Sequencing Requirements: Stage each component within mock-ups so that each layer of construction can be reviewed and tested as required to verify performance before succeeding layers of materials are applied.~~

~~.4~~.2 Post Mock-Up Debrief: arrange for post mock-up debrief meetings attended by Contractor, Owner, third-party inspection and testing company, Consultant, and Subcontractors whose work is directly associated or impacted by Building Enclosure activities.

.1 Schedule debrief meeting immediately after testing results and observations of the mock-ups is completed.

.2 Incorporate lessons-learned arising from observed conditions and testing into Contractor's quality control plan.

~~.5~~.3 Modifications to Mock-Ups: mock-ups may require modifications to account for site conditions and compatibility between adjacent materials and assemblies.

.1 Provide corrective actions as required to obtain acceptance. Repair mock-ups which are permitted to form a part of the final construction that have been damaged or that failed testing.

~~.2 Mandatory Qualifications:~~

~~.1 Mandatory Passive House Certification:~~

~~.1 Prior to commencement of building envelope work for this project, the Project Manager, site superintendent, building envelope coordinator and mechanical and electrical coordinators from the Contractor's team assigned to Project shall have received formal training in the Passive House Trades Course (minimum 3 day workshop) as offered by Peel Passive; https://www.peelpassivehouse.ca or similar. All costs are Contractor's responsibility. Proof of certification to be submitted upon request. Proposed replacements for any of these positions by the Contractor will require the same certification prior to commencing work on the project.~~

~~.2 Mandatory Passive House Training:~~

~~.1 At least one senior on-site member (site foreman) from all sub trades performing work which forms part of the building envelope and the mechanical and electrical sub trades will be required to attend a mandatory one-day passive house training course. Duration of training shall be not less than 8 hours. Instructor shall be provided and paid for by Owner. Contractor to assume all other costs, including provision of on-site facilities to administer the course and required compensation to Contractor's team members for attending training.~~

~~.2 Owner and Consultant will schedule with Contractor mutually agreed timing for delivery of training to avoid delays to the Work.~~

PART 2 - PRODUCTS

2.1 DESIGN AND PERFORMANCE REQUIREMENTS

.1 Statement of Building Enclosure Design Intent: The design intent of this building's enclosure is to provide exterior floor, wall, and roof assemblies which prevent uncontrolled air and vapour infiltration into the building; eliminate water infiltration (including condensation) into conditioned spaces; and provide thermal insulation continuity to minimize cold bridging. Products and assemblies used to perform these functions must be technically sound, durable and serviceable.

.1 Design Assumptions:

.1 Exterior Air Temperature:

.1 Summer: 30 deg C dry bulb, 23 deg C wet bulb
.2 Winter: - 24 deg C

.2 Ambient Interior Air Temperature (Design (for all spaces within the building, except for mechanical and electrical rooms and the garage):

.1 Summer: 24 deg C dry bulb
.2 Winter: 22 deg C

.3 Interior Relative Humidity: 55 percent +/- 5 percent

.2 General Assembly Performance:

.1 Assemblies described in Contract Documents are expected to achieve the minimum performance requirements specified in this Section as verified by inspection and testing. Performance criteria identified in this Section shall supersede other criteria identified in other parts of Contract Documents.

.2 Comply with applicable building code, and other regulations and requirements of Authorities Having Jurisdiction, in design, engineering, fabrication and installation of the Work.

.3 Drawings and details are diagrammatic and are only intended to show design concept, aesthetics, interfacing requirements, configuration, components and arrangements. They are not intended to identify or solve completely problems of thermal and structural movements, assembly framing, engineering design, fixings and anchorages.

.4 When difficult-to-construct material connections occur within Building Enclosure construction, advise Consultant at once so that details can be reviewed and installation methodologies confirmed. Poor installation of a difficult-to-construct detail is not acceptable.

.5 Design of Building Enclosure assemblies is based on "Rain Screen" principle. The definition of the rain screen principle for the purpose of these Specifications is "as advocated by National Research Council of Canada".

.1 This approach is founded on the premise that multiple-element protection is necessary in most situations to achieve effective control, by means of

.1 a first line of defense that minimizes rainwater passage into wall by minimizing number and size of holes and managing driving forces acting on wall;
.2 a second line of defense that intercepts all water that gets past first line of defense and effectively dissipates it to exterior.

.2 All voids between assembly components as well as those between components and structure shall have:

.1 Gaskets, baffles, overlaps, seals and compartmentalization as required to provide a barrier "Rain Screen" to effectively prevent excessive rain water entry into any of Building Enclosure cavities but allow pressure moderation of cavity air spaces.
.2 Low permeability Vapour Barriers to minimize vapour diffusion, where required.
.3 Air barriers and seals as required to prevent entry of interior building air into Building Enclosure cavities, and exterior air into building. Air barriers and seals shall be able to withstand wind design pressures.
.4 Thermal separators, isolators and seals placed to eliminate direct contact between interior humid air and a cold surface or structural component to prevent condensation and ice build-up on surfaces during cold weather.

.6 Air Barrier Continuity:

.1 This Project incorporates design principles of positive air and vapour leakage control at Building Enclosure line. Drawing details illustrate continuity of air barrier/vapour retarder at penetrating elements such as door, window and louver frames.

.1 In order to maintain continuity of Air Barrier Assemblies, interfacing of various building elements requires close coordination by all trades involved with exterior building elements.

.2 Air-barrier assembly extends nominally from foundation line, vertically along exterior walls and to positively contact with roof air barrier/vapour retarder or roofing membrane as applicable. Continuity also extends to waterproofing at podium areas, and to inner surface of glazing units. Provide a continuous, unbroken and non-perforated air and vapour seal to totally enclose Building Enclosure and to separate interior and exterior environments.

.3 Manufacturers of window and door frames must ensure correctly designed and positioned metallic legs, extensions or recesses are provided at thermal break line to facilitate connections of rigid or flexible transition materials prior to setting these elements in their allotted openings.

.4 Penetrations of air barrier and paths of air infiltration / exfiltration must be sealed.

.5 Air barrier system shall have following characteristics:

.1 It must be continuous, with all joints sealed.
.2 It must be structurally supported to withstand positive and negative air pressures applied to Building Enclosure.
.3 Connection shall be made between:

.1 Foundation and walls.
.2 Walls and windows or doors.
.3 Different wall systems.
.4 Wall and roof.
.5 Wall and roof over unconditioned space.
.6 Walls, floor and roof across construction, control and expansion joints.
.7 Walls, floors and roof to utility, pipe and duct penetrations.

.6 Materials: materials used for air barrier system in opaque wall assemblies shall comply with CAN/ULC S741 and shall have an air permeance not exceeding 0.02 L/(s·m2) (0.004 cfm/ft2) under a pressure differential of 75 Pa (1.57 psf) when tested in accordance with ASTM E2178.

.3 Air Leakage Criteria (in-situ): The air leakage of the following assemblies must not exceed the following criteria when tested in the field in accordance with ASTM E783.

.1 Whole Building ('enclosure-only testing' and with 'sealed openings' testing results) for office area: less than 0.6 air changes per hour (ACH) under a pressure differential of 50 Pa (1.04 psf) and normalized leakage rate of 0.22 L/(s·m2) under a pressure differential of 50 Pa (1.04 psf).

.2 Opaque wall assemblies: less than 0.2 L/(s·m2) under a pressure differential of 75 Pa (0.04 cfm/ft2 @ 1.57 psf)

.3 Fixed glazed assemblies: less than 0.01 L/(s·m2) under a pressure differential of 300 Pa (0.002 cfm/ft2 @ 6 psf)

.4 Operable assemblies:

.1 Glazed ~~Windows, Sliding doors and~~ Swing Doors: less than less than 0.06 L/(s·m2) under a pressure differential of 75 Pa (0.01 cfm/ft2 @ 1.57 psf)

.2 Sectional doors: less than 2.0 L/(s·m2) under a pressure differential of 75 Pa (0.4 cfm/ft2 @ 1.57 psf)

~~.3 Rolling doors: less than less than 5.0 L/(s·m2) under a pressure differential of 75 Pa (1 cfm/ft2 @ 1.57 psf)~~

.4 Thermal Performance Criteria: install insulation materials to maintain continuity of performance of the Building Enclosure meeting thermal resistance or thermal conductance ratings specified below:

.1 Roofing Assemblies:

.1 Nominal: Minimum ~~R60~~ R35 ci sq.ft·h·deg F/BTU (RSI 10.59 sq.m·deg·K/W)

.2 Opaque Wall Assemblies Above-Grade:

.1 Nominal: Minimum ~~R40~~ R25 ci sq.ft·h·deg F/BTU (RSI ~~7.064~~.4 sq.m·deg·K/W)

.3 ~~Curtain Wall and~~ Glazed Assemblies:

.1 Maximum U0.23 BTU/sq.ft·h·deg F (U1.30 W/sq.m·K)

.2 Solar Heat Gain Coefficient: Maximum 0.4

.4 Skylights:

.1 Maximum U0.22 BTU/sq.ft·h·deg F (U1.25 W/sq.m·K)

.2 Solar Heat Gain Coefficient: Maximum 0.4

.5 Slabs-on-Grade:

.1 Nominal: Minimum ~~R40~~ R15 sq.ft·h·deg F/BTU (RSI ~~7.062~~.64 sq.m·deg·K/W)

.5 Water Infiltration: There must be no uncontrolled water infiltration when following assemblies are tested in the field in accordance with the test method described in Part 3 of this Section.

.6 Thermal Bridging: Ensure wall assembly and interface details are thermally broken and meet the OBC SB-10 requirements for continuous insulation to reduce structural connections which create thermal bridging.

.1 As a minimum, provide materials to minimize or prevent thermal bridging at the following locations and interfaces:

.1 Cladding and insulation attachment at opaque wall assemblies.

.2 At-grade transitions.

.3 Slab-edges and transitions.

.4 Glazing-to-wall transitions.

.5 Interior-to-exterior wall intersections.

.6 Assembly corners.

.7 Parapets.

.8 Roof penetrations and transitions.

.9 Exterior-to-interior structural components .

.2 Generally, select and install thermal break materials in accordance with “Building enclosure Thermal Bridging Guide, 2016 Ed.” prepared by Morrison Hershfield to meet “EFFICIENT” Performance Categories in accordance with Chapter 4.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Examine substrates, areas, and conditions, for compliance with requirements for installation tolerances, supports, and other conditions affecting performance of the Work.

3.2 PREPARATION

.1 Protect construction from weather and other sources of moisture that are deleterious to the tested assemblies.

.2 Repair or replace Building Enclosure components that are damaged as a consequence of exposure to weather conditions deleterious to the final construction.

3.3 WORKMANSHIP

.1 Install materials and systems according to best-practices relating to quality of workmanship, and coordination and installation of specified Products to maintain continuity of the Building Enclosure.

.1 Treatment of Penetrations: Use methods for making and sealing penetrations to maintain continuity of vapour, water and air control assemblies.

.1 Ensure mechanical and electrical work scheduled installed/modified within exterior Building Enclosure system is properly tied into Building Enclosure and does not compromise performance of Building Enclosure.

.2 Ensure mechanical and electrical penetrations through Building Enclosure are sealed against air leakage and water penetration and are designed to prevent condensation within exterior Building Enclosure system.

.3 Ensure mechanical water piping that is installed/modified within exterior wall system is free of leaks and protected from freezing.

.2 Modification of Installation: Identify installation difficulties and make modification to installation to account for site conditions that differ from manufacturer's standard detailing or testing results. Make such modifications to reduce or eliminate potential for installation deficiencies.

.3 Sequencing and Compatibility: Confirm compatibility between Products provided by different parties or that are used to join dissimilar components. Sequence such transitions and overlap materials to ensure they shed water to the exterior face of the Building Enclosure.

.4 Workmanship: Train installers on Building Enclosure best-practices and provide them with update when modifications occur resulting from changes to site conditions and testing results.

3.4 FIELD QUALITY CONTROL (PERFORMANCE TESTING)

.1 The objective of performance testing is to demonstrate that each Building Enclosure system, and system-to-system interface meets or exceeds the performance requirements of the Contract Documents and the Building Enclosure Design Intent specified in this Section.

.1 Unless otherwise indicated, costs associated with initial performance testing shall be paid by Owner through cash allowance.

.2 Costs associated with re-testing caused by failure of the Building Enclosure tests, during mock-up review or during the construction phase, shall be the responsibility of the Contractor.

.2 Contractor's Collaboration: third-party inspection and testing company will coordinate with Contractor's schedule and make themselves aware of current work. Third-party inspection will bring to attention of the Consultant and Contractor any observation or testing requirement forming a part of their scope of auditing services, but not less than those listed in this Section.

.1 Access to Site: Contractor must provide reasonable access to the Project site, and any personnel to assist third-party inspection and testing company in performance of their service and maintain site safety.

.2 Services: Contractor must provide electrical, water or other utilities or services required by third-party inspection and testing company for performance of their work.

.3 Scheduling and Coordination:

.1 Contractor must coordinate sequence of testing activities to accommodate required inspection and testing services with minimum delay.

.2 Contractor must coordinate construction activities to avoid removing and replacing construction to accommodate observations and tests required by third-party inspection and testing company.

3.5 NON-CONFORMANCE

.1 Non-conformance and deficiencies identified during periodic site visits or performance testing shall be resolved as follows:

.1 Third-party inspection and testing company will record the results of the performance test or its site visit observation in a report. All deficiencies or non-conformance issues shall be noted as action items on a punch-list and reported to Contractor through Consultant.

.2 Corrections of identified minor deficiencies may be made during the site visit at the discretion of third-party inspection and testing company. In such cases the deficiency and associated resolution will be documented in the field report.

.3 As site visits or tests progress and a deficiency is identified, the third-party inspection and testing company will discuss the issue with Contractor and Consultant for follow-up and resolution.

.1 Third-party inspection and testing company shall document deficiency and Contractor's response.

.2 Contractor shall correct the deficiency and notify third-party inspection and testing company and Consultant in writing that issue is resolved and/or product, material or assembly is ready to be retested.

.3 Contractor shall reschedule the test and the test shall be repeated. This process shall be repeated until test results meet or exceed requirements of Contract Documents.

.4 Contractor shall be responsible for costs associated with re-testing.

3.6 AIR INFILTRATION TESTING

.1 Glazed Assemblies (curtain wall and punched windows):

.1 Test Method(s): pressurized chamber testing in accordance with ASTM E783.

.2 Scope of Testing: Mock-up (first installation) and during construction phase.

.3 Frequency: As determined by third-party inspection and testing company.

.4 Success Criteria: As specified in this Section.

.2 Opaque Wall Assemblies (including transitions to adjacent systems, field of air barrier and penetrations):

.1 Test Method(s):

.1 pressurized chamber testing in accordance with ASTM E783.

.2 smoke tracer testing in accordance with ASTM E1186.

.2 Scope of Testing: Mock-up (first installation) and during construction phase.

.3 Frequency: As determined by third-party inspection and testing company.

.4 Success Criteria: As specified in this Section.

.3 Whole Building Air Leakage Testing:

.1 Test Method(s):

.1 Fan pressurization testing in accordance with ASTM E779 or orifice blower door testing in accordance with ASTM E1827 or EN 13829 Method A (should Owner elect to pursue Passive House certification).

.2 Smoke Tracer: third-party inspection and testing company may include observations using smoke tracer or theatrical fog in accordance with ASTM E1186 in conjunction with building pressurization to confirm anomalies identified using infrared scanning or to differentiate thermal bridging effects.

.2 Frequency:

.1 At completion of air barrier work, and prior to installation of insulation ('enclosure-only testing').

.2 At completion of mechanical systems work, upon systems start-up ('sealed openings testing').

.3 Success Criteria: As specified in this Section.

3.7 WATER PENETRATION TESTING

.1 Glazed Assemblies (curtain wall and punched windows):

.1 Test Method(s): pressurized chamber testing in accordance with ASTM E1105

.2 Scope of Testing: Mock-up (first installation) and during construction phase.

.3 Frequency: As determined by third-party inspection and testing company.

.4 Success Criteria: No leakage at 720 Pa (15 psf) pressure differential.

.2 Roof Assemblies:

.1 Test Method(s):

.1 Water-spray test in accordance with AAMA 501.2 at transitions, corners, penetrations determined by Consultant.

.2 Scope of Testing: Mock-up (first installation) and during construction phase.

.3 Frequency: As determined by third-party inspection and testing company.

.4 Success Criteria: No leakage.

.3 Opaque Wall Assemblies including auxiliary components such as louvers, expansion joints and similar components:

.1 Test Method(s): Water-spray test in accordance with AAMA 501.2 at transitions, corners, penetrations determined by Consultant.

.2 Scope of Testing: Mock-up (first installation) and during construction phase.

.3 Frequency: As determined by third-party inspection and testing company.

.4 Success Criteria: No leakage.

3.8 THERMAL PERFORMANCE VERIFICATION

.1 Wall Assemblies including openings and auxiliary components such as louvers, expansion joints and similar components:

.1 Test Method(s): Thermographic scan in accordance with ASTM C1060 or CAN/CGSB 149-GP-2MP.

.2 Frequency: As determined by third-party inspection and testing company.

.3 Success Criteria: Insulation is at full thickness and continuous in all cavities. No unacceptable thermal bridging.

.2 Roof Assemblies:

.1 Test Method(s): Thermographic scan in accordance with ASTM C1153.

.2 Frequency: As determined by third-party inspection and testing company.

.3 Success Criteria: Insulation is at full thickness and continuous. No thermal anomalies associated with wet insulation.

3.9 ADHESION TESTING

.1 Air Barrier Membrane Testing:

.1 Test Method(s): Pull-off testing in accordance with ASTM D4541

.2 Frequency: As determined by third-party inspection and testing company.

.3 Success Criteria: Pull-off strength of membrane conforms to manufacturer’s published data.

.2 Sealants Adhesion Tests:

.1 Test Method(s):

.1 Destructive: in accordance with Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.

.2 Non-destructive: in accordance with ASTM C1521, using Nondestructive Spot Method.

.3 For joints with dissimilar substrates, verify adhesion to each substrate separately.

.2 Frequency: As determined by third-party inspection and testing company.

.3 Success Criteria: Sealant adhesion passes sealant manufacturer's field-adhesion hand-pull test published data.

3.10 REPAIR AND PROTECTION

.1 Repair damaged construction and restore substrates and finishes following observation, testing, sample taking and similar services. Repair surfaces immediately after testing and sampling is completed to prevent damage to assemblies resulting from moisture diffusion or air leakage.

.2 Protection of Installed Products: take necessary precautions to prevent puncturing, tearing, weakening or damaging of Building Enclosure membranes during construction; and immediately repair damage as directed by Consultant.

END OF SECTION

Part 1 General

.1 A registered, licensed, professional land surveyor (Ontario Land Surveyor) qualified to operate at the project location, shall perform the following activities which include providing the Consultant with completed drawings to the minimum Specifications below, and in general conformance to those provided in the Contract Documents.

.2 The surveyor shall include within the total costing, all confined space entry and underground utility locates as the Project requires in order to obtain the necessary inverts and utility alignments indicated in the Contract Documents. If necessary, the surveyor will engage external service providers to complete the Work. Costs for private location services (if required) are to be included in the Bid price.

.3 Construction engineering drawings provided shall be utilized for **reference purposes only** and do not replace survey Work. All inverts, manholes, pipe sizes, and any other site features are to be verified in the field. Furthermore, the engineering drawings provided do not replace private locates.

.4 The completed survey will be reviewed against these Specifications and any deviation will be brought to the attention of the surveyor and shall be rectified at no additional cost to the Owner or its representatives.

Part 2 Requirements

2.1 SURVEY PERFORMANCE REQUIREMENTS

.1 All survey services and plans must be provided in accordance with the Accuracy Standards for Land Title Surveys as adopted by the National Society of Professional Surveyors and the American Land Title Association, prepared to the Minimum Standard Detail requirements for ALTA/ACSM Surveys and include all optional items requested.

.2 The survey must be performed using professional survey equipment and employ the Canadian Standard of measurements.

.3 The accuracy of the survey measurements shall comply with the Regulations made under the applicable provincial Surveyors Act.

.4 The survey benchmark used shall;

.5 Have an elevation based on the geodetic datum.

.6 Two on-site “temporary” benchmarks shall be provided and set by the surveyor. Elevations must be established based on a minimum of 3 geodetic benchmarks.

.7 Have the location ID and elevation indicated, and a description provided.

.8 The survey shall indicate all legal property lines referenced to the north (incl. bearings, dimensions, and curve data).

2.2 DRAWING REQUIREMENTS

.1 As a minimum, all Drawings shall contain the following;

.2 North arrow.

.3 Bar scale (1:500, unless otherwise approved by the Consultant).

.4 Key plan showing the subject property location.

.5 Name and address of surveyor.

.6 Surveyor's license number.

.7 Drawing size shall be 36” x 48” (unless otherwise approved by the Consultant).

.8 The topographic survey and digital terrain model are required in Land Development Desktop and shall contain (but are not limited to) all topographic features (either natural or man made), 3-D contour break lines, spot elevations, and drainage features. The TIN must be provided after quality checks to prevent aberrations in the contours and with extraneous vectors removed. All crossing break lines must be resolved prior to creating the TIN.

.9 The Drawing shall show ground contour lines generated at 0.25 metre intervals and labelled at 0.50 metre intervals.

.10 Parcel limits and lease limits are to be incorporated and shown on all Drawings.

.11 Each survey type must be submitted as a separate Drawing file independent of other survey types if requested by the Consultant or owner.

2.3 Legal/Boundary Information

.1 The complete legal description of the property and street address (where applicable).

.2 Easements, both existing and proposed, based on a current registry search indicating the registered owner (include the date of search). Any subsequent changes shall be brought to the attention of the Consultant immediately.

.3 Right of Way (ROW) lines, including names and numbers of highways and roadways where applicable and the registered owner.

.4 Exact measurements and descriptions of all property line encroachments (aboveground and underground).

.5 Names of adjacent landowners and lot and block numbers, street addresses, and known landuse.

.6 Complete interior lot lines shall be shown where applicable.

.7 Existing Zoning shall be indicated for the subject property and all adjacent properties.

.8 The gross land area of the lands under survey and any parts thereof shall be appropriately labelled on the face of the plan. Appropriate units shall be selected for area labels with sufficient decimal places shown (a minimum of 2 decimal places are required).

.9 The surveyor shall Provide the signed and sealed survey plan that shall fully comply with the applicable provincial Surveys Act, Surveyors Act and the Regulations made under them. In addition, all applicable Drawing items must be in accordance with Part 3 of this Section.

2.4 Topographic Information

.1 The required survey(s) shall include all site features and improvements (aboveground and underground) within the Project including all Work completed by the Contractor unless otherwise directed by the Consultant. The survey shall include all aboveground features 30 metres beyond the construction limit in all directions unless otherwise directed by the Consultant. Where the width of an adjacent road, ROW or encroachment is within the 30 metres, the survey shall be extended to include the entire road, ROW or encroachment (up to and including the opposite street line) unless otherwise specified by the Consultant. The survey shall include all underground features 50 metres beyond the construction limit in all directions unless otherwise specified by the Consultant. Where the nearest catch basin, maintenance hole, or water valve exceeds 50 metres, the survey shall be extended to include the catch basin, maintenance hole or water valve, unless otherwise specified by the Consultant. Topographic information shall include all items listed within this Specification.

.2 Existing ground contours are to be based on a maximum of 15 metre grid shots, generated at 0.25 metre intervals based on geodetic datum (labelled at 0.5 metre intervals). Other spot elevations include, but are not limited to:

- .1 High points, low points, and grade changes
- .2 Along property line
- .3 Centreline of roadways
- .4 Gutter lines
- .5 Top and bottom of the curb
- .6 Top and bottom of slope
- .7 Top and bottom of retaining walls and toe walls (or steep grade changes)
- .8 Ditch inverts, streams, rivers, etc. (include direction of flow)
- .9 Flood hazard area limits if applicable
- .10 Edge of pavement (identify if shoulder, barrier curb, curb & gutter)
- .11 Top of service structures (maintenance holes, catchbasins, water valves)
- .12 Edge of sidewalk

.3 Above ground features include, but are not limited to:

- .1 Buildings/structures, including;
- .2 Finished floor elevation (FFE)
- .3 Length of each side of the structure
- .4 Truck dock(s) and/or truck well(s)
- .5 Porches
- .6 Garden centre(s)

.7 Trash and bale storage area(s)
.8 Cart coral(s)
.9 Fences, including lengths, type of construction, and any openings/gates
.10 Retaining walls and toe walls (including length and width)
.11 Signage (labelled with type and material)
.12 Roadway and parking lot painting (incl. size and number of regular and handicapped parking spaces)
.13 Walkways and sidewalks
.14 Curb depressions / Curb cuts
.15 Construction debris
.16 Surface materials (i.e.. asphalt, paving stone, concrete, sod)
.17 Berms
.18 Trees (identify the type of tree and diameter of the trunk at a height of 1.2 metres from the ground if more than 0.1 metres in diameter)
.19 Bushes, woods, or brush
.20 Sprinkler heads or other indications of irrigation
.21 Large boulders, plantings, or landscaping features
.22 Bodies of water including current elevation (& date), and high water elevation
.23 Evidence of flooding or erosion
.24 Railroad tracks

.4 Underground storm and sanitary service, including;

.1 Maintenance holes (top & bottom elevation, size, upstream and downstream inverts)
.2 Catchbasin maintenance holes (top & bottom elevation, size, upstream and downstream inverts)
.3 Catchbasins (top & bottom elevation, size, upstream and downstream inverts)
.4 Pipes drawn and shown from structure to structure (size, material/type, direction of flow, length, and slope)
.5 Orifice plates installed in drainage structures.
.6 Location of connection to any buildings
.7 Underground storage tanks (location only)
.8 Headwalls, including top and bottom elevations
.9 Culverts, with upstream and downstream inverts, size and material
.10 Lift stations (location only)

.5 Watermain lines including off-site sources and the following;

.1 Hydrants
.2 Valves/curb stops, including measured depths
.3 Location of connection to any buildings including valves

.4 Meters
.5 Chambers (including type, i.e.. meter chamber, valve chamber)
.6 Watermain lines (size, material/type)

.6 Above and underground utility lines including, but not limited to:

.1 Light standards
.2 Gas
.3 Telephone
.4 Hydro
.5 Junction boxes
.6 Pylon signs
.7 Cable TV
.8 Fibre optics
.9 Utility poles, maintenance holes, handwells, pedestals
.10 Listing of the sources of information (i.e. utility companies, locate companies, companies specializing in confined space entry)

.7 Off-site adjoining roadways (include the same level of detail as within the Project) including, but not limited to:

.1 Road names
.2 Type of driving surface
.3 Medians and openings
.4 Lane configuration and marking
.5 Underground and above-ground services and utilities
.6 Driveways
.7 Width of right-of-way and width of pavement labelled
.8 Shoulders, curbs and sidewalks

.8 The surveyor shall sign the “Certificate of Survey” as provided within Schedule ‘C’ for the areas where Work has been completed. Modifications to the certificate, where required by the Surveyor, will be approved by the Consultant prior to completion.

.9 All surveys are to include all legal and boundary information as noted within this Specification.

Part 3 Execution

3.1 Drawing Specifications

.1 The Consultant will provide a base drawing that is to be used solely for the Consultant’s purposes and that includes all base layers, blocks, details and line types required to provide the final Drawings in the Specified formats. This Specification is to be used in conjunction with the provided base Drawing. Any

documents or Drawings issued for the surveyor's use shall not be forwarded to any third party without written authorization from the Consultant.

.2 All information shall be submitted on compact disk(s) in AutoCAD 2004 or 2007 dwg format (".dxf" format is **not** acceptable). Any special fonts, symbols, logos, blocks, shape files, or cross-reference files not included in attached Schedule 'B' shall also be included on compact disk(s). Presentation Drawings shall not be rotated. Where applicable, AutoCAD base point 0,0 = Softdesk base point 0,0. North shall always be up on digital files presented to the Consultant.

.3 The drawing shall be accompanied by an ASCII point file containing the following: NORTHINGS EASTINGS ELEVATIONS DESCRIPTIONS

.4 Elevation text insertion points shall be located at the same coordinates as the spot elevation point marker.

.5 Contours shall be constructed of continuous polylines with true Z elevations. Contours shall be labelled above or at the end of lines (lines are not to be broken). The digital terrain model (Softdesk) or a 3D AutoCAD line Drawing of the existing ground surface will be provided in digital format.

.6 All plans shall be referenced to the Coordinate Reference System as utilized by the local governing authority. Coordinate System utilized shall be noted on the submitted Drawing.

.7 Any area not included in the survey due to restricted access, flooding, or other factors should be identified on the Drawing accordingly.

.8 The Consultant will reject surveys or Drawings that do not meet all requirements noted herein and no payment will be made for rejected Work until the requirements have been met and final survey Drawings are accepted as complete.

3.2 Drawing Requirements

.1 The Consultant will provide a base Drawing that is to be used solely for reference purposes and that includes all base layers, blocks, details and line types required to provide the final Drawings in the Specified format. The following is to be used for reference in conjunction with the provided base Drawing.

DRAWING FEATURE	LAYER			TEXT				2 COMMENTS
	Name	Colour	Line Type	Style	Height	Fonts	Symbols	
Title Block, Border, Certification, Logo, etc.	T-Border						As per individual surveyor standard	
Legal Boundary	T-Boundary	2-Yellow	Border					
Legal Bearings and Distances	T-Bearings	3-Green	Cont	L80	1	Simplex		
Legal, Parcel Ref./Reg. Plan and Deposit Plan Desc.	T-Pldesc	2-Yellow	Cont				As per individual surveyor standard	

DRAWING FEATURE	LAYER			TEXT				2 COMMENTS
	Name	Colour	Line Type	Style	Height	Fonts	Symbols	
Surveying Symbols e.g. SIB	T-Bars	7-White	Cont	L80	1	Simplex	Filled 1unit Square no circles	
Street Line	T-Stline	2-Yellow	Dashed					Pavement Grades 15 m max intervals
Centre Line of Road	T-Cline	7-White	Center					Pavement Grades 15 m max intervals
Street Names	T-Stname	2-Yellow	Cont		5	Bolds		All Capitals
Dimensions	T-Stdim	3-Green	Cont	L60	0.75	Simplex	Dimension all roads & access roads radii	
Contour Lines, Wells, Tilebeds, Foundations and Boreholes	T-Contour	8-Grey	Cont					Includes any topsoil pile & SWM/Sed pond
Contour Labels	T-Convalue	7-White	Cont	L60	0.75	Simplex		
Top and Bottom of Slopes	T-Slope	7-White	Cont				Long & Short Lines dir.of slope	Grades @ top and bottom of slope
Deciduous Trees	T-Dtree	15	Cont	L60	0.75	Simplex	As per Individual surveyor std	Dia. Type and Drip Line
Coniferous Trees	T-Ctree	15	Cont	L60	0.75	Simplex	As per Individual surveyor std	Dia. Type and Drip Line
Other Vegetation, Hedges, Planters, Shrubs & Woodlots	T-Veg	15	Cont	L60	0.75	Simplex	As per Individual surveyor std	Label
Railroad	T-Rail	7-White					As per Individual surveyor std	
Misc. Features (park benches, trash receptacles, phone booths)	T-Misc	7-White	Cont	L60	0.75	Simplex	As per Individual surveyor std	Label
Ditches, Swales, Inlets, Creeks Rivers and Culverts	T-Wcourse	5-Blue	Divide	L60	0.75	Simplex	Label Creeks & Rivers L140 1.8	Label culvert size & inverts,flow direction
Point Tics	T-Points	7-White	Cont				Point Mode x	Max 15 m grid interval
Elevations (grades)	T-Elev	1-Red	Cont	L60	0.75	Simplex		Max 15 m grid interval
Bench Mark Description	T-Bmark	3-Green	Cont	L80	1	Simplex		
Coordinate Grid	T-Grid	15	Cont					
Point Description	T-Pdesc	7-White	Cont	L60	0.75	Simplex		
Sanitary Sewer and Plugs	T-San	2-Yellow	Hidden	L60	0.75	Simplex		Includes pipe size, length and slope
Storm Sewers and CB Leads	T-Stm	5-Blue	Phantom	L60	0.75	Simplex		Includes pipe size, length and slope
Sanitary Manholes and Plugs	T-Sanmh	2-Yellow	Cont	L60	0.75	Simplex	Filled Circle 0.6 Radius	Manhole ID and Rim Grades & inverts
Storm Manholes,Headwalls and Trench Drains	T-Stmmh	5-Blue	Cont	L60	0.75	Simplex	Open Circle 0.6 Radius	Manhole ID and Rim Grades & inverts
Storm Catchbasins	T-Cb	3-Green	Cont	L60	0.75	Simplex	Open 1unit square no grid	Catchbasin ID and Rim Grades & inverts
Hickenbottom	T-Hicken	7-White		L60	0.75	Simplex	See Index of Symbols Std. (Attached)	Grade at top of pipe & bottom of retention area
Area Drain	T-Adrain	3-Green		L60	0.75	Simplex	See Index of Symbols Std. (Attached)	Inverts
Watermain	T-Wmain-ug	4-Cyan	Center	L60	0.75	Simplex	Text Continuous	Includes pipe size
Watermain Valves, Valve Boxes, Hydrants, Plugs, Siamese and blow offs	T-Wmain	4-Cyan	Cont	L60	0.75	Simplex	See Index of Symbols Std. (Attached)	For Hydrants Elev at top of nut & direction of nozzle
T.V. Cable	T-Cable-ug	3-Green	Dashdot	L60	0.75	Simplex		Label
T.V. Boxes	T-Cable	3-Green	Cont	L60	0.75	Simplex	As per Individual surveyor std/label & grade	
Bell Cable	T-Bell-ug	13	Divide	L60	0.75	Simplex		Label
Bell Pedistals and Poles	T-Bell	13	Cont	L60	0.75	Simplex	As per Individual	

DRAWING FEATURE	LAYER			TEXT				2 COMMENTS
	Name	Colour	Line Type	Style	Height	Fonts	Symbols	
							surveyor std/label & grade	
Hydro Ducts	T-Hydro-ug	6-Magenta	Divide2	L60	0.75	Simplex		Label
Hydro Light Std., MH's, Handwells, Traffic Signals, Transf./Pads & Jnctn box	T-Hydro	6-Magenta	Cont	L60	0.75	Simplex	As per Individual surveyor std/label & elev	
Gasmain	T-Gas-ug	15	Dot2	L60	0.75	Simplex		Label
Overhead Wires	T-Owire	7-White	Cont	L60	0.75	Simplex	As per Individual surveyor std	
Overhead Guys and Poles	T-Opole	7-White	Cont	L60	0.75	Simplex	As per Individual surveyor std/label & elev	
Irrigation Ducts	T-Irrig	7-White	Dashdot2	L60	0.75	Simplex		Label
All Signs	T-Signs	7-White	Cont	L60	0.75	Simplex		As per Individual surveyor std/label & elev
Buildings, Doorways, Cart Corrals and Speed Humps, Roof Drains	T-Bldg	3-Green	Cont	L60	0.75	Simplex	As per individual surveyor Std	Label and elev at doorways & around Bldg corners
Retaining Walls	T-Retwall	3-Green	Cont	L60	0.75	Simplex		Gradess top and bottom of wall
Fences	T-Fence	7-White	Cont	L60	0.75	Simplex	As per individual surveyor Std	Gradess bottom of fence poles
Road Markings, Parking Stalls, Turning Arrows & Painted Islands, Barrier Curbs, Barricades	T-Rdmark	8-Grey	Cont				See Index of Symbols Std. (Attached)	Label
Bollards	T-Bollard	7-White	Cont	L60	0.75	Simplex	As per Individual surveyor std./Label	
Curb and Gutter incl. Islands, Public/Private Roads etc.	T-Curbs	7-White	Cont	L60	0.75	Simplex		Grades top and bottom
Sidewalk Both Sides, concrete islands	T-Sw	7-White	Cont	L60	0.75	Simplex		Grades at dep curb & any obvious grade change
Edge of Asphalt	T-Eop	8-Grey	Hidden	L60	0.75	Simplex		Grades at edge of asphalt
Edge of Shoulder incl. Ex. Access roads, Public ROW & Gran. @ end of Phase	T-Eos	8-Grey	Hidden	L60	0.75	Simplex	15m max interval	Grade changes along shoulder
Loading areas	T-Loading	7-white	Cont					Grades on all corners, asphalt or concrete
Erosion Control incl. Rock Ck. Dam, Ckdam and Outlets	T-Ec	7-White	Cont	L60	0.75	Simplex	See Index of Symbols Std. (Attached)	Grades where possible
Stripping Limit	T-Slimit	2-Yellow	Dashed	L80	1	Simplex		Grades where possible
Sub. Excavation Limit	T-Subex	5-Blue	Border	L80	1	Simplex		Grades where possible

END OF SECTION

Updated through ADD#10

PART 1 - GENERAL

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL INSTRUCTIONS

.1 Read and conform to:

.1 the General Conditions and the Supplementary Conditions of the Contract;

.2 Division 1 requirements and documents referred to therein.

1.3 SUMMARY

.1 Work Included: Provide concrete floor finishing including but not limited to following:

.1 dry shake floor hardener.

.2 curing and sealing.

.3 premoulded joint filler.

.4 sawcutting construction and control joints in concrete.

.5 caulking construction and control joints and over premoulded joint filler with sealant.

.2 Related Requirements: Specifications throughout entirety of Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.4 REFERENCES

.1 Reference Standards: Latest published editions of reference standards listed in this Section in effect as of closing date and time of the Request for Tenders for the Contract, including any amendments adopted, are applicable unless otherwise indicated.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meetings:

.1 Prior to starting work of this Section, convene a pre-installation meeting at Project site to review Project requirements and site conditions with pertinent parties. Conform to requirements of Section 01 30 00.

1.6 SUBMITTALS

.1 Product Data: Submit manufacturer's literature and data sheets for each type of material provided under this Section for the Project in accordance with requirements of Section 01 30 00. Ensure data sheets provide required information including detailed instructions for installing as well as maintaining, preserving and keeping materials in clean and safe conditions. Provide adequate warning of maintenance practices or cleaning agents detrimental to specified materials.

.2 Safety Data Sheets (SDS): Submit SDS for inclusion in Operation and Maintenance Manual specified in Section 01 70 00, for adhesives, sealants and any other material designated by Consultant.

.3 Maintenance Data: Submit maintenance manuals in accordance with Section 01 70 00 to the Consultant. Contribute to this manual complete, detailed and specific instruction for maintaining, preserving and keeping clean surfaces of this work and which give adequate warning of maintenance practices or materials detrimental to sealed surfaces.

1.7 QUALITY ASSURANCE

.1 Qualifications:

.1 Manufacturers: Provide Products for Work of this Section by manufacturer with minimum 10 years' experience in the manufacture of such materials.

.2 Installers: Provide work of this Section executed by competent installers with minimum 5 years' experience in the application of the Products, systems and assemblies specified in this Section and with the approval and training of the Product manufacturers.

.3 Cast in place concrete and concrete materials shall be inspected and tested by a CSA certified testing laboratory.

.2 Single Source Responsibility: Ensure primary materials provided in this Section are obtained from 1 source by a single manufacturer and secondary materials are obtained from sources recommended by primary materials manufacturers.

.3 Mock-ups: Provide mock-ups in locations designated by Consultant and as required to demonstrate quality of workmanship. Maintain mock-ups during construction in an undisturbed condition as a standard for judging the completed work. As a minimum, Provide slab panel at least 1220 mm (4'-0") by 1525 mm (5'-0") feet and 100 mm (4") thick to demonstrate specified slab finish. Provide each slab panel with full length joint line.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Store materials on Site in manner to prevent damage thereto. Protect materials from inclement weather. Comply with CSA A23.1.

.2 Protect materials and work of this Section from damage in accordance with CSA A23.1. Protect other work from damage resulting from this work. Replace damaged work which cannot be satisfactorily repaired.

1.9 PROJECT CONDITIONS

.1 Temporary Lighting: Minimum 1-200 W light source, placed 2.5 m (8') above floor surface, for each 40 m^2 (430 sq ft) floor being finished.

.2 During hot weather or cold weather, conform to requirements of CSA A23.1 for mixing, placement and protection of concrete in extreme weather. During cold weather, Provide temporary heating and enclosures required.

1.10 WARRANTY

.1 The Contractor warrants the work of this Section for a period of 5 years against defects and/or deficiencies in accordance with General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within this 5 year warranty period, to the satisfaction of the Consultant and at no expense to the Owner. Defects include but are not limited to: failure of floor finish to remain in place, bonding failure, finish becoming defective, spalling and/or cracking.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Products of following manufacturers (or equivalent) may be acceptable subject to conformance to requirements of Drawings, schedules and Specifications:

.1 Adsil Advanced Silane Technology.

.2 Advanced Floor Products, Inc.

.3 ChemRex Inc.

.4 CPD Construction Products

.5 Day1 (Solomon Colors)

.6 Euclid Chemical

.7 PROSOCO.

.8 Sika Canada Inc.

.9 W.R. Meadows of Canada

.2 Substitution Limitations: Comparable Products from manufacturers listed herein offering functionally and aesthetically equivalent Products in Consultant's opinion and subject to Consultant's review, will be considered provided they meet the requirements of this Specification.

2.2 DESCRIPTION

.1 Design and Performance Requirements:

.1 Concrete finishing shall comply with applicable CSA and ACI standards and best practices whether specifically listed in this Section or not. Generally, perform Work in accordance with CSA-A23.1/A23.2.

.2 Place cast-in-place concrete of appropriate properties for intended use in accordance with requirements of applicable CSA-A23.1/A23.2 for applicable concrete exposure class and content of mix. Refer to Section 03 30 00.

.3 Coordinate with finish flooring supplier and installer to ensure adequate slab flatness is provided for floor finish scheduled to be installed on slab.

.4 Finish concrete floors with a smooth, dense, steel trowel finish to achieve the following tolerances per CSA-A23.1/A23.2 (Table 22)

.1 For surfaces scheduled to have thick-set tile, for concrete surfaces exposed to view (sealed concrete) in back-of-house areas, under raised flooring, and unless otherwise indicated: Class A (Overall FF 20 and FL 15)
.2 Under resilient finishes and other flooring less than or equal to 3 mm thick: Class B (Overall FF 25 and FL 20)
.3 Under thin-set flooring (tiling), and concrete surfaces exposed to view (sealed concrete) in public areas: Class C (Overall FF 30 and FL 25)
.4 At helicopter hangar: Class D (Overall FF 50 and FL 40)

.5 Repair cracks in concrete floors to suit the floor finish and long-term serviceability requirements of floor.

.6 Tolerances: Construct forms to produce plumb and level concrete and true to linear building lines. Conform to CSA A23.1, Clause 6.4 for maximum variations (not accumulative).

.7 Static Coefficient of Friction: Ensure floor surfaces are stable, firm and slip resistant after completing finishing procedures (where exposed). Provide Products with the following minimum values as determined by ASTM D2047 unless otherwise indicated:

.1 Level Surfaces: Minimum 0.6.
.2 Ramp Surfaces: Minimum 0.8.

2.3 MATERIALS

.1 Dry-shake Floor Hardener: Provide factory-mixed, ready-to-use dry shake floor hardener. Ensure items are delivered to the Site in sealed, moisture resistant bags, ready to apply, finish and cure.

.1 Non-Metallic Quartz Hardener: Provide 1 of following:

.1 "Surflex" by Euclid Chemical,
.2 “Maximent HD” by ChemRex Inc.,
.3 "Diamag 7" by Sika Canada Inc.

.2 Use in following locations: Exposed ‘sealed’ concrete floors subject to wheel traffic ~~(sally port)~~ and helipad. ~~Do not use on floors subject to steel wheels.~~

.2 Liquid Densifier/Sealer and Dustproofing Compound (SLR): "LS/CS-SCS Indoor Gold" by PROSOCO, or “Liqui-Hard” by W.R. Meadows Inc. or equivalent ~~meeting LEED v4 emissions criteria~~.

.1 Gloss Level: Low sheen

.2 Film Forming Protective Treatments: Follow application of penetrating concrete floor densifier with minimum of two coats of general-purpose medium gloss, film forming sealer to treat surfaces to increase resistance damage from water, staining, and abrasion.

.1 Basis-of-Design: “Bellatrix” by W.R. Meadows Inc. or approved equivalent.

.3 Use in following locations: Where interior horizontal concrete slabs are indicated on Drawings and Schedules to be ‘sealed’ or marked as ‘exposed’. Do not use on floors exposed to water, salts and inorganic acids.

.3 Joint Sealants: In accordance with performance requirements of Section 07 92 00.

.1 Standard Joint Sealant: 2 component, chemically reactive polyurethane modified sealant over premoulded joint filler; self-levelling, grey colour. Provide 1 of following:

.1 Vulkem 245 by Tremco, or equivalent ~~meeting LEED v4 criteria~~.

.2 Heavy Duty Sealant for Sawcut Joints: Epoxy modified joint sealant, cold-applied, 2 component, pour grade self levelling compound with minimum Shore A Hardness of 80 and Shore D Hardness of 50.

.1 Loadflex by Sika Canada Inc., or equivalent ~~meeting LEED v4 criteria~~.

.3 Backer Rod: Extruded, closed cell, circular polyethylene foam, sized 25% larger than joint width into which it will be installed.

.4 Miscellaneous Materials:

.1 Water for Curing: Water conforming to CSA A23.1, Clause 7.4.1 clear and entirely free from any elements which might cause staining of concrete.

.2 Polyethylene Film (for Water Curing): Minimum 0.1 mm (4 mils) thick, complying with maximum allowable moisture loss requirements of ASTM C156.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Site Verification of Conditions: Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation. Commencement of work implies acceptance of previously completed work.

3.2 PREPARATION

.1 After concrete has been placed, strike off concrete level and flush to screeds with true straight edge.

.2 Immediately after striking off concrete, level and consolidate with wooden darby or bull float. Complete levelling and consolidation before free moisture (bleeding) rises to surfaces.

.3 Wait until concrete stiffens sufficiently to sustain foot pressure with only about 6 mm (1/4") indentation.

.4 Float concrete with hand float or with power float. If free bleeding water remains on surface at this time, remove it before floating.

3.3 INSTALLATION

.1 Floor Finishing:

.1 Laser screed floor slabs as scheduled herein, using laser screed vehicle. Laser vibratory screed is to be operated only by trained and qualified personnel who are familiar with equipment.

.2 Power screed interior floor slabs with mechanical vibratory screeding equipment. Machine float and machine trowel floor surfaces to smooth, level and dense surfaces free from trowel marks, ridges and depressions, except where specified otherwise.

.3 Power screed exterior floor slabs with mechanical vibratory screeding equipment. Float using magnesium floats and trowel to level and dense surfaces and finish to sidewalk "swirl" texture.

.4 Use hand held vibrators and hand screed, float and trowel areas where power equipment is inaccessible, to same density and surface quality specified in Contract Documents for floors finished with power operated equipment.

.5 For concrete mixes containing steel fibre reinforcement, ensure finishing process leaves surface free of protruding fibres. If fibres protrude from surface after concrete has set, remove protruding fibres by grinding.

.6 Non-Metallic Quartz Hardener:

.1 In areas indicated to receive non-metallic quartz hardener, power screed floor slab and float.

.2 Over floated concrete (at plastic stage), apply premixed non-metallic quartz shake in 2 equal applications at right angles to total application rate of 7.5 kg/m2 (1.5 lbs/sq ft) of floor area. Distribute evenly. Do not throw shake. Float between application of shake and after second shake application with power float. Machine trowel to smooth, level and dense surface, in uniform colour, free from trowel marks, ridges, pinholes and other defects.

.7 Liquid Densifier/Sealer and Dustproofing Compound: In areas to receive penetrating floor sealer, prepare surfaces as recommended, mix and apply at rate of application in accordance with manufacturer's recommendation.

.8 Miscellaneous Finishes:

.1 In areas specified to receive subsequent epoxy or urethane floor overlay or coating, finish concrete floor surface with 1 pass steel trowel.

.2 Swirled Finish: In final trowelling of Steel Trowel Finish, where swirled finish is scheduled, impart slightly textured surface to concrete by spin trowelling.

.3 Install abrasive nosings to stair treads prior to placement of concrete and hand trowel treads to swirl, non-slip surface.

.2 Sawcutting of Control Joints And Construction Joints:

.1 Saw cut control joints (contraction joints) to CSA-A23.1/A23.2, 24 hours maximum after placing of concrete, and before concrete develops random contraction cracks. Do not postpone sawing operations beyond these time limitations.

.2 Refer to Section 03 30 00 for joint requirements for structural work. For other requirements, provide control joints in unreinforced slabs, spaced at maximum 4.5 m (14.76 ft) on centre in square patterns.

.3 Construct control joints for a depth equal to no more than one-fourth of concrete thickness. Do not cut through reinforcement, heating systems and other embedded items.

.4 Form control joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades, minimum 3 mm (1/8 inch) wide, ensuring cutting action will not tear, abrade, or otherwise damage surface.

.5 Continuously spray water on saw blade during sawing. Grind edges of sawcuts to eliminate burrs; do not grind to bevel or chamfer joint edges.

.6 After sawing and grinding, clean joints with jet of water and blow-out with compressed air. Immediately broom clean, residue caused by sawing operation as work progresses.

.7 When cleaned joints are dry and prior to traffic being allowed over area, install temporary filler using polyethylene rope in such joints to prevent contamination.

.8 Install joint-filler strips at junctions with slabs-on-grade and vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated on Drawings and Schedules.

.9 Do not fill isolation joints, construction joints and control joints sooner than 120 Days after concrete placement. Execute joint sealing during cool, dry ambient conditions when slab is in contracted state to minimize future joint separation at sealant filled joints.

.10 Ensure joints are clean and sound. Remove oil, dirt, debris, paint and other materials that may be a bond breaker. Remove temporary filler from sawcut joints. Clean joints and blow with compressed air.

.11 Extend joint fillers full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated on Drawings and Schedules. Overfill joints during placement. Cut flush or grind flush with floor within 24 hours after placement.

.3 Curing/sealing of Floors:

.1 Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with CSA A23.1/A23.2 for cold-weather protection and hot-weather protection during curing.

.2 Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

.3 Curing Methods: Cure formed and unformed concrete for at least seven days, or until minimum structural strength of concrete indicated in Section 03 30 00, and as required by CSA A23.1/CSA 23.2 (Table 2) for exposure class and floor finishes specified.

.4 Joint Sealant:

.1 Following joint sealant installation Specifications, do not apply in areas of concrete slab to receive subsequent floor finishes such as quarry tile, ceramic tile, carpet, resilient tile and epoxy topping system.

.2 Do not fill isolation joints, construction joints and control joints sooner than 120 Days after concrete placement. Execute joint sealing during cool, dry ambient conditions when slab is in contracted state to minimize future joint separation at sealant filled joints.

.3 Remove temporary filler from sawcut joints. Remove 6 mm (1/4") scored strip from top of premoulded joint filler. Clean joints and blow clean with compressed air.

.4 ReInstall backer rod into construction/expansion joints, set to proper sealant depth per sealant manufacturer's printed directions. Fill remainder of joint with standard joint sealant.

.5 No sooner than 120 Days, fill interior sawn construction and control joints in concrete slabs full depth with heavy duty sawcut joint sealant in accordance with manufacturer's printed directions. Joints must be overfilled with sealant and then shaved flush with slab surface once hardened.

.6 Caulk over premoulded isolation joint fillers with specified standard joint filler sealant.

.7 Prime wall of joint as recommended by sealant manufacturer. Mix sealant as directed by manufacturer. Coat surfaces of metal in contact with sealant with primer as recommended by sealant manufacturer.

.8 Fill exterior sawn construction and control joints and over premoulded isolation joint filler with specified standard joint sealant.

.9 Comply with manufacturer's application and substrate temperature requirements.

3.4 REPAIR/RESTORATION

.1 Crack Repair:

.1 After concrete has cured, examine concrete floor surfaces and repair cracks. Route cracks out with mechanical router to minimum depth of 13 mm (1/2"). Then clean and fill cracks in same manner as control joints.

.2 Correct defects in defined traffic floor only by grinding or removal and replacement of defective slabs. Areas requiring corrective work will be identified by Consultant. Verify corrected areas with Consultant.

.2 Perform corrective work at times convenient to the Consultant and at no cost to the Owner.

3.5 FIELD QUALITY CONTROL

.1 Employ services of a trained concrete technician from staff of surface hardener manufacturer to give assistance to this Section in proper use of material during initial periods of installation.

.2 Give 5 (five) Days' notice to surface hardener manufacturer in advance of commencing work.

.3 Independent inspection and testing company may be appointed and paid for by the Owner to carry out inspection and testing as directed by the Consultant.

.4 Perform tests in accordance with CSA A23.2.

.5 Forward inspection company's reports of tests to the Consultant with opinion or reason for any abnormalities noted thereon.

.6 Cooperate with and assist Inspection Company's personnel during inspection and tests.

.7 Remove defective materials and completed work which fail tests and replace as directed by the Consultant.

3.6 FLOOR FINISHING SCHEDULE

Scheduled Floor Finish	**Concrete Finish Required**	**Hardener**	**Curing/Sealing Method***
Carpet	Steel Trowel	None Required	Dissipating curing compound or water or poly curing.
Resilient Flooring	Steel trowel followed by blastrack.	None Required	Dissipating curing compound (where approved by flooring manufacturer), or water or poly curing
Trowel Applied Composition Flooring (Epoxy, Urethane Acrylic, Polyester):	Steel trowel followed by blastrack in accordance with CSA A23.1.	If recommended by composition flooring material manufacturer	Poly curing
Liquid Applied Rubber or Plastic Membrane (Mechanical Waterproofing):	Steel trowel in accordance with CSA A23.1	None required	Water or poly curing
Thinset Ceramic and Quarry Tile, Clay Tile and Brick Tile	Steel trowel in accordance with CSA A23.1	None required	Water or poly curing
Ceramic and Quarry Tile, Clay Tile and Brick Tile over mortar bed	Steel trowel followed by blastrack in accordance with CSA A23.1	None required	Water or poly curing
Exposed Concrete – Interior	Steel trowel in accordance with CSA A23.1.	Non-Metallic Quartz Hardener	Curing/sealing compound
Exposed Concrete – Exterior	Nonslip Broom Finish (final texture to be determined in coordination with the Owner)	Non-Metallic Quartz Hardener	Curing/sealing compound

.1 * Curing/Sealing Method: Refer to room finish schedule for specific types of sealers required on exposed concrete floors.

.2 ** Exposed concrete finishes: Provide swirled finish where concrete is scheduled to be exposed at ramps or in staircases.

END OF SECTION

PART 1 - GENERAL

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL INSTRUCTIONS

.1 Read and conform to:

.1 the General Conditions and the Supplementary Conditions of the Contract.

.2 Division 01 requirements and any additional documents referred to therein.

1.3 SUMMARY

.1 Work Included: This Section includes the common work results for masonry specified herein. This includes, but is not necessarily limited, to general requirements for:

.1 Masonry mortars and grouts.

.2 Masonry anchorage and connectors.

.3 Masonry accessories.

.4 Unit masonry components.

.5 Unless indicated otherwise, requirements specified in this Section govern masonry requirements for The Work

.2 Related Requirements: Specifications throughout the entirety of Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.4 REFERENCES

.1 Reference Standards: Latest published editions of reference standards listed in this Section in effect as of the closing date and time of the Request for Tenders for the Contract, including any amendments adopted, are applicable unless otherwise indicated.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meetings:

.1 Prior to starting work of this Section, convene a pre-installation meeting at Project site to review Project requirements and site conditions with pertinent parties. Conform to requirements of Section 01 30 00.

1.6 SUBMITTALS

.1 Product Data: Submit manufacturer's literature and data sheets for each type of material provided under this Section for Project in accordance with requirements of Section 01 30 00.

.1 Submit manufacturer's instructions, printed product literature and data sheets for masonry and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Safety Data Sheets (SDS): Submit SDS for inclusion in Operation and Maintenance Manual specified in Section 01 70 00, for adhesives, sealants and any other material designated by Consultant.

.3 List of Materials Used in Constructing Mock-ups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.

.1 Submittal is for information only. Receipt of list does not constitute approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Consultant and approved in writing.

.4 Shop Drawings: Submit Shop Drawings for work of this Section in accordance with Section 01 30 00.

.1 Submit shop drawings detailing temporary bracing required, designed to resist wind pressure and lateral forces during installation.

.2 Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.

.3 Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars.

.4 Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

.5 Samples: Submit samples in accordance with Section 01 30 00.

.1 2 of each type of masonry unit specified, including special shapes.

.2 1 of each type of masonry accessory and flashing specified.

.3 1 of each type of masonry anchorage, reinforcement and connector proposed for use.

.4 As required for testing purposes.

.6 Certificates: submit manufacturer's product certificates certifying materials comply with specified requirements.

.7 Test and Evaluation Reports:

.1 Test reports to certify compliance of masonry units and mortar ingredients with specified performance characteristics and physical properties.

.2 Submit data for masonry units, in addition to requirements set out in referenced CSA and ASTM Standards, indicating initial rates of absorption.

1.7 CLOSEOUT SUBMITTALS

.1 Submit manufacturer's instructions for care, cleaning and maintenance of masonry units for incorporation into manual specified in Section 01 70 00.

1.8 QUALITY ASSURANCE

.1 Qualifications:

.1 Manufacturers: Provide Products for Work of this Section by manufacturer with minimum 10 years' experience in the manufacture of such materials.

.2 Installers: Provide work of this Section executed by competent installers with minimum 5 years' experience in the application of Products, systems and assemblies specified and with approval and training of the Product manufacturers.

.2 Single Source Responsibility: Ensure primary materials provided in this Section are obtained from one source by a single manufacturer and secondary materials are obtained from sources recommended by primary materials manufacturers.

.1 Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted by Consultant.

.3 Licensed Professionals: Employ a professional structural engineer registered in the province of Ontario, carrying minimum of $2,000,000.00 professional liability insurance to:

.1 design the components of the work of this Section requiring structural performance and their attachments to building's structure,

.2 be responsible for full assemblies and connections,

.3 be responsible for determining sizes, yield strengths, gauge thicknesses and joint spacing to allow thermal movement and loading of components in accordance with applicable codes and regulations,

.4 be responsible for production and review of Shop Drawings,

.5 inspect the work of this Section during fabrication and erection,

.6 stamp and sign each shop drawing,

.7 Provide site administration and inspection of this part of the Work.

.8 Submit certificate validating seismic assessment and field review of this part of the Work.

.4 Mock-ups:

.1 Construct mock-up panel of typical exterior masonry wall construction 1200 x 1800 mm (48 inches x 72 inches) showing masonry colours and textures, use of reinforcement, ties, through-wall flashing, weep holes, jointing, pointing, coursing, mortar and quality of work.

.1 Include a sealant-filled joint at least 400 mm (16 inches) long in each mockup.

.2 Include lower corner of window opening at upper corner of exterior wall mockup. Make opening approximately 300 mm (12 inches) wide by 400 mm (16 inches) high.

.3 Include through-wall flashing installed for a 600-mm (24-inch) length in corner of exterior wall mockup approximately 400 mm (16 inches) down from top of mockup, with a 300-mm (12-inch) length of flashing left exposed to view (omit masonry above half of flashing).

.4 Include studs, sheathing, sheathing joint-and-penetration treatment, air barrier, veneer anchors, flashing, cavity drainage material, and weep holes in exterior masonry-veneer wall mockup.

.2 Mock-ups will be used to judge quality of work, substrate preparation, operation of equipment and material application.

.1 Mock-ups may also be used for testing to determine compliance with performance requirements. Perform following tests.

.1 For clay units, in addition to requirements set out in referenced CSA and ASTM Standards include data indicating initial rate of absorption.

.3 Construct mock-up where directed by Consultant.

.4 Allow 24 hours for inspection of mock-up by Consultant before proceeding with work.

.5 When reviewed by Consultant, mock-up to demonstrate minimum standard for this work.

.6 Subject to compliance with requirements, reviewed mock-ups may become part of the completed Work if undisturbed at time of Substantial Performance of the Work.

1.9 DELIVERY, STORAGE AND HANDLING

.1 Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

.2 Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

.3 Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

.4 Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.

.5 Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.10 SITE CONDITIONS

.1 Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

.1 Extend cover a minimum of 600 mm (24 inches) down both sides of walls, and hold cover securely in place.

.2 Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 600 mm (24 inches) down face next to unconstructed wythe, and hold cover in place.

.2 Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

.1 Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.

.2 Protect sills, ledges, and projections from mortar droppings.

.3 Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.

.4 Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

.3 Ambient Conditions: assemble and erect components when temperatures are above 4 deg C (40 deg F).

.4 Cold weather requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in CAN/CSA-A371 and following requirements.

.1 Maintain temperature of mortar between 5 deg C and 50 deg C (40 deg F and 122 deg F) until batch is used or becomes stable.

.2 Maintain ambient temperature of masonry work and its constituent materials between 5 deg C and 50 deg C (40 deg F and 122 deg F and protect site from windchill.

.3 Maintain temperature of masonry above 0 deg C (32 deg F) for minimum of 7 days, after mortar is installed.

.4 Preheat unheated wall sections in enclosure for minimum 72 hours above 10 deg C (50 deg F), before applying mortar.

.5 Hot weather requirements:

.1 Protect freshly laid masonry from drying too rapidly, by means of waterproof, non-staining coverings.

.2 Keep masonry dry using waterproof, non-staining coverings that extend over walls and down sides sufficient to protect walls from wind driven rain, until masonry work is completed and protected by flashings or other permanent construction.

.6 Spray mortar surface at intervals and keep moist for maximum of 3 days after installation.

PART 2 - PRODUCTS

2.1 DESIGN AND PERFORMANCE REQUIREMENTS

.1 Masonry Structural Design Standard: Design masonry systems in accordance with limit states design method of the Ontario Building Code and CSA S304. Design masonry walls for maximum deflection of L/360 under design loads.

.2 Masonry Connectors Standard: Comply with CAN/CSA-A370, for minimum requirements for design of masonry connectors (ties, anchors, fasteners, and repair connectors) to interconnect wythes of masonry assemblies, attach masonry veneer to structural backings, and connect masonry assemblies to intersecting walls or to other structural members.

.3 Masonry Construction Standard: Comply with CAN/CSA-A371, except as modified by requirements in the Contract Documents.

.4 Masonry Materials Standards:

.1 Clay Masonry Units: Comply with CSA A82, for minimum requirements for testing, freeze-thaw durability, finish, texture, colour, compressive strength, absorption, efflorescence, size, warpage, and out-of-square.

.2 Concrete Masonry Units: Comply with CSA A165 Series, for minimum requirements for compressive strength, concrete type, moisture content, and other physical properties.

.3 Mortar and Grout: Comply with CSA A179, for minimum requirements for mortar for use in bedding, jointing, and bonding of masonry units; and grout (fine or coarse) for use in filling core, cell, or cavity space in unit masonry construction.

.4 Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work and will be within 6 m (20 feet) vertically and horizontally of a walking surface.

.5 Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.

.1 Where fire-resistance-rated construction is indicated, units shall be listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction.

.2 If no ULC or NRCC fire tests are indicated, construct masonry fire protection and fire separation of thickness for required fire resistance ratings, and conforming to the Fire Performance Ratings, Appendix D to the National Building Code of Canada.

.3 Ensure fire and smoke masonry separations conform to building code requirements with respect to materials, classification, equivalent thicknesses, fire resistance ratings, type of concrete and other requirements of authorities having jurisdiction.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Examine conditions, substrates and work to receive work of this Section.

.2 Examine openings to receive masonry units. Verify opening size, location, and that opening is square and plumb, and ready to receive work of this Section.

.1 Inform Consultant of unacceptable conditions immediately upon discovery.

.2 Proceed with installation after unacceptable conditions have been remedied.

.3 Verification of Conditions:

.1 Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation. Commencement of work implies acceptance of previously completed work.

.2 Substrate conditions which have been previously installed under other sections or contracts, are acceptable for product installation in accordance with manufacturer's instructions prior to installation of masonry.

.3 Site conditions are acceptable and are ready to receive work.

.4 Built-in items are in proper location, and ready for roughing into masonry work.

.4 Commencing installation means acceptance of existing conditions.

3.2 PREPARATION

.1 Surface Preparation: prepare surface in accordance with manufacturer's written recommendations.

.2 Establish and protect lines, levels, and coursing.

.3 Protect adjacent materials from damage and disfiguration.

3.3 INSTALLATION

.1 Do masonry work in accordance with CAN/CSA-A371 except where specified otherwise.

3.4 SITE QUALITY CONTROL

.1 Manufacturer's Services:

.1 Manufacturer's site services: provide manufacturer's site services, consisting of product use recommendations and periodic site visits for inspection of product installation, in accordance with manufacturer's instructions.

.2 Schedule site visits to review work as installation is about to begin.

3.5 CLEANING

.1 Unless otherwise indicated on Drawings and Schedules, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

.2 Leave Work area clean at end of each day.

3.6 PROTECTION

.1 Temporary Bracing:

.1 Provide temporary bracing of masonry work during and after erection until permanent lateral support is in place.

.2 Brace masonry walls as necessary to resist wind pressure and lateral forces during construction.

.2 Moisture Protection:

.1 Keep masonry dry using waterproof, non-staining coverings that extend over walls and down sides sufficient to protect walls from wind driven rain, until completed and protected by flashing or other permanent construction.

.2 Cover completed and partially completed work not enclosed or sheltered with waterproof covering at end of each workday. Anchor securely in position.

END OF SECTION

PART 1 - GENERAL

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL INSTRUCTIONS

.1 Read and conform to:

.1 the General Conditions and the Supplementary Conditions of the Contract.

.2 Division 01 requirements and documents referred to therein.

1.3 SUMMARY

.1 Work Included: Provide labour, materials, products, equipment and services to complete the masonry mortar and grout work specified herein. This includes, but is not necessarily limited, to:

.1 Pre-packaged dry combined materials,

.2 Auxiliary materials required for a complete installation,

.3 Mixing procedures.

.2 Related Requirements: Specifications throughout the entirety of Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.4 REFERENCES

.1 Reference Standards: Latest published editions of reference standards listed in this Section in effect as of the closing date and time of the Request for Tenders for the Contract, including any amendments adopted, are applicable unless otherwise indicated.

.2 Definitions: The following definitions as indicated in CSA A179 apply to this Section:

.1 Type N mortar: a moderate-strength mortar suitable for general use in exposed masonry above grade and recommended particularly when high compressive and/or lateral masonry strengths are not required. Minimum compressive strength of 3.5 Mpa (510 psi) after 28 days in accordance with “Property Specifications” of CSA A179.

.2 Type S mortar: a mortar suitable for general use and recommended particularly when high lateral strength of masonry is required. It can also be used for below-grade applications Minimum compressive strength of 8.5 Mpa (1235 psi) after 28 days in accordance with “Property Specifications” of CSA A179.

.3 Type M mortar: a high-strength mortar recommended when maximum masonry compressive strength is required, or for masonry below grade and in contact with earth. Minimum compressive strength of 14 Mpa (2030 psi) after 28 days in accordance with “Property Specifications” of CSA A179.

.4 Type O mortar: a low-strength, high-lime mortar suitable for use in nonloadbearing interior walls, or loadbearing walls with low-strength requirements. Minimum compressive strength of 2 Mpa (290 psi) after 28 days in accordance with “Property Specifications” of CSA A179.

.5 Fine Grout: Minimum compressive strength of 10 Mpa (1450 psi) after 28 days in accordance with “Property Specifications” of CSA A179. Maximum aggregate size and grout slump: CAN/CSA-A179.

.6 Coarse Grout: Minimum compressive strength of 12.5 Mpa (1815 psi) after 28 days in accordance with “Property Specifications” of CSA A179. Maximum aggregate size and grout slump: CAN/CSA-A179.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meetings:

.1 Prior to starting work of this Section, convene a pre-installation meeting at Project site to review Project requirements and site conditions with pertinent parties. Conform to requirements of Section 01 30 00.

1.6 PRECONSTRUCTION TESTING

.1 Preconstruction Testing Service: Owner may engage a qualified independent testing agency to perform preconstruction testing indicated below. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

.1 Mortar Test: Perform test for each mix required, according to CAN/CSA A179 for the following:

.1 Compressive strength.

.2 Consistency.

.3 Mortar aggregate ratio.

.4 Sand/cement ratio.

.5 Water content and water/cement ratio.

.6 Air content.

.7 Splitting tensile strength.

.2 Grout Test: Perform test for each mix required, according to CAN/CSA A179 for the following:

.1 Compressive strength.

.2 Sand/cement ratio.

.3 Water content and water/cement ratio.

.4 Slump.

1.7 SUBMITTALS

.1 Product Data: Submit manufacturer's literature and data sheets for each type of material provided under this Section for Project in accordance with requirements of Section 01 30 00.

.1 Ensure data sheets provide required information including detailed instructions for installing as well as maintaining, preserving, and keeping materials in clean and safe conditions. Provide adequate warning of maintenance practices or cleaning agents detrimental to specified materials.

.2 Submit confirmation of source or product data sheet, prior to mixing or preparation of mortars, to Consultant, for:

.1 Aggregate: course aggregate and sand.

.2 Cement.

.3 Lime.

.4 Colour pigment samples.

.2 Safety Data Sheets (SDS): Submit SDS for inclusion in Operation and Maintenance Manual specified in Section 01 70 00, for adhesives, sealants and any other material designated by Consultant.

.3 Samples: submit unit samples in accordance with Section 04 05 00, supplemented as follows:

.1 Submit two 300 mm (12 inch) size samples of coloured mortar.

.4 Test Reports: submit certified test reports including sand gradation tests in accordance with CAN/CSA-A179 showing compliance with specified performance characteristics and physical properties, and in accordance with Section 04 05 00.

.5 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.8 QUALITY ASSURANCE

.1 Qualifications:

.1 Manufacturers: Provide Products for Work of this Section by manufacturer with minimum 10 years' experience in the manufacture of such materials.

.2 Installers: Provide work of this Section executed by competent installers with minimum 5 years' experience in the application of Products, systems and assemblies specified and with approval and training of the Product manufacturers.

.2 Single Source Responsibility: Ensure primary materials provided in this Section are obtained from 1 source by a single manufacturer and secondary materials are obtained from sources recommended by primary materials manufacturers.

.3 Mock-ups: Construct mock-ups in accordance with Section 01 40 00 and requirements of Section 04 05 00.

.4 Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

1.9 DELIVERY, STORAGE AND HANDLING

.1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.2 Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

.3 Store aggregates where grading and other required characteristics can be maintained, and contamination avoided.

.4 Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in covered weatherproof dispensing silos.

1.10 SITE CONDITIONS

.1 Ambient Conditions: maintain materials and surrounding air temperature to the most stringent requirements of manufacturer's recommendations, Section 04 05 00 and CAN/CSA A371.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Products of following manufacturers may be acceptable subject to conformance to requirements of Drawings, Schedules and Specifications:

.1 Pre-packaged Mortar and Grout

.1 King Packaged Materials (a Sika Company);

.2 Maxi-Mix;

.3 Quikcrete;

.4 Spec Mix;

.2 Mortar Pigments

.1 BayFerrox;

.2 Interstar Pigment, Admixture and Fibers;

.3 Solomon Pigments;

.4 Venator Pigments (previously Rockwood Pigments).

.2 Comparable Products from manufacturers listed herein offering functionally and aesthetically equivalent products in Consultant's opinion, and subject to Consultant's review, will be considered provided they meet the requirements of this Specification.

2.2 DESIGN AND PERFORMANCE REQUIREMENTS

.1 Use only pre-blended, prepackaged dry combined materials (mortar and grout) mixed under controlled factory conditions or in site silo. Ingredients batching limitations to be within 1% accuracy. Hand mixing of bags and sand is not permitted.

.2 Water Repellent Admixture: Provide water repellent admixture to all exterior masonry units and mortar to yield resistance to water penetration in accordance with ASTM E514 (Class E water permeance)

2.3 MATERIALS

.1 Portland Cement: CAN/CSA-A3001, Type GU - General use hydraulic cement (Type 10), unless indicated otherwise.

.1 Colour: Provide natural color or white cement as required to produce mortar color indicated on Drawings and Schedules. At architectural concrete masonry units, provide white colour cement.

.2 Where required for cold-weather construction, provide Type HE – High Early Strength Hydraulic Cement (Type 30) or accelerator admixtures as recommended by pre-blended mortar and grout manufacturer.

.2 Pre-Packaged Dry Combined Materials: CAN/CSA-A179, factory-packaged blend of dry cementitious materials, lime and dry sand, proportioned and blended at a manufacturing plant, and requiring only the addition of water, and mixing at construction site; with Types as follows (based on Property Specifications):

.1 Mortar for exterior masonry above grade:

.1 Load Bearing: Type S (Portland Cement/Lime).

.2 Non-Load Bearing: Type N (Portland Cement/Lime).

.2 Parapet walls: Type S (Portland Cement/Lime).

.3 Mortar for interior masonry:

.1 Load Bearing: Type S (Portland Cement/Lime).

.2 Non-Load Bearing: Type N (Portland Cement/Lime).

.4 Mortar for foundation walls, manholes, sewers, pavements, walks, patios and other exterior masonry at or below grade: type M or Type S.

.3 Aggregate: CAN/CSA-A179

.4 Water: clean and potable.

.5 Hydrated Lime: to ASTM C207, Type S.

2.4 AUXILIARY MATERIALS

.1 Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979. Use only pigments with a record of satisfactory performance in masonry mortar.

.1 Use colouring admixture not exceeding 10% of cement content by mass, or integrally coloured masonry cement, to produce coloured mortar to match approved sample. Ensure admixtures are approved prior to use. Use in accordance with specific manufacturer's recommendations.

.2 Water-Repellent Admixture: Low VOC, water-repellent mortar admixture intended for use with masonry units containing integral water repellent by same manufacturer.

.1 Acceptable Products:

.1 “RainBloc for Mortar” by ACM Chemistries

.2 “Rheopel Mortar Admixture” by BASF Canada Inc.

.3 “Dry-Block Mortar Admixture” by GCP Applied Technologies

.4 Approved equivalent.

2.5 MORTAR MIXING

.1 Use only pre-packaged dry combined materials, pre-blended, pre-coloured mortar produced under controlled factory conditions or in site silo.

.2 Mix mortar ingredients in accordance with CAN/CSA-A179 and manufacturer’s instructions in quantities needed for immediate use.

.3 Add mortar colour and admixtures in accordance with manufacturer's instructions. Provide uniformity of mix and colouration.

.4 Use continuous silo mixer or batch type mixer in accordance with CAN/CSA-A179.

.5 Use of calcium chloride or chloride-based admixtures is prohibited.

.6 Use mortar within 2 hours after mixing. Discard unused mixed mortar after 2 hours.

.7 Contractor to appoint one individual to mix mortar, for duration of project. In event that this individual is changed, mortar mixing must cease until new individual is trained, and mortar mix is tested.

2.6 GROUT MIXING

.1 Use only pre-packaged, pre-mixed, pre-bagged dry combined grout materials specifically designed for applications indicated and produced under controlled factory conditions or in site silo.

.2 Conform to CSA A23.1/A23.2 and CAN/CSA-A179.

.1 Fine Grout: Minimum compressive strength of 10 Mpa (1450 psi) after 28 days in accordance with “Property Specifications” of CSA A179. Maximum aggregate size and grout slump: CAN/CSA-A179.

.2 Coarse Grout: Minimum compressive strength of 12.5 Mpa (1815 psi) after 28 days in accordance with “Property Specifications” of CSA A179. Maximum aggregate size and grout slump: CAN/CSA-A179.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Site Verification of Conditions:

.1 Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation. Commencement of work implies acceptance of previously completed work.

3.2 PREPARATION

.1 Plug clean-out holes with masonry units. Brace masonry for wet grout pressure.

3.3 MORTAR AND GROUT WORK

.1 Do masonry mortar and grout work in accordance with CSA A371 and CAN/CSA-A179 except where specified otherwise.

.2 Mix mortar and grout in accordance with manufacturer’s instructions.

.3 Clean mixing boards and mechanical mixing machine between batches.

.4 Ensure mortar compressive strength is weaker than units it is binding.

.5 Keep cavities clean of mortar droppings and other materials during construction.

.6 Remove excess mortar from grout spaces.

.7 Do not place grout until the entire height of masonry to be grouted has attained enough strength to resist grout pressure.

.8 Work grout into masonry cores and cavities to eliminate voids.

.9 Comply with requirements in CAN/CSA-A371 for cleanouts and for grout placement, including minimum grout space and maximum pour height.

.1 Limit height of vertical grout pours to not more than 1.5m (60 inches).

.2 Do not install grout in lifts greater than 400 mm (16 inches), without consolidating grout by rodding.

.3 Do not displace reinforcement while placing grout.

3.4 TOOLING

.1 Provide joints in masonry, firmly pointed, compacted and tooled.

.2 Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated on Drawings and Schedules.

.3 Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated on Drawings and Schedules.

.4 For parged masonry, provide raked joints, minimum 13 mm (1/2 inch) unless otherwise indicated on Drawings and Schedules.

3.5 CLEANING

.1 Leave Work area clean at end of each day.

.2 Remove droppings and splashings using clean sponge and water.

.3 Clean masonry with low pressure clean water and soft natural bristle brush.

.4 Upon completion remove surplus materials, rubbish, tools and equipment.

3.6 PROTECTION

.1 Cover completed and partially completed work not enclosed or sheltered with waterproof covering at end of each workday. Anchor securely in position.

END OF SECTION

PART 1 - GENERAL

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL INSTRUCTIONS

.1 Read and conform to:

.1 the General Conditions and the Supplementary Conditions of the Contract.

.2 Division 01 requirements and documents referred to therein.

1.3 SUMMARY

.1 Work Included: Provide labour, materials, products, equipment and services to complete the masonry anchorage and reinforcing work specified herein. This includes, but is not necessarily limited, to:

.1 Masonry ties,

.2 Joint reinforcement,

.3 Masonry anchors,

.4 Fasteners,

.5 Auxiliary materials required for complete installation.

.2 Related Requirements: Specifications throughout the entirety of Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.4 REFERENCES

.1 Reference Standards: Latest published editions of reference standards listed in this Section in effect as of the closing date and time of the Request for Tenders for the Contract, including any amendments adopted, are applicable unless otherwise indicated.

.2 Definitions: The following definitions as indicated in CSA A370 apply to this Section:

.1 Masonry Ties: masonry connectors used to interconnect the wythes of a masonry wall; or attach masonry veneer to its structural backing;

.2 Masonry Anchors: masonry connectors used to connect masonry walls to intersecting walls or to other structural members, attach stone to its structural backing, or interconnect stone;

.3 Masonry Fasteners: masonry connectors used to secure masonry ties and anchors to structural elements;

.4 Repair Connectors: repair connectors used to restore or improve masonry construction.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meetings:

.1 Prior to starting work of this Section, convene a pre-installation meeting at Project site to review Project requirements and site conditions with pertinent parties. Conform to requirements of Section 01 30 00.

1.6 SUBMITTALS

.1 Product Data: Submit in accordance with requirements of Section 01 30 00 for each type of product indicated on Drawings and Schedules. Include recommendations for application and use. Include test data substantiating that products comply with requirements.

.1 Ensure data sheets provide required information including detailed instructions for installing as well as maintaining, preserving, and keeping materials in clean and safe conditions. Provide adequate warning of maintenance practices or cleaning agents detrimental to specified materials.

.2 Safety Data Sheets (SDS): Submit SDS for inclusion in Operation and Maintenance Manual specified in Section 01 70 00, for adhesives, sealants and any other material designated by Consultant.

.3 Shop Drawings: Submit Shop Drawings in accordance with Section 01 30 00.

.1 Submit drawings detailing bar bending details, anchorage details lists and placement drawings

.2 On placement drawings, indicate sizes, spacing, location and quantities of reinforcement and connectors.

.3 Indicate on shop drawings, bar bending details, lists, quantities of reinforcement, sizes, spacings, locations of reinforcement and mechanical splices, with identifying code marks to permit correct placement.

.4 Indicate sizes, spacings and locations of chairs, spacers and hangers.

.5 Prepare reinforcement drawings in accordance with Reinforcing Steel Manual of Standard Practice - by Reinforcing Steel Institute of Canada. ANSI/ACI 315 and ACI 315R.

.4 Test Reports: submit certified test reports including sand gradation tests in accordance with CAN/CSA-A370 showing compliance with specified performance characteristics and physical properties, and in accordance with Section 04 05 00.

.5 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.7 QUALITY ASSURANCE

.1 Qualifications:

.1 Manufacturers: Provide Products for Work of this Section by manufacturer with minimum 10 years' experience in the manufacture of such materials.

.2 Installers: Provide work of this Section executed by competent installers with minimum 5 years' experience in the application of Products, systems and assemblies specified and with approval and training of the Product manufacturers.

.2 Single Source Responsibility: Ensure primary materials provided in this Section are obtained from one source by a single manufacturer and secondary materials are obtained from sources recommended by primary materials manufacturers.

.3 Mock-ups: Construct mock-ups in accordance with Section 01 40 00 and requirements of Section 04 05 00.

.4 Source Limitations for Masonry Connectors: Obtain masonry connectors from single source from single manufacturer for each product type required.

.5 Licensed Professionals: Employ a professional structural engineer registered in the province of Ontario, carrying minimum of $2,000,000.00 professional liability insurance to:

.1 design the components of the work of this Section requiring structural performance and their attachments to building's structure,

.2 be responsible for full assemblies and connections,

.3 be responsible for determining sizes, yield strengths, gauge thicknesses and joint spacing to allow thermal movement and loading of components in accordance with applicable codes and regulations,

.4 be responsible for production and review of Shop Drawings,

.5 inspect the work of this Section during fabrication and erection,

.6 stamp and sign each shop drawing,

.7 Provide site administration and inspection of this part of the Work.

.8 Submit certificate validating seismic assessment and field review of this part of the Work.

1.8 SITE CONDITIONS

.1 Make site measurements necessary for proper fit of members.

1.9 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Products of following manufacturers may be acceptable subject to conformance to requirements of Drawings, Schedules and Specifications:

.1 Blok Lok; a Hohmann & Barnard company;

.2 Fero Corporation;

.3 Heckmann Building Products Inc.

.2 Comparable Products from manufacturers listed herein offering functionally and aesthetically equivalent products in Consultant's opinion, and subject to Consultant's review, will be considered provided they meet the requirements of this Specification.

2.2 DESIGN AND PERFORMANCE REQUIREMENTS

.1 Design masonry anchorage and reinforcing in accordance with CSA A370, the Ontario Building Code and CSA S304 and the following requirements:

.1 Size units to accommodate total thickness of wall assemblies, including thickness of sheathing, air barrier and vapour retarder membranes, and insulation where applicable.

.2 Mechanical free play: For single- and multi-component ties, not to exceed 1.2 mm (0.05 inches) when assembled in any possible configuration and position of adjustment, including any mechanical free play between a tie component and the structural backing.

.3 Displacement: For single- and multi-component ties, not to exceed 2.0 mm (0.08 inches) under a compressive or tensile load of 0.45 kN (100 lbs.), when assembled in any possible configuration and position of adjustment, including free play; displacement includes secondary deformations of the structural backing.

.4 Positive restraint: For adjustable ties, provide positive restraint to prevent disengagement at all positions of adjustment including that of maximum adjustment.

.5 Corrosion protection and material compatibility: Unless indicated otherwise, Provide Type 316 stainless steel anchoring and reinforcing materials and accessories at exterior locations and high-moisture (where relative humidity levels are greater than 75%) interior locations (e.g. pools and showers). At other interior locations, mill galvanized and hot-dipped galvanized materials are permitted.

.6 Structural integrity: Determined in accordance with CSA A370.

.7 Load determination: Determined in accordance with CSA S304.1.

.8 Include expansion joints to accommodate movement in wall system and between wall system and building structure, caused by structural movements, without permanent distortion, damage to infills, racking of joints, breakage of seals, or water penetration.

.9 Seismic Performance: Design work of this Section to withstand seismic motions determined in accordance with requirements of OBC and CAN/CSA S832. Provide connections with additional anchorage and lateral stabilization in accordance with CSA A371 and CSA S304 requirements.

2.3 MATERIALS

.1 Provide ties and anchors specified in this Section that are made from materials that comply with the following unless otherwise indicated on Drawings and Schedules.

.1 Mill-Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M; with ASTM A 641/A 641M, Class 1 coating.

.2 Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M; with ASTM A 153/A 153M, Class B-2 coating.

.3 Stainless-Steel Wire: ASTM A 580/A 580M, Type 316L.

.4 Galvanized Steel Sheet: ASTM A 653/A 653M, Commercial Steel, Z275 (G90) zinc coating.

.5 Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, with ASTM A 153/A 153M, Class B coating.

.6 Stainless-Steel Sheet: ASTM A 666, Type 316L.

.7 Stainless-Steel Bars: ASTM A 276 or ASTM A 666, Type 304.

.8 Steel Bar reinforcement: CSA-A371, and CAN/CSA G30.18, Grade 400.

2.4 MASONRY TIES

.1 Unless otherwise indicated on Drawings and Schedules, size wire ties in accordance with CSA A370 and CSA S304.1. Corrugated strip ties are not permitted.

.2 Masonry ties components to stainless steel as specified in this Section. Galvanized components are not permitted.

.3 Provide ties that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall. Provide units consisting of a wire tie, a metal plate section and insulation support. Provide proprietary adjustable ties, types, styles and sizes to suit application in accordance with manufacturer's recommendations and as follows:

.1 For tying to Exterior Structural Metal Stud Framing:

.1 "Stud Shear Connectors™" by Fero Corporation

.2 “Blok Lok BL607 connector with Flex O Lok Tie, Flex O Lok insulation retaining device and Blok Lok Coated Tek Screws” by Blok Lok; a Hohmann & Barnard company.

.2 For tying to Concrete Masonry Backup:

.1 "Block Shear Connectors™" by Fero Corporation

.2 “Blok Lok BL507S connector with Flex O Lok Tie and Flex O Lok insulation retaining device” by Blok Lok; a Hohmann & Barnard company.

.3 For tying to Poured Concrete Backup:

.1 "Rap Tie System" by Fero Corporation

.2 “Blok Lok BL407 connector with Flex O Lok Tie and Flex O Lok insulation retaining device and Blok Lok Coated Tek Screws” by Blok Lok; a Hohmann & Barnard company.

.4 For tying to Structural Steel Columns and Beams:

.1 "CAT Tie System" by Fero Corporation

.2 “Blok Lok BLT-9A” or “Blok Lok Gripstay System” by Blok Lok; a Hohmann & Barnard company.

2.5 JOINT REINFORCEMENT

.1 Provide wire reinforcement to CSA A371 with corrosion protection to CSA S304, CSA G30.3-M and CSA A370.

.2 Provide masonry reinforcements as required to improve performance of masonry walls and control shrinkage cracking. Fabricate reinforcing in accordance with CSA-A23.1/A23.2 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.

.1 Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 400 mm (16 inches) o.c.

.2 Provide in lengths of not less than 3 m (10 feet) , with prefabricated corner and tee units.

.3 Single Wythe Joint Reinforcement:

.1 Interior dry locations: Mill galvanized, cold drawn steel wire.

.2 Interior high-moisture locations; Steel wire, hot dip galvanized: to ASTM A 641, Class 3 after fabrication.

.3 Exterior locations: Stainless steel conforming to ASTM A 580, Type 304.

.4 Provide ladder type reinforcement unless indicated otherwise. Where vertical reinforcement is not required in masonry walls, truss types are permitted.

.5 Provide shop fabricated corners, intersections and curved configuration where required.

.6 Acceptable Products:

.1 Ladder Type: “Ladur” by Dur-O-Wal Limited or “BL10, BL 11 or BL 13" by Blok-Lok Limited or approved equivalent.

.2 Truss Type: “DW 100 Dur-O-Wal Truss” or “BL30, BL 31 or BL 32" by Blok-Lok Limited or approved equivalent.

.4 Multiple Wythe Joint Reinforcement Provide adjustable types as follows:

.1 Interior dry locations: Mill galvanized, cold drawn steel wire.

.2 Interior high-moisture locations; Steel wire, hot dip galvanized: to ASTM A 641, Class 3 after fabrication.

.3 Exterior locations: Stainless steel conforming to ASTM A 580, Type 304.

.4 Provide ladder type reinforcement unless indicated otherwise. Where vertical reinforcement is not required in masonry walls, truss types are permitted.

.5 Acceptable Products:

.1 Ladder Type: “Ladur” by Dur-O-Wal Limited or “BL10, BL 11 or BL 13" by Blok-Lok Limited or approved equivalent.

.2 Truss Type: “DW 100 Dur-O-Wal Truss” or “BL30, BL 31 or BL 32" by Blok-Lok Limited or approved equivalent.

2.6 MASONRY ANCHORS

.1 Conform to CAN/CSA A370 and to suit application.

2.7 FASTENERS

.1 Provide fasteners as recommended by manufacturer.

.2 Bolts and Screws: size and type to suit application, locate where indicated.

.3 Powder-Driven Fasteners: pin styles and lengths to suit fastening application in accordance with manufacturers use, load and hold recommendations.

.4 Adhesives: epoxies, mastics and contact cements for fastening applications, use in accordance with manufacturers' recommendations.

2.8 FABRICATION

.1 Fabricate reinforcing in accordance with CSA-A23.1/A23.2 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.

.2 Fabricate connectors in accordance with CSA-A370.

.3 Obtain Consultant’s confirmation for locations of reinforcement splices other than shown on reviewed Shop drawings.

.4 Upon confirmation of Consultant, weld reinforcement in accordance with CSA W186.

.5 Ship reinforcement and connectors, clearly identified in accordance with drawings.

2.9 SOURCE QUALITY CONTROL

.1 Upon request, provide Consultant with certified copy of mill test report of reinforcement steel and connectors, showing physical and chemical analysis, minimum 5 weeks prior to commencing reinforcement work.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Site Verification of Conditions:

.1 Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation. Commencement of work implies acceptance of previously completed work.

3.2 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.3 INSTALLATION

.1 Provide masonry connectors and reinforcement in accordance with CSA-A370, CSA-A371, CSA-A23.1/A23.2, and CSA-S304.1, unless indicated otherwise.

.2 Prior to placing concrete, mortar, obtain Consultant’s approval of placement of reinforcement and connectors.

.3 Install additional reinforcement to masonry as indicated.

3.4 BONDING AND TYING

.1 Bond walls of two or more wythes using metal connectors in accordance with CSA S304.1, CSA-A371, and as indicated.

.2 Tie masonry veneer to backing in accordance with Ontario Building Code, CSA-S304.1, CSA-A371, and as indicated.

3.5 REINFORCED LINTELS AND BOND BEAMS

.1 Reinforce masonry lintels and bond beams as indicated.

.2 Place and grout reinforcement in accordance with CSA-S304.1, CSA-A371 and CSA-A179.

.3 Support and position reinforcing bars in accordance with CAN/CSA A371.

3.6 GROUTING

.1 Grout masonry in accordance with CSA-S304.1, CSA-A371 and CSA-A179, and as indicated.

.2 Refer to Section 04 05 13 for additional requirements.

3.7 ANCHORS

.1 Install metal anchors as indicated.

3.8 LATERAL SUPPORT AND ANCHORAGE

.1 Install lateral support and anchorage in accordance with CSA-S304.1 and as indicated.

3.9 MOVEMENT JOINTS

.1 Ensure reinforcement is not continuous across movement joints unless otherwise indicated.

3.10 FIELD BENDING

.1 Do not field bend reinforcement and connectors except where indicated or authorized by Consultant.

.2 When field bending is authorized, bend without heat, applying a slow and steady pressure.

.3 Replace bars and connectors which develop cracks or splits.

3.11 FIELD TOUCH-UP

.1 Touch up damaged and cut ends of epoxy coated or galvanized reinforcement steel and connectors with compatible finish to provide continuous coating.

3.12 CLEANING

.1 Leave Work area clean at end of each day.

.2 Upon completion remove surplus materials, rubbish, tools and equipment.

END OF SECTION

PART 1 - GENERAL

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL INSTRUCTIONS

.1 Read and conform to:

.1 the General Conditions and the Supplementary Conditions of the Contract.

.2 Division 01 requirements and documents referred to therein.

1.3 SUMMARY

.1 Work Included: Provide labour, materials, products, equipment and services to complete the masonry accessories work specified herein. This includes, but is not necessarily limited, to:

.1 Moisture control materials,

.2 Miscellaneous masonry accessories required for complete installation.

.2 Related Requirements: Specifications throughout the entirety of Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.4 REFERENCES

.1 Reference Standards: Latest published editions of reference standards listed in this Section in effect as of the closing date and time of the Request for Tenders for the Contract, including any amendments adopted, are applicable unless otherwise indicated.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meetings:

.1 Prior to starting work of this Section, convene a pre-installation meeting at Project site to review Project requirements and site conditions with pertinent parties. Conform to requirements of Section 01 30 00.

1.6 SUBMITTALS

.1 Product Data: Submit in accordance with requirements of Section 01 30 00 for each type of product indicated on Drawings and Schedules. Include recommendations for application and use. Include test data substantiating that products comply with requirements.

.2 Ensure data sheets provide required information including detailed instructions for installing as well as maintaining, preserving, and keeping materials in clean and safe conditions. Provide adequate warning of maintenance practices or cleaning agents detrimental to specified materials.

.3 Safety Data Sheets (SDS): Submit SDS for inclusion in Operation and Maintenance Manual specified in Section 01 70 00, for adhesives, sealants and any other material designated by Consultant.

.4 Shop Drawings:

.1 Submit Shop Drawings in accordance with requirements of Section 01 30 00. Indicate flashings, installation details, sizes, spacing, location and quantities of fasteners on Drawings.

.5 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.7 QUALITY ASSURANCE

.1 Qualifications:

.1 Manufacturers: Provide Products for Work of this Section by manufacturer with minimum 10 years' experience in the manufacture of such materials.

.2 Installers: Provide work of this Section executed by competent installers with minimum 5 years' experience in the application of Products, systems and assemblies specified and with approval and training of the Product manufacturers.

.2 Single Source Responsibility: Ensure primary materials provided in this Section are obtained from 1 source by a single manufacturer and secondary materials are obtained from sources recommended by primary materials manufacturers,

.3 Mock-ups: Construct mock-ups in accordance with Section 01 40 00 and requirements of Section 04 05 00.

.4 Source Limitations for Masonry Accessories: Obtain masonry accessories from single source from single manufacturer for each product type required.

1.8 SITE CONDITIONS

.1 Make site measurements necessary for proper fit of members.

1.9 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Keep fillers and adhesives dry, protected against dampness, and freezing.

.3 Store packaged materials off ground and in accordance with manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Products of following manufacturers may be acceptable subject to conformance to requirements of Drawings, Schedules and Specifications:

.1 Blok Lok; a Hohmann & Barnard company;

.2 Heckmann Building Products Inc.;

.3 Mortar Net Solutions;

.2 Comparable Products from manufacturers listed herein offering functionally and aesthetically equivalent products in Consultant's opinion, and subject to Consultant's review, will be considered provided they meet the requirements of this Specification.

2.2 DESIGN AND PERFORMANCE REQUIREMENTS

.1 Design exterior envelope cavity walls based on Rain Screen Principle advocated by NRCC and Provide for drainage of water entering envelope cavity wall system. Provide for compartments in long cavity wall and at corners to achieve appropriate pressure equalization in exterior envelope cavity wall design;

.2 Design exterior walls to provide continuous, complementary, and compatible air/vapour/thermal barriers throughout building envelope. Provide continuity of air seal materials and assemblies.

.3 Include expansion joints to accommodate movement in wall system and between wall system and building structure, caused by structural movements, without permanent distortion, damage to infills, raking of joints, breakage of seals, or water penetration.

2.3 FLASHING MATERIALS

.1 Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual", Section 07 62 00 and as follows:

.1 Provide prefinished sheet metal (painted galvanized steel) conforming to ASTM A653/A 653M, Z275 (G90) coating designation; prepainted by coil-coating process to comply with ASTM A755/A 755M.

.2 Thickness: Not less than 0.455 mm (0.021 inch – 26 ga).

.3 Coating: Conforming to AAMA 2605, fluoropolymer finish containing not less than 70 percent PVDF resin by weight in colour coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

.1 Basis-of-Design: “Pre-coat 10000 Series” by ArcelorMittal based on “Kynar 500” by Arkema or approved equivalent.

.4 Fabricate continuous flashings in sections 2400 mm (96 inches) long minimum, but not exceeding 3.7 m (12 feet). Provide splice plates at joints of formed, smooth metal flashing.

.5 Fabricate through-wall flashing with drip edge unless otherwise indicated. Fabricate by extending flashing 13 mm (1/2 inch) out from wall, with outer edge bent down 30 degrees and hemmed.

.6 Fabricate metal drip edges from prepainted galvanized steel. Extend at least 76 mm (3 inches) into wall and 13 mm (1/2 inch) out from wall, with outer edge bent down 30 degrees and hemmed.

.2 Cavity Wall Flashing: Composite flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 1.0 mm (0.039 inch)

.1 Acceptable Products:

.1 “CCW-705-TWF Thru-Wall Flashing” by Carlisle Coatings & Waterproofing

.2 “Perm-A-Barrier Wall Flashing” by GCP Applied Technologies.

.3 “Blok Lok Airtight 40 Self Adhered Air and Vapour Barrier” by Hohmann & Barnard, Inc.

.4 “Air-Shield Thru-Wall Flashing” by W.R. Meadows Inc., Canada

.5 “Blueskin TWF” by Henry Company

.6 “AquaBarrier™ TWF” by IKO Industries Ltd.

.7 “ExoAir TWF” by Tremco Incorporated, an RPM company

.8 “Sopraseal WFM” by Soprema Inc.

.2 Primer: as per manufacturer’s recommendation.

.3 Mechanical fasteners: recommended by flashing manufacturer to suit project requirements.

.3 Application: Unless otherwise indicated, use the following:

.1 Where flashing is indicated to receive counterflashing, use metal flashing.

.2 Where flashing is indicated to be turned down at or beyond the wall face, use metal flashing.

.3 Where flashing is partly exposed and is indicated to terminate at the wall face, use metal flashing with flexible flashing adhered overtop, and a metal drip edge.

.4 Where flashing is fully concealed, use flexible flashing.

2.4 AUXILIARY MATERIALS

.1 Weeps/Vents: Following types are acceptable:

.1 Cellular Plastic: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 3 mm (1/8 inch) less than depth of outer wythe, in color selected from manufacturer's standard.

.2 Acceptable Products:

.1 “Cell Vent” by Blok-Lok Limited

.2 “No. 85 Cell Vent” by Heckmann Building Products Inc.

.3 “Quadro-Vent” by Hohmann & Barnard, Inc.

.4 “CellVent” by Mortar Net Solutions

.2 Cavity Drainage Material / Grout Screens: Free-draining, monofilament screen fabricated form high-strength, non-corrosive from polymer strands that will not degrade within the wall cavity and that will isolate flow of grout in designated areas.

.1 Provide strips, full depth of cavity and minimum 250 mm (10 inches) high, with dovetail shaped notches or similar design to prevent clogging with mortar droppings.

.2 Acceptable Products:

.1 “Mortar Net” by Mortar Net Solutions

.2 “Mortar Trap” by Blok Lok Limited.

.3 “Cavity Net DT” by Wire Bond.

.3 Control joint filler: purpose-made elastomer 70 durometer hardness to ASTM D2240 of size and shape indicated and to suit conditions.

.1 Acceptable Products:

.1 Concrete Masonry Units: "RS Series Rubber Control Joint" by Blok-Lok or “No. 352 Rubber Control Joint” by Heckmann Building Products Inc. or approved equivalent.

.2 Brick Masonry: “NS Series Neoprene Sponge” by Blok Lok or approved equivalent.

.4 Control Joint Bond Break: CAN/CGSB-51.34-M, 0.15 mm (6 mil) clear polyethylene cut into 1-piece strips with width to suit wall thickness.

.5 Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D226, Type I (No. 15 asphalt felt) to separate masonry from dissimilar materials, including foundations and slabs

.6 Compressible Filler: Closed cell, pre-moulded filler strips complying with ASTM D1056, Grade 2A1; of width and thickness indicated. Pre-moulded filler shall be twice thickness of opening to be filled.

.1 "NS Series Neoprene Sponge" by Blok Lok or approved equivalent by W.R Meadows of Canada.

.7 Dampproofing Emulsion: CAN/CGSB-37.2, Heavy bodied black asphalt coating "700-01 Asphalt Emulsion Dampproofing" by Bakor; or "Dehydratine No 4" by Euclid or approved equivalent.

.8 Sealant: ASTM C920, Grade NS, Use M, Class 50; Polyurethane or silicone type, tested for non-staining of masonry conforming to requirements of Section 07 92 00. Colour to be selected by Consultant.

.9 Air Barrier / Vapour Retarder: Refer to Section 07 27 14.

.10 Insulation: As specified in Section 07 21 00.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Site Verification of Conditions:

.1 Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation. Commencement of work implies acceptance of previously completed work.

3.2 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.3 INSTALLATION

.1 Install continuous movement joint fillers in movement joints at locations indicated on reviewed Shop Drawings, and generally as follows:

.1 Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

.2 Concrete Masonry Units: Conform to requirements of NCMA TEK 10-2C

.1 Locations: Generally, Provide control joints at following locations:

.1 at column grid locations,

.2 at changes in wall height,

.3 at changes in wall thickness, such as at pipe and duct chases and pilasters,

.4 at (above) movement joints in foundations and floors,

.5 at (above and below) movement joints in roofs and floors that bear on a wall,

.6 near one or both sides of door and window openings unless other crack control measures are used, such as joint reinforcement or bond beams, and

.7 adjacent to corners of walls or intersections within a distance equal to half the control joint spacing

.2 Spacing: Ensure distance between joints does not exceed length to height ratio of 1.5:1 or 7.6 m (25 ft), whichever is less.

.3 Masonry Veneer Assemblies: Conform to requirements of BIA Technical Note 18.

.1 Locations: Generally, Provide expansion joints at following locations:

.1 at or near corners

.2 at offsets and setbacks

.3 at wall intersections

.4 at changes in wall height

.5 where wall backing system changes

.6 where support of brick veneer changes

.7 where wall function or climatic exposure changes

.8 periodically along continuous lengths of wall

.9 immediately below shelf angles

.2 Spacing:

.1 For brickwork without openings, space vertical joints no more than 7.6 m (25 ft),

.2 For brickwork with openings, space vertical joint no more than 6.1 m (20 ft). Locate control joints in symmetrical arrangements and as noted on reviewed Shop Drawings.

.3 When spacing between vertical joints in parapets is more than 4.6 m (15 ft), make joints wider or place additional joints halfway between joints. Extend to top of brickwork, including parapets.

.4 Below shelf angles, Provide horizontal, pressure-relieving joints by inserting a compressible filler of width required for installing sealant and backer rod specified in Section 07 92 00, but not less than 10 mm (3/8 inch).

.5 Provide expansion joints at brick infills, between the top of brickwork and structural frame.

.6 Where no shelf angles are provided, accommodate movement by:

.1 placing expansion joints around elements that are rigidly attached to the frame and project into the veneer, such as windows and door frames

.2 installing metal caps or copings that allow independent vertical movement of wythes

.3 installing jamb receptors that allow independent movement between the brick and window frame

.4 Installing adjustable anchors or ties

.2 Mechanical fasteners: install fasteners to suit application and in accordance with manufacturer's written installation instructions.

.3 Reglets: install reglets at locations indicated on reviewed Shop Drawings.

.4 Brick vents: install brick vents at locations indicated on reviewed Shop Drawings.

.5 Install weep hole vents in vertical joints immediately over flashings, in exterior wythes of cavity wall and masonry veneer wall construction, at maximum horizontal spacing of 600 mm (24 inches) on centre. Do not locate vent within 600 mm (24 inches) next to corners of building.

.6 Grout screens: install purpose made screens in cavities where indicated and as directed, size and shape to suit purpose and function.

.7 Flashings: Build in flashings in masonry in accordance with CAN/CSA-A371.

.1 Install flashings under exterior masonry bearing on foundation walls, slabs, shelf angles, and steel angles over openings, and at base of cavity wall and where cavity interrupted by horizontal members or supports and as shown on drawings. Install flashings under weep hole courses and as indicated.

.2 In cavity walls and veneered walls, carry flashings from front edge of exterior masonry, under outer wythe, then up backing minimum 150 mm (6 inches), and as follows:

.1 For masonry backing embed or bond flashing 25 mm (1 inch) in joint.

.2 For concrete backing, insert or bond flashing into reglets.

.3 For gypsum board and glass fibre faced sheathing backing, bond to wall using manufacturer's recommended adhesive.

.3 Lap joints 150 mm (6 inches) and seal with adhesive. Seal joints thoroughly.

.4 Form flashing (end dams) at lintels, sills and wall ends to prevent water from travelling horizontally past flashing ends.

.5 Extend flashing through exterior wythe of masonry to exterior. Provide exposed edge of flashing to maximum 6 mm (1/4 inch) and present a neat, even appearance.

.6 Provide 2.66 mm (0.104 inch - 12 ga) metal drip hemmed with a drip edge at all locations where thorough wall flashing occurs at a wall face.

.7 Remove excess projecting material.

.8 Install vertical flashing where outer veneer returns at window or door jambs, to prevent contact of veneer with inner wall.

3.4 CLEANING

.1 Leave Work area clean at end of each day.

.2 Upon completion remove surplus materials, rubbish, tools and equipment.

END OF SECTION

SEE ADD#4
Q#98

PART 1 - GENERAL

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL INSTRUCTIONS

.1 Read and conform to:

.1 the General Conditions and the Supplementary Conditions of the Contract.

.2 Division 01 requirements and documents referred to therein.

1.3 SUMMARY

.1 Work Included: Provide labour, materials, products, equipment and services to complete the concrete unit masonry work specified herein. This includes, but is not necessarily limited, to:

.1 Concrete masonry units.

.2 Auxiliary materials required for complete installation.

.2 Related Requirements: Specifications throughout the entirety of Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.4 REFERENCES

.1 Reference Standards: Latest published editions of reference standards listed in this Section in effect as of the closing date and time of the Request for Tenders for the Contract, including any amendments adopted, are applicable unless otherwise indicated.

.2 Definitions

.1 CMU(s): Concrete masonry unit(s).

.2 Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meetings:

.1 Prior to starting work of this Section, convene a pre-installation meeting at Project site to review Project requirements and site conditions with pertinent parties. Conform to requirements of Section 01 30 00.

1.6 SUBMITTALS

.1 Product Data: Submit manufacturer's literature and data sheets for each type of material provided under this Section for Project in accordance with requirements of Section 01 30 00.

.1 Ensure data sheets provide required information including detailed instructions for installing as well as maintaining, preserving, and keeping materials in clean and safe conditions. Provide adequate warning of maintenance practices or cleaning agents detrimental to specified materials.

.2 Safety Data Sheets (SDS): Submit SDS for inclusion in Operation and Maintenance Manual specified in Section 01 70 00, for adhesives, sealants and any other material designated by Consultant.

.3 Shop Drawings:

.1 Submit Shop Drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, for lintels, and reinforced masonry.

1.7 QUALITY ASSURANCE

.1 Qualifications:

.1 Manufacturers: Provide Products for Work of this Section by manufacturer with minimum 10 years' experience in the manufacture of such materials.

.2 Installers: Provide work of this Section executed by competent installers with minimum 5 years' experience in the application of Products, systems and assemblies specified and with approval and training of the Product manufacturers.

.2 Single Source Responsibility: Ensure primary materials provided in this Section are obtained from 1 source by a single manufacturer and secondary materials are obtained from sources recommended by primary materials manufacturers.

.1 Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted by Consultant.

.3 Sample Panels (Mock-ups): Build sample panels to verify selections made under sample submittals and to demonstrate aesthetic effects.

.1 Build sample panels for each type of exposed unit masonry construction in sizes approximately 1500 mm (60 inches) long by 1200 mm (48 inches) high by full thickness.

.2 Where masonry is to match existing, erect panels adjacent and parallel to existing surface.

.3 Protect approved sample panels from the elements with weather-resistant membrane.

.4 Review of sample panels is for colour, texture, and blending of masonry units; relationship of mortar and sealant colours to masonry unit colours; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Consultant in writing.

.4 Licensed Professionals: Employ a professional structural engineer registered in the province of Ontario, carrying minimum of $2,000,000.00 professional liability insurance to:

.1 design the components of the work of this Section requiring structural performance and their attachments to building's structure,

.2 be responsible for full assemblies and connections,

.3 be responsible for determining sizes, yield strengths, gauge thicknesses and joint spacing to allow thermal movement and loading of components in accordance with applicable codes and regulations,

.4 be responsible for production and review of Shop Drawings,

.5 inspect the work of this Section during fabrication and erection,

.6 stamp and sign each shop drawing,

.7 Provide site administration and inspection of this part of the Work.

.8 Submit certificate validating seismic assessment and field review of this part of the Work.

1.8 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 04 05 00 and with manufacturer's written instructions.

.2 Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

1.9 FIELD CONDITIONS

.1 Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

.1 Extend cover a minimum of 600 mm (24 inches) down both sides of walls and hold cover securely in place.

.2 Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.

.3 Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

.1 Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.

.2 Protect sills, ledges, and projections from mortar droppings.

.3 Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.

.4 Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

.4 Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in CAN/CSA-A371.

.1 Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in CAN/CSA-A371.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Products of following manufacturers may be acceptable subject to conformance to requirements of Drawings, Schedules and Specifications:

.1 Concrete Unit Masonry:

.1 Brampton Brick Limited;

.2 Permacon;

.3 Basalite Concrete Products;

.4 Approved equivalent

.2 Architectural Concrete Masonry Units:

.1 Richvale York Block Inc.

.2 Day & Campbell Limited.

.3 Shouldice.

.4 Thames Valley Brick.

.2 Comparable Products from manufacturers listed herein offering functionally and aesthetically equivalent products in Consultant's opinion, and subject to Consultant's review, will be considered provided they meet the requirements of this Specification.

2.2 REGULATORY REQUIREMENTS

.1 Fire-Resistance Ratings: Where indicated on Drawings and Schedules, provide units that comply with requirements for fire-resistance ratings indicated on Drawings and Schedules as determined by testing according to CAN/ULC-S101, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

.2 Classification: same as specified in this Section except as modified by aggregate used in units and equivalent thickness of units to comply with applicable Code for fire-resistance ratings indicated. For fire-resistance ratings requiring a fire-resistance rating of 3 hours or greater, use CAN/ULC-S101 certified units.

2.3 DESIGN AND PERFORMANCE REQUIREMENTS

.1 Masonry Structural Design Standard: Design masonry systems in accordance with limit states design method of the Ontario Building Code and CSA S304. Design masonry walls for maximum deflection of L/360 under design loads.

.2 Masonry Connectors Standard: Comply with CAN/CSA-A370, for minimum requirements for design of masonry connectors (ties, anchors, fasteners, and repair connectors) to interconnect wythes of masonry assemblies, attach masonry veneer to structural backings, and connect masonry assemblies to intersecting walls or to other structural members.

.3 Masonry Construction Standard: Comply with CAN/CSA-A371, except as modified by requirements in the Contract Documents.

.4 Masonry Materials Standards:

.1 Concrete Masonry Units: Comply with CSA A165 Series, for minimum requirements for compressive strength, concrete type, moisture content, and other physical properties.

.2 Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.

.5 Seismic Performance: Design work of this Section to withstand seismic motions determined in accordance with requirements of Ontario Building Code and CAN/CSA S832.

2.4 CONCRETE MASONRY UNITS

.1 Concrete Block Masonry Units (CMU): Metric modular units to CSA A165 Series (CSA A165.1).

.1 Classification: Provide normal weight units conforming to the following requirements unless otherwise indicated.

.1 Hollow Units: Type H/15/A/O (typical assemblies, < 75% of the gross cross-sectional area)

.2 Semi-Solid Units: Type SS/15/A/O (sound-rated and fire-resistance rated assemblies, ≥ 75% but < 100% of the gross cross-sectional area)

.2 Provide H/15/C/O lightweight units where required for fire-rating requirements or at suspended slabs.

.1 Hollow Units: Type H/15/A/O (typical assemblies, < 75% of the gross cross-sectional area)

.2 Semi-Solid Units: Type SS/15/A/O (sound-rated and fire-resistance rated assemblies, ≥ 75% but < 100% of the gross cross-sectional area)

.3 Provide “moisture-controlled” units (Moisture Content Facet: Type “M”) where masonry will be exposed to moisture or changes in humidity.

.4 Dimensions: As noted on Drawings.

.5 Special shapes: provide bull-nosed units for exposed corners. Provide purpose-made shapes for lintels, beams and bond beams. Provide additional special shapes as indicated or required.

2.5 MORTAR AND GROUT MATERIALS

.1 Conform to requirements of Section 04 05 13.

2.6 REINFORCEMENT

.1 Provide wire reinforcement to CSA A371 with corrosion protection to CSA S304, CSA G30.3-M and CSA A370. Conform to requirement of Section 04 05 19.

2.7 AUXILIARY MATERIALS

.1 Integral Water Repellent: Provide units made with integral water repellent for all units unless indicated otherwise.

.1 Provide polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested according to ASTM E 514 as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive, with test period extended to 24 hours, shall show no visible water or leaks on the back of test specimen.

.2 Acceptable Products:

.1 “RainBloc” by ACM Chemistries, Inc.

.2 “Rheopel Plus” by BASF Canada Inc.

.3 “Dry-Block” by GCP Applied Technologies Inc.

.4 Approved equivalent.

2.8 MASONRY ACCESSORIES

.1 Refer to Section 04 05 23.

2.9 TOLERANCES

.1 Tolerances for standard concrete unit masonry tolerances in accordance with CAN/CSA-A165.1, supplemented as follows:

.1 Maximum variation between units within specific job lot not to exceed 2 mm.

.2 No parallel edge length, width or height dimension for individual unit to differ by more than 2 mm.

.3 Out of square tolerance not to exceed 2 mm.

.2 Tolerances for architectural concrete masonry units in accordance with CAN/CSA-A165.1, supplemented as follows:

.1 Maximum variation in length or height between units within specific job lot for specified dimension not to exceed 2 mm (0.08 inch).

.2 No parallel edge length, width or height dimension for individual unit to differ by more than 2 mm (0.08 inch).

.3 Out of square tolerance not to exceed 2 mm (0.08 inch).

.4 Maximum variation in width between units within specific job lot for specified dimension not to exceed 2 mm (0.08 inch).

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Site Verification of Conditions:

.1 Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation. Commencement of work implies acceptance of previously completed work.

.2 For the record, prepare a written report, endorsed by Installer, listing conditions detrimental to performance of work.

.3 Verify that foundations are within tolerances specified.

.4 Verify that reinforcing dowels are properly placed.

.5 Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

.6 Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

.1 Conform to requirements of CSA A371.

.2 Build chases and recesses to accommodate items specified in this and other Sections.

.3 Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

.4 Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

.5 Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

.6 Build around frames previously set and braced. Fill behind hollow frames within masonry walls with mortar or grout and embed anchors.

.7 Fit masonry closely against electrical and plumbing outlets so collars, plates and covers overlap and conceal cuts.

.8 Hollow Units: spread mortar setting bed from outside edge of face shells. Gauge amount of mortar on top and end of unit to create full joints, equivalent to shell thickness. Avoid excess mortar.

.9 Solid Units: apply mortar over entire vertical and horizontal surfaces. Avoid bridging of airspace between brick veneer and backup wall with mortar.

.10 Ensure compacted head joints. Use full or face-shell joint as indicated.

.11 Tamp units firmly into place.

.12 Do not adjust masonry units after mortar has set. Where resetting of masonry is required, remove, clean and reset units in new mortar.

.13 Unless indicated otherwise, tool joints as follows:

.1 Interior exposed: raked or concave as determined by Consultant during Shop Drawing review.

.2 Interior concealed: flush.

.14 After mortar has achieved initial set up, tool joints.

.15 Do not interrupt bond below or above openings.

.16 Bond Pattern for Exposed Masonry:

.1 Concrete block units:

.1 Bond: running.

.2 Coursing height: 200 mm (8 inches) for one block and one joint.

.2 Do not use units with less than nominal 100-mm (4-inch) horizontal face dimensions at corners or jambs.

.17 Special Shapes:

.1 Install special units to form corners, returns, offsets, reveals and indents without cut ends being exposed and without losing bond or module.

.2 Install reinforced concrete block lintels over openings in masonry where steel or reinforced concrete lintels are not indicated.

.3 End bearing: not less than 200 mm, and as indicated on drawings.

.18 Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar before laying fresh masonry.

.19 Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

.20 Fill space between steel frames and masonry solidly with mortar unless otherwise indicated on Drawings and Schedules.

.21 Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.

.22 Fill cores in hollow CMUs with grout 600 mm (24 inches) under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated on Drawings and Schedules.

.23 Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated on Drawings and Schedules.

.1 Install compressible filler in joint between top of partition and underside of structure above.

.2 Fasten partition top anchors to structure above and build into top of partition. Space anchors in accordance with requirements of CSA S304.1 and CSA A370.

.3 At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 07 84 10.

3.3 CONTROL JOINTS AND MOVEMENT JOINTS

.1 Install continuous movement joint fillers in movement joints at locations indicated on reviewed Shop Drawings, and generally as follows:

.1 Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

.2 Conform to requirements of NCMA TEK 10-2C

.3 Locations: Generally, Provide control joints at following locations:

.1 at column grid locations,

.2 at changes in wall height,

.3 at changes in wall thickness, such as at pipe and duct chases and pilasters,

.4 at (above) movement joints in foundations and floors,

.5 at (above and below) movement joints in roofs and floors that bear on a wall,

.6 near one or both sides of door and window openings unless other crack control measures are used, such as joint reinforcement or bond beams, and

.7 adjacent to corners of walls or intersections within a distance equal to half the control joint spacing

.4 Spacing: Ensure distance between joints does not exceed length to height ratio of 1.5:1 or 7.6 m (25 ft), whichever is less.

3.4 REINFORCEMENT

.1 Install reinforcing in accordance with Section 04 05 19.

3.5 CONNECTORS

.1 Install connectors in accordance with Section 04 05 19.

3.6 MORTAR AND GROUT PLACEMENT

.1 Place mortar in accordance with Section 04 05 13.

3.7 LINTELS

.1 Provide concrete or masonry lintels where shown and where openings of more than 300 mm (12 inches) for brick-size units and 600 mm (24 inches) for block-size units are shown without structural steel or other supporting lintels.

.2 Provide minimum bearing of 200 mm (8 inches) at each jamb unless otherwise indicated on Drawings and Schedules.

3.8 REPAIRING, POINTING, AND CLEANING

.1 Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

.2 Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated on Drawings and Schedules.

.3 In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

.1 Standard Concrete Unit Masonry:

.1 Allow mortar droppings on masonry to partially dry then remove by means of trowel, followed by rubbing lightly with small piece of block. Clean wall surface with suitable brush or burlap.

.4 Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

.1 Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.

.2 Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Consultant's approval of sample cleaning before proceeding with cleaning of masonry.

.3 Protect adjacent nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.

.4 Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.

.5 Clean concrete masonry by cleaning method indicated on Drawings and Schedules in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

END OF SECTION

SEE ADD#4, Q#98 & ADD#15, Q#363

PART 1 - GENERAL

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL INSTRUCTIONS

.1 Read and conform to:

.1 the General Conditions and the Supplementary Conditions of the Contract;

.2 Division 1 requirements and documents referred to therein.

1.3 SUMMARY

.1 Work Included: Provide labour, materials, products, equipment and services to complete the masonry veneer work specified herein. This includes, but is not necessarily limited, to:

.1 Architectural concrete masonry units.

.2 Auxiliary materials required for complete installation.

.2 Related Requirements: Specifications throughout the entirety of Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.4 REFERENCES

.1 Reference Standards: Latest published editions of reference standards listed in this Section in effect as of the closing date and time of the Request for Tenders for the Contract, including any amendments adopted, are applicable unless otherwise indicated.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meetings:

.1 Prior to starting work of this Section, convene a pre-installation meeting at Project site to review Project requirements and site conditions with pertinent parties. Conform to requirements of Section 01 30 00.

1.6 SUBMITTALS

.1 Product Data: Submit manufacturer's literature and data sheets for each type of material provided under this Section for Project in accordance with requirements of Section 01 30 00.

.1 Ensure data sheets provide required information including detailed instructions for installing as well as maintaining, preserving, and keeping materials in clean and safe conditions. Provide adequate warning of maintenance practices or cleaning agents detrimental to specified materials.

.2 Safety Data Sheets (SDS): Submit SDS for inclusion in Operation and Maintenance Manual specified in Section 01 70 00, for adhesives, sealants and any other material designated by Consultant.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario.

.2 Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.

.3 Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

.4 Samples: Submit samples in accordance with Division 01, for each type and colour of the following:

.1 Architectural concrete masonry units.

.2 Special masonry shapes.

.5 List of Materials Used in Constructing Mock-ups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.

.1 Submittal is for information only. Receipt of list does not constitute approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Consultant and approved in writing.

.6 Cold-Weather and Hot-Weather Procedures: Submit detailed description of methods, materials, and equipment to be used to comply with requirements of CSA A371.

1.7 QUALITY ASSURANCE

.1 Qualifications:

.1 Manufacturers: Provide Products for Work of this Section by manufacturer with minimum 10 years' experience in the manufacture of such materials.

.2 Installers: Provide work of this Section executed by competent installers with minimum 5 years' experience in the application of Products, systems and assemblies specified and with approval and training of the Product manufacturers.

.2 Single Source Responsibility: Ensure primary materials provided in this Section are obtained from one source by a single manufacturer and secondary materials are obtained from sources recommended by primary materials manufacturers.

.3 Licensed Professionals: Employ a professional structural engineer registered in the province of Ontario, carrying minimum of $2,000,000.00 professional liability insurance to:

.1 design the components of the work of this Section requiring structural performance and their attachments to building's structure,

.2 be responsible for full assemblies and connections,

.3 be responsible for determining sizes, yield strengths, gauge thicknesses and joint spacing to allow thermal movement and loading of components in accordance with applicable codes and regulations,

.4 be responsible for production and review of Shop Drawings,

.5 inspect the work of this Section during fabrication and erection,

.6 stamp and sign each shop drawing,

.7 Provide site administration and inspection of this part of the Work.

.8 Submit certificate validating seismic assessment and field review of this part of the Work.

.4 Mock-ups: Construct mock-ups in accordance with Section 01 40 00 and requirements of Section 04 05 00. Build mock-ups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

.1 Build mockup of typical wall area as designated on site.

.2 Where masonry is to match existing, erect mock-ups adjacent and parallel to existing surface.

.3 Clean one-half of exposed faces of mock-ups with masonry cleaner as indicated.

.4 Protect reviewed mock-ups from the elements with weather-resistant membrane.

.5 Review of mock-ups is for colour, texture, and blending of masonry units; relationship of mortar and sealant colours to masonry unit colours; tooling of joints; and aesthetic qualities of workmanship.

.1 Review of mock-ups does not constitute approval of deviations from the Contract Documents contained in mock-ups unless Consultant specifically approves such deviations in writing.

.6 Subject to compliance with requirements, reviewed mock-ups may become part of the completed Work if undisturbed at time of Substantial Performance of the Work.

.5 Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and colour, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.

1.8 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 04 05 00 and with manufacturer's written instructions.

.2 Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

1.9 FIELD CONDITIONS

.1 Protection of Masonry: During construction, cover tops of veneer, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

.1 Extend cover a minimum of 600 mm (24 inches) down face of veneer, and hold cover securely in place.

.2 Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry. Immediately remove grout, mortar, and soil that come in contact with masonry.

.1 Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.

.2 Protect sills, ledges, and projections from mortar droppings.

.3 Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.

.4 Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

.3 Cold-Weather Requirements and Hot-Weather Requirements: maintain materials and surrounding air temperature to the most stringent requirements of manufacturer’s recommendations, Section 04 05 00 and CAN/CSA A371.

.1 Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing

conditions. Comply with cold-weather construction requirements contained in CAN/CSA-A371.

1.10 WARRANTY

.1 Installer's Extended Warranty: Standard form, signed by Installer, covering Work of this Section, for warranty period of five years from date of Substantial Performance of the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Products of following manufacturers may be acceptable subject to conformance to requirements of Drawings, Schedules and Specifications:

.1 Arriscraft

.2 Brampton Brick

.3 IXL Brick;

.4 Meridian Brick (Previously Forterra Brick);

.5 Permacon;

.6 Richvale York Block

.2 Comparable Products from manufacturers listed herein offering functionally and aesthetically equivalent products in Consultant's opinion, and subject to Consultant's review, will be considered provided they meet the requirements of this Specification.

2.2 DESIGN AND PERFORMANCE REQUIREMENTS

.1 Masonry Standard: Comply with CAN/CSA-A371 and CSA S304, except as modified by requirements in the Contract Documents.

.1 Design masonry veneer assemblies, including comprehensive engineering analysis by a Professional Engineer licensed to practice in the Province of Ontario, in accordance with requirements of Ontario Building Code, and using performance requirements and design criteria indicated in this Section.

.2 Design masonry in accordance with requirements of CSA S304.1 unless noted otherwise.

.2 Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects will be exposed in the completed Work and will be within 6 m (20 feet) vertically and horizontally of a walking surface.

2.3 EXTERIOR ARCHITECTURAL CONCRETE MASONRY (MA)

.1 Provide architectural concrete masonry units complying with CAN/CSA-A165 Series, H/20/A/O.

.1 Density Classification: Normal weight.

.2 Sizes: Ensure units are manufactured to dimensions 10 mm (3/8 inch) less than nominal dimensions to allow for mortar joint.

.3 Basis-of-Design:

.1 MA-2: "ONYX PRP Contempo" by Brampton Brick

.2 MA-3: "Adair Parliament" by Arriscraft

.3 Concrete Block at Base: “Standard Block” by Brampton Brick

.4 Provide in sizes and colours noted on Drawings.

.4 Nominal Size: As indicated on Drawings.

.5 Texture: As selected by Consultant from manufacturer's full range.

.6 Colours: As selected by Consultant from manufacturer's full range.

.2 Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.

.1 Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.

.2 Sills (MA-1): “White Rocked Cambridge Sills” by Arriscraft.

.3 Integral Water Repellent: Provide exposed units made with integral water repellent complying with the following:

.1 Integral Water Repellent: polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested according to ASTM E514/E514M as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive, with test period extended to 24 hours, shall show no visible water or leaks on the back of test specimen.

2.4 MORTAR AND GROUT MATERIALS

.1 Conform to requirements of Section 04 05 13.

2.5 TIES AND ANCHORS

.1 Conform to requirements of Section 04 05 19.

2.6 EMBEDDED FLASHING MATERIALS

.1 Conform to requirements of Section 04 05 23.

2.7 MISCELLANEOUS MASONRY ACCESSORIES

.1 Conform to requirements of Section 04 05 23.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Site Verification of Conditions:

.1 Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation. Commencement of work implies acceptance of previously completed work.

3.2 INSTALLATION

.1 Perform masonry work in accordance with CSA-A371, CSA A370 and CSA-A179, and as defined and specified in Section 04 05 00.

.2 Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

.3 Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

.4 Select and arrange units for exposed unit masonry to produce a uniform blend of colours and textures. Mix units from several pallets or cubes as they are placed.

.5 Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds more than 30 g/(minute x 20,000 sq. mm). Allow units to absorb water so they are damp but not wet at time of laying.

3.3 TOLERANCES

.1 As specified in CSA A371.

3.4 LAYING MASONRY WALLS

.1 Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

.2 Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in bond pattern indicated on Drawings; do not use units with less-than-nominal 100-mm (4-inch) horizontal face dimensions at corners or jambs.

.3 Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

.4 Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

.5 Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

3.5 MORTAR BEDDING AND JOINTING

.1 Lay masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

.2 Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

.3 Refer to Section 04 05 13 for additional requirements.

3.6 ANCHORING MASONRY VENEERS

.1 Anchor masonry veneers to structural back-up assemblies with masonry-veneer anchors to comply with requirements indicated in Section 04 05 19.

3.7 EXPANSION JOINTS

.1 Install expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span expansion joints without provision to allow for in-plane wall or partition movement.

.2 Refer to Section 04 05 23 for additional requirements.

3.8 LINTELS

.1 Install steel lintels where indicated. Provide minimum bearing of 200 mm (8 inches) at each jamb unless otherwise indicated.

3.9 FLASHING, WEEP HOLES, AND VENTS

.1 Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to move flow of water downward in wall, and where indicated.

.2 Install vents at shelf angles, ledges, and other obstructions to move flow of air upward in cavities, and where indicated.

.3 Install flashings and masonry accessories as noted in Section 04 05 23 unless otherwise indicated.

3.10 REPAIRING, POINTING, AND CLEANING

.1 Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

.2 Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

.3 In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

.4 Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

.1 Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.

.2 Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Consultant’s approval of sample cleaning before proceeding with cleaning of masonry.

.3 Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.

.4 Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.

.5 Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.

3.11 MASONRY WASTE DISPOSAL

.1 Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

END OF SECTION

PART 1 - GENERAL

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL INSTRUCTIONS

.1 Read and conform to:

.1 the General Conditions and the Supplementary Conditions of the Contract;

.2 Division 1 requirements and documents referred to therein.

1.3 SUMMARY

.1 Work Included: Provide structural steel stud framing system including but not limited to following:

.1 wall studs subjected to lateral loads (no axial loads other than self weight and weight of applied finishes).

.2 steel bridging.

.3 top and bottom track.

.4 head, sill and jamb members for wall openings.

.5 studs, bridging and track connections.

.6 top and bottom connections to structure complete details to accommodate structure deflections.

.7 exterior sheathing.

.2 Related Requirements: Specifications throughout entirety of Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them

1.4 REFERENCES

.1 Definitions: the following definitions shall apply to this Section:

.1 Steel Thickness:

.1 “Base Steel Thickness”: Thickness of bare steel exclusive of coatings.

.2 “Design Thickness”: Target or "nominal" thickness used to determine structural properties of the cold formed Products.

.3 “Minimum Thickness”: Design thickness minus minimum allowable under-tolerance required by CSA S136 (95% of design thickness) or material specification; whichever is more stringent.

.4 “Designation Thickness”: For the purposes of this Specification, thicknesses provided will be minimum base steel thicknesses in accordance with CSA S136 and determined by the following table:

Designation Thickness	Minimum Base Steel Thickness		Gauge No. (For reference Only)	Colour
(mils)	(in)	(mm)	Ga	
33	0.0329	0.836	20	White
43	0.0428	1.087	18	Yellow
54	0.0538	1.367	16	Green
68	0.0677	1.72	14	Orange

.2 Reference Standards: Latest published editions of reference standards listed in this Section in effect as of closing date and time of the Request for Tenders for the Contract, including any amendments adopted, are applicable unless otherwise indicated.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meetings:

.1 Prior to starting work of this Section, convene a pre-installation meeting at the Project site to review the Project requirements and site conditions with pertinent parties. Conform to requirements of Section 01 30 00.

1.6 SUBMITTALS

.1 Product Data: Submit manufacturer's literature and data sheets for each type of material provided under this Section for Project in accordance with requirements of Section 01 30 00. Ensure data sheets provide required information including detailed instructions for installing as well as maintaining, preserving and keeping materials in clean and safe conditions. Provide adequate warning of maintenance practices or cleaning agents detrimental to specified materials.

.2 Safety Data Sheets (SDS): Submit SDS for inclusion in Operation and Maintenance Manual specified in Section 01 70 00, for adhesives, sealants and any other material designated by Consultant.

.3 Shop Drawings:

.1 Submit Shop Drawings of work of this Section in accordance with Section 01 30 00, bearing stamp and signature of a structural Professional Engineer licensed to design structures and registered in Province of Ontario. Ensure Shop Drawings show the following items as minimum:

.1 coating materials,
.2 connection details for attaching framing to itself and for attachments to structure,
.3 connections to concrete, steel and other structures abutting and supporting the steel stud work,
.4 details and erection diagrams including temporary bracing required for erection purposes,
.5 details of other pertinent components of work and adjacent constructions to which work is attached,
.6 erection Drawings of steel studs and panel assemblies.
.7 layout diagrams for setting anchor bolts,
.8 member sizes, locations and thicknesses exclusive of coating,
.9 profiles, dimensions, openings as well as requirements of related work and critical installation procedures,
.10 provision for expansion and contraction,

.11 screwed connection details,
.12 shop details indicating sizes, cuts and connections of all members,
.13 splice details as required, and
.14 welds, both field and shop welds.

.2 If requested by Consultant, submit calculations certified by a Professional Engineer licensed to design structures and registered in Province of Ontario, substantiating sizes for members and connections based on the design loads before fabrication and erection. Indicate design loads on Shop Drawings.

1.7 QUALITY ASSURANCE

.1 Qualifications:

.1 Manufacturers: Provide Products for Work of this Section by manufacturer with minimum 10 years' experience in the manufacture of such materials

.2 Installers: Provide work of this Section executed by competent installers with minimum of 5 years' experience in application of the Products, systems and assemblies specified in this Section and with approval and training of the Product manufacturers.

.3 Companies Engaged in Welding: Certified by the Canadian Welding Bureau to CSA W47.1 and welders qualified for the base material and procedures to be executed. Welding shall conform to CSA W59

.2 Licensed Professionals: Employ a full time structural Professional Engineer registered in the Province of Ontario, carrying minimum $2,000,000.00 professional liability insurance, to:

.1 design the components of the Work of this Section requiring structural performance,

.2 be responsible for full assemblies and connections,

.3 be responsible for determining sizes, yield strengths, gauge thicknesses and joint spacing to allow thermal movement and loading of components in accordance with applicable codes and regulations,

.4 be responsible for production and review of Shop Drawings,

.5 inspect the Work of this Section during fabrication and erection,

.6 stamp and sign each Shop Drawing, and

.7 provide site administration and inspection of this part of the Work.

.8 Submit certificate validating seismic assessment and field review of this part of the Work.

.3 Mock-ups: Provide mock-ups in locations designated by Consultant and as required to demonstrate quality of workmanship. Maintain mock-ups during construction in an undisturbed condition as a standard for judging the completed work. Construct 1 typical site mock-up of structural metal stud framing assemblies. Provide mock-up approximately 2400 mm x 2400 mm (8' x 8'). Do not commence work of this Section until mock-up has been reviewed by the Consultant.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Transport, store and handle materials in a manner to prevent damage. Store units off ground and protected from mud and rain splashes.

.2 Deliver materials in original, unopened containers or bundles stored in a place providing protection from damage and exposure to exterior elements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Products of the following manufacturers may be acceptable subject to conformance to requirements of Drawings, schedules and Specifications:

.1 Bailey Metal Products Ltd.

.2 Dietrich Metal Framing Canada;

.3 DCM Metal Corp.

.2 Substitution Limitations: Comparable Products from manufacturers listed herein offering functionally and aesthetically equivalent Products in Consultant's opinion and subject to Consultant's review, will be considered provided they meet the requirements of this Specification.

2.2 DESCRIPTION

.1 Regulatory Requirements:

.1 Design shall be based on Limit States Design principles using factored loads and resistance. Resistance and resistance factors shall be determined in accordance with the OBC and CSA S136 requirements.

.2 For wind load calculations, velocity pressure shall be based on OBC requirements

.3 Design guards and walls-acting-as-guards in accordance with requirements of the OBC, in particular paragraphs 4.1.10.1 "Loads on Guards" and 4.1.10.3 "Loads on Walls Acting as Guards".

.4 Seismic Performance: Design work of this Section to withstand seismic motions determined in accordance with requirements of OBC and CAN/CSA S832

.2 Design and Performance Requirements:

.1 Architectural Drawings and details are diagrammatic and are only intended to show design concept, aesthetics, interfacing requirements, configuration, components and arrangements. They are not intended to identify or solve completely problems of thermal and structural movements, assembly framing, engineering design, fixings and anchorages.

.2 Exterior cladding for this Project is based on "Rain Screen" design principle as recommended by the Division of Building Research of National Research Council of Canada. This principle requires that construction behind cladding act as an air and vapour barrier to prevent passage of moisture laden air and diffusion of water vapour. Construction behind cladding shall accommodate installation of sealants, insulation, compartmentalization of air space, air/vapour barrier system and drainage slots as required and shown. To ensure provision for continuity of thermal blanket, vapour and air barrier within construction specified herein and with adjacent barrier construction is part of responsibility of this Section.

.3 Stud Design, Depth and Thicknesses:

.1 For studs, conform to the design thicknesses in the table below. Use greater stud thicknesses if required by design and performance requirements related to applied loadings and deflection criteria specified in Contract Documents.

Minimum Thicknesses for Framing Members					
Stud Depth	Designation Thickness	Minimum Base Steel Thickness		Gauge No. (For reference Only)	Colour
(mm)	(mils)	(in)	(mm)	Ga	
92	33	0.0329	0.836	20	White
102	33	0.0329	0.836	20	White
152	43	0.0428	1.087	18	Yellow
203	43	0.0428	1.087	18	Yellow

.2 Design metal framing based on stud depth shown on Drawings. Adjust stud material thicknesses and spacings as required to meet design criteria. Use greater or lesser depths only if reviewed with Consultant.

.3 Section properties shall be computed on basis of nominal core thickness.

.4 Do not rely on collateral sheathing to help restrain member rotation and translation perpendicular to minor axis.

.5 Design metal framing based on wall stud spacing at 400 mm (16") maximum. Use lesser stud spacing if required to meet design criteria.

.4 Design Deflections:

.1 Design metal framing for exterior wall systems and their connections to withstand their own weight, weight of exterior sheathing, motion of operable elements, minimum design loads, pressure, suction of wind and internal pressure.

.1 Maximum flexural stud deflection under specified wind loads shall be limited to L/480 for stud system supporting masonry veneer in accordance with requirements of CSA S304.1.

.2 Maximum flexural stud deflection under specified wind loads shall be limited to L/360 for stud system supporting other cladding in accordance with requirements of CSA S16 and CSA S136.

.2 Deflection limit shall be such that integrity of air/vapour barrier will be maintained at design loading. Permanent deformation of members due to applied loads is not permitted.

.3 Notwithstanding limits specified herein, the structural steel framing system shall not deflect under design loads sufficient to cause noise, breaking of sealants, or to break integrity of insulation thermal blanket or air/vapour barrier seal.

.5 Design connections to accommodate vertical deflection movement of structure, frame shortening and vertical tolerances without imposing axial loads onto framing. Leave a minimum gap of 25 mm (1"). Larger gaps may be required for longer spans to accommodate structural movement.

.6 Limit free play and movement in connections perpendicular to plane of framing to ± 0.51mm (0.02“) relative to building structure.

.7 Design components and assemblies to accommodate specified erection tolerances of structure.

.8 Bridging:

.1 Provide bridging to prevent member rotation and member translation perpendicular to minor axis. Provide for secondary stress effects due to torsion between lines of bridging.

.2 Provide bridging at 1200 mm (48”) oc maximum. Space bridging at equal intervals over span length of member. Closer spacings may be required to satisfy structural

design requirements. Provide minimum of 2 rows of equally spaced bridging. Design anchorage and splice details for bridging.

.3 Design bridging to prevent member rotation and member translation perpendicular to minor axis. Provide for secondary stress effects due to torsion between lines of bridging.

.9 Design for local loading due to anchorage of cladding and interior wall mounted fixtures where required to meet design requirements.

.10 Connections between wind bearing steel stud members shall be by bolts, welding or sheet metal screws.

.11 Provide head, sill and jamb members and connections to frame openings larger than 100 mm (4“) in any dimension.

.12 Anchor top and bottom track to structure at a maximum spacing of 800 mm (32 “) oc. Closer spacings may be required to satisfy structural design requirements.

.13 Construct work to Provide for expansion and Contraction of components as will be caused by ambient temperature range without causing buckling, failure of joint seals, undue stress on fasteners or other effects detrimental to appearance or performance.

2.3 MATERIALS

.1 Steel: Sheet steel to ASTM A924.

.2 Zinc Coating: Studs, track, and components to be hot-dipped galvanized with coating conforming to Z275.

.3 Welding Materials: To CSA W59.

.4 Screws: #8 or heavier, 11 mm dia. pan head, self-drilling, case hardened, self-tapping sheet metal screws, 0.008 mm coating of zinc or cadmium plating. Screw length equal to thickness of materials penetrated plus not less than 1/2 inch (12 mm) penetration of the stud. Use not less than 3/8 inch (10 mm) pan head self-drilling, self-tapping screws for fastening studs to track.

.5 Anchors: Concrete expansion anchors or other suitable drilled type fasteners, as selected by the steel stud design engineer.

.6 Bolts, Nuts, Washers: Hot dipped galvanized to ASTM A153, 2 oz/sq ft (600 g/m2) zinc coating.

.7 Touch-up Primer: Zinc rich, to CAN/CGSB 1.181.

.8 Insulation for Deflection Channel: Owens Corning Commercial Wall Insulation or equivalent by Roxul (or Equivalent).

.9 Structural Metal Stud Framing:

.1 Ensure steel conforms to requirements of CSA S136 and identified with respect to Specification, grade, mechanical properties and coating type and thickness.

.2 Provide steel having metallic coatings conforming to ASTM A653/A653M or ASTM A792/A792M. Ensure wind bearing steel studs and tracks have a minimum coating of Z275 (G90) galvanizing in accordance with ASTM A653/A653M. Other coatings (e.g. aluminum-zinc alloy to ASTM A792/A792M) providing equal or better corrosion protection may be used.

.3 Wind bearing steel stud, configuration and Cutouts: CAN/CGSB 7.1.

.4 Size: 150 mm (6") unless otherwise indicated.

.5 Design Wind Loading: As noted herein and in accordance with OBC.

.6 Maximum Span: As noted herein.

.7 Top Track: Telescopic 2 piece slip track. Fill deflection cavity with batt insulation.

.8 Bottom Track: Of sufficient width to receive studs. Ensure gap between end of stud and web of track does not exceed 4.8 mm (3/16”). Provide 9 mm (3/8") diameter weep holes draining through exterior flange at 800 mm (32") oc.

.9 Colour code ends of individual gauges of studs as indicated in designation thickness table specified herein.

.10 Zinc-Rich Paint: CAN/CGSB-1.81-M.

.11 Isolation Strip for Studs: Provide one of the following:

.1 Asphalt-Saturated Organic Felt: ASTM D226, Type I (No. 15 asphalt felt), nonperforated or CSA A123.3; No. 15 Type.

.2 Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch (3.2 mm) thick, in width to suit steel stud size.

.1 “Rubatex” by Rubatex Corp. or “Perma-Stik 122X” by Jacobs and Thompson Inc.,
.2 “Arnofoam” by Arno Adhesive Tapes Incorporated
.3 “Greyflex Expanding Foam Sealant” by Emseal Corporation.

.12 Bituminous Paint: Provide dielectric separation and which will dry to be tack-free and able to withstand high temperatures. Bituminous paint, alkali-resistant bituminous paint or epoxy resin solution to provide dielectric separation which will dry to be tack-free and withstand high temperatures. Cold-applied asphalt mastic complying with SSPC-Paint 12, except containing no asbestos fibers.

.1 Acceptable Products: Carboline Bitumastic 50 by Carboline Canada, or Copper Creek Top Service 760 Black by Sherwin Williams Company, 410-02 by Bakor Inc. or other Equivalent Product and manufacturer acceptable to Consultant.

.13 Exterior Gypsum Sheathing Board: Refer to Section 09 21 16.

.14 Anchors, Fasteners and Welds: Supply veneer anchors for installation under this Section by Section 04 05 19.

.1 Bolts and nuts shall conform to the requirements of ASTM A307 or ASTM A325M. Provide washers. Hot-dip galvanize bolts, nuts and washers.

.2 Sheet metal screws shall have a minimum of coating thickness of 0.008 mm (0.33 mil) of zinc. Other coatings providing equal or better corrosion protection may be used.

.3 Welding materials shall conform to requirements of CSA W59-M.

.4 Welding electrodes shall be of the 480 MPa minimum tensile strength series (e.g. E480XX, ER480S-X).

.5 Ensure zinc rich paint for touching up welds and damaged metallic coatings conforms to CAN/CGSB-1.181.

.6 Concrete anchors shall have a minimum coating thickness of 0.008 mm (0.33 mil) of zinc. Other coatings providing equal or better corrosion protection may be used.

.7 Powder actuated/low velocity fasteners shall not be permitted for fastening to structural steel or for fastening to concrete.

2.4 FABRICATION

.1 Do not commence fabrication until shop and erection Drawings have been reviewed, and samples have been approved.

.2 Except as noted herein, fabricated wall framing components shall conform to requirements of CAN/CGSB-7.1.

.3 Insofar as practical, execute fitting and assembly in shop with various parts or assemblies ready for erection at building site.

.4 Provide cutouts centred in webs of members to accommodate services. Limit dimensions of unreinforced cutouts to suite design requirements and effects on strength and stiffness of members.

.5 Take field measurements and levels required to verify or supplement those shown on Drawings for proper layout and installation of work. Coordinate dimensional tolerances in adjacent building elements and confirm prior to commencement of work.

.6 Accurately machine file and fit frames rigidly together at joints, corners and mitres. Match components carefully to produce perfect continuity of line and design.

.7 Fabrication Tolerances: Provide light-weight steel framing true and plumb within following tolerances:

.1 Track and Framing:

.1 Member Depth: ± 0.76 mm, (± 0.03").
.2 Flange Width: ± 0.76 mm (± 0.03") (where exterior board is attached directly to flange).
.3 Minimum flange width shall be 32 mm (1-1/4”).
.4 Lip length: +3 mm (+1/8").
.5 Thickness: -0 mm (-0").
.6 Corner Angles: ± 3 mm (±1/8").
.7 Framing Length: ± 3 mm (±1/8").

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions:

.1 Before commencing installation, examine work of other Sections to which this work will be fastened. Report immediately in writing to Consultant all discrepancies in accuracy and suitability which will adversely affect this work.

.2 Ensure openings and recesses to receive this work are within acceptable tolerances. Proceed with installation only after structural defects are corrected, permanent connections are completed and supporting structure is straight and plumb.

.3 Commencement of installation shall indicate acceptance of work of other Sections upon which this work depends.

3.2 ERECTION

.1 Ensure erection conforms to reviewed Shop Drawings. Methods of construction may be either piece by piece (stick-built) or by fabrication into panels (panelized) either on or off site.

.2 Erect work plumb, true and in proper alignment and relationship to established lines and grades. Modifications required to accommodate as-built conditions (other than minor dimensional changes) shall be submitted for review.

.3 Employ temporary bracing whenever necessary to withstand all loads to which structure may be subjected during erection and subsequent construction. Leave temporary bracing in place as long as required for safety and integrity of structure. Ensure during erection a margin of safety consistent with requirements of OBC and CSA S136-01 is provided.

.4 Erection Tolerances:

.1 For purposes of this Section, camber is defined as deviation from member or any portion of member with respect to its major axis, and sweep is defined as deviation from straightness of a member or any portion of a member with respect to its minor axis.

.2 For wind bearing studs, out of plumbness shall not exceed 1/500th of member length. Out of straightness (camber and sweep) shall not exceed 1/1000th of the member length.

.3 For track, camber shall not exceed 1/1000th of member length.

.5 Wind bearing stud erection:

.1 Install studs at 300 mm (12") or 400 mm (16") oc maximum. Ensure studs seat into top and bottom tracks. Ensure gap between end of stud and web of track does not exceed 4.8 mm (3/16”). Allow 25 mm (1") minimum at top of framing for anticipated floor slab deflection, unless otherwise noted on structural Drawings.

.2 Provide isolation strips under steel studs runners for wind breaking stud wall constructed on slab on grade, above grades and other locations as applicable to suit design requirements

.3 Align adjacent or abutting members in same plane to within 0.5 mm (0.02“) maximum.

.4 Spacing of studs shall not be more than ±3 mm (1/8") from design spacing. Cumulative error in spacing shall not exceed requirements of finishing materials.

.5 Align web cut-outs in studs as required for installation of through-the-knockout style bridging and services.

.6 Make all field measurements necessary to insure proper fit of all members.

.7 Reinforce cut-outs where distance from centreline of cut-out to end of member is less than 300 mm (12"). Submit reinforcing detail for review.

.8 Holes that are field cut into lightweight steel framing members shall conform to requirements specified herein.

.9 Replace and remove damaged members from Site.

.10 Unless a closer spacing is shown on shop requirements of OBC and Drawings, anchor top and bottom tracks securely to structure at 800 mm (32”) oc maximum. Place 1 additional anchor within 100 mm (4") of end of each piece of track and additionally as required by Shop Drawings.

.11 Install additional studs at abutting walls, openings, terminations against other materials and on each side at corners unless explicitly detailed otherwise on Shop Drawings.

.12 Place insulation in jamb and header assemblies that may be inaccessible after their installation into wall. Insure insulation is kept dry and not compressed.

.13 Handling and lifting of prefabricated panels shall not cause permanent distortion to any member or collateral material.

.6 Fasteners and Welds:

.1 Ensure connected parts are in contact. Provide clamping before welding or installing screws.

.2 Companies engaged in welding shall be certified by Canadian Welding Bureau to CSA W47.1. Companies shall have welding procedures approved and welders qualified for base material types and thicknesses that are to be welded.

.3 Welds shall conform to CSA S136-01 or CSA W59-M, whichever is applicable.

.4 For material less than 3 mm (1/16") thick, Shop Drawings may show nominal weld leg sizes. For such material, effective throats of welds shall not be less than thickness of thinnest connected part.

.5 Touch-up welds and coatings damaged by welding with zinc rich paint. Prior to touching-up prepare surface in accordance with paint manufacturer's recommendations.

.6 Sheet metal screw thread types, drilling capability and installation shall conform to manufacturer's recommendations. Sheet metal screws shall be of minimum diameter indicated on Shop Drawings but not less than a #8. Sheet metal screws covered by sheathing materials shall have low profile heads. Penetration beyond joined materials shall be not less than 3 exposed threads. Secure steel stud framing to bottom track with minimum #8 x 13 mm (1/2") long screws both sides of framing.

.7 Base resistance for sheet metal screws on manufacturer’s lower bond test values multiplied by appropriate resistance factor, diameter is given in CSA S136.

.8 Install concrete anchors in accordance with manufacturer's recommendations. Connections between light-weight steel framing members shall be by bolts, welding or sheet metal screws. Welded connections are only acceptable if touched-up with zinc-rich paint.

.9 Take delivery of veneer anchors for installation under this Section from Section 04 20 00. Install veneer anchors in accordance with manufacturer's recommendations. Ensure connectors attach to web side of stud with fasteners loaded in shear and have thin vertical edge to minimize accumulation of mortar droppings.

.7 Mechanically fasten track and clip angles to concrete slab by drill-in fastenings. Bear cost of repair satisfactory to Consultant of concrete chipped by drilling or fixing operations.

.8 Secure framing at top with sliding connection. Provide inner and outer track deflection head under steel beams and decks.

.9 Erection Tolerances: For purpose of this work, camber is defined as deviation from straightness of a member or any portion of a member with respect to its major axis and sweep is defined as deviation from straightness of a member or any portion of a member with respect to its minor axis:

.1 Out of plumbness shall not exceed 1/500th of member length; out of straightness (camber or sweep) shall not exceed 1/1000th of member length.

.2 For track, camber shall not exceed 1/1000 of member length.

.3 Do not space framing more than 3 mm (1/8") from design spacing. Cumulative error in spacing shall not exceed requirements of finishing materials.

.10 Field Cutting:

.1 Cut members using saw or shear. Torch cutting is not permitted.

.2 Field cut holes into light-weight steel framing shall be limited to 64 mm (2-1/2”) maximum across member web 110 mm (4-3/8") maximum along member length, 610 mm (24") oc minimum.

.3 Apply 1 coat of zinc-rich paint to all galvanized surfaces which have been damaged or had coating removed.

.4 Coordinate with other Sections for installation of anchors and ties required for work specified under other Sections.

.11 Exterior Sheathing:

.1 Provide exterior sheathing in accordance with manufacturer's instructions.

.2 Minimum Fastening Requirements:

.1 Perimeter Edge of Each Board: 200 mm (8") oc max.
.2 Intermediate Supports: 300 mm (12") oc max.

.3 Provide exterior sheathing neatly with tight butt joints and without gaps and holes.

.4 Bear edges of exterior sheathing fully onto structural framing.

.5 Do not crush exterior sheathing edges.

.6 Do not countersink fasteners below exterior paper skin of exterior sheathing boards.

.7 Secure exterior sheathing to exposed leg of inner track of telescopic 2-piece top track.

.8 Provide ready to receive air/vapour barrier membrane.

3.3 FIELD QUALITY CONTROL

.1 Field Tests and Inspections: Perform field tests and inspections including:

.1 checking mill test reports are properly correlated to materials; welded and screwed connections, connections to main structure member, sizes, location and material and coating thicknesses.

.2 sampling fabrication and erection procedures for general conformity to requirements of Contract Documents.

.3 checking fabricated members against specified member shapes.

.4 sample checking of screwed and bolted joints.

.5 sample checking that tolerances are not exceeded.

.6 general inspection of field cutting and alterations required by other trades.

.7 submission of reports to Consultant, Owner and local jurisdictional authorities covering work inspected with details of deficiencies discovered.

3.4 CLEANING

.1 Keep installed work clean as work progresses.

.2 Clean and Make Good to approval of Consultant, surfaces soiled or otherwise damaged in connection with this work. Replace finishes or materials that cannot be satisfactorily touched up, cleaned or which have been damaged by improper cleaning materials and methods at no additional cost.

.3 Upon completion of this work, remove all debris, equipment and excess material resulting from this work from site.

END OF SECTION

PART 1 - GENERAL

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL INSTRUCTIONS

.1 Read and conform to:

.1 the General Conditions and the Supplementary Conditions of the Contract;

.2 Division 1 requirements and documents referred to therein.

1.3 SUMMARY

.1 Work Included: Provide metal fabrications including but not limited to following:

.1 steel framing and supports for cubicle and toilet partitions.

.2 steel framing and supports for overhead openings.

.3 steel framing and supports for architectural woodwork elements.

.4 steel framing and supports for mechanical and electrical equipment.

.5 steel framing and supports for openings including sliding doors, oversized doors, and glazing.

.6 steel framing and supports for masonry walls including lateral support.

.7 metal ladders and safety cages.

.8 door operator pedestals.

.9 metal floor plates and supports.

.10 metal bollards.

.11 steel pipe handrails and guardrails.

.12 floor trench and sump pit cover plates.

.13 metal gratings.

.14 roof coping.

.15 rooftop access, stairs, railings and platforms.

.16 ceiling-mounted monitors and equipment

.17 miscellaneous sections and framing for applications where framing and supports are not specified in other sections.

.18 miscellaneous sections and framing as required to complete the Work and as indicated in the Canadian Institute for Steel Construction (CISC) - Handbook of Steel Construction for applications where framing and supports are not explicitly specified in this Section.

.2 Related Requirements: Specifications throughout entirety of Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.4 REFERENCES

.1 Reference Standards: Latest published editions of reference standards listed in this Section in effect as of the closing date and time of the Request for Tenders for the Contract, including any amendments adopted, are applicable unless otherwise indicated.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meetings:

.1 Prior to starting work of this Section, convene a pre-installation meeting at Project site to review Project requirements and site conditions with pertinent parties. Conform to requirements of Section 01 30 00.

.2 Coordination:

.1 coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

.2 coordinate installation of anchorages and steel weld plates and angles for casting into concrete. Supply setting Drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry.

1.6 SUBMITTALS

.1 Product Data: Submit manufacturer's literature and data sheets for each type of material provided under this Section for the Project in accordance with the requirements of Section 01 30 00. Ensure data sheets provide required information including detailed instructions for installing as well as maintaining, preserving and keeping materials in clean and safe conditions. Provide adequate warning of maintenance practices or cleaning agents detrimental to specified materials.

.2 Safety Data Sheets (SDS): Submit SDS for inclusion in Operation and Maintenance Manual specified in Section 01 70 00, for adhesives, sealants and any other material designated by Consultant.

.3 Shop Drawings: Submit Shop Drawings for work of this Section in accordance with Section 01 30 00. In addition to minimum requirements of Section 01 30 00, the Shop Drawings shall indicate following:

.1 large scale details of members, materials and connections.

.2 jointing details.

.3 methods of setting, sealing, securing, anchorage.

.4 field connections.

1.7 QUALITY ASSURANCE

.1 Qualifications:

.1 Metal Fabricator: Provide Products for Work of this Section by manufacturer with minimum 10 years’ experience in the manufacture of such materials.

.2 Installer’s Qualifications: Provide work of this Section executed by competent installers with minimum 5 years’ experience in the manufacture and application of metal fabrication work and assemblies specified in this Section and with the approval and training of manufacturers. Demonstrate experience of projects of similar scope and size, and

evidence of a continuing quality assurance program for both materials and installation crews.

.2 Welding:

.1 Provide welding in accordance with CSA W59-M performed by a fabricator and mechanics fully by Canadian Welding Bureau for fusion welding of steel structures to CSA W47.1 and for fusion welding of aluminum to CSA W47.2.

.3 Licensed Professionals: Employ a structural Professional Engineer carrying a minimum $2,000,000.00 professional liability insurance and registered in the Province of Ontario in accordance with requirements of Section 01 40 00, to:

.1 design components of the Work of this Section requiring structural performance

.2 be responsible for full assemblies and connections

.3 be responsible for determining sizes, joint spacing to allow thermal movement and loading of components in accordance with applicable codes and regulations.

.4 be responsible for production and review of Shop Drawings.

.5 inspect work of this Section during fabrication and erection.

.6 stamp and sign each Shop Drawing.

.7 provide site administration and inspection of this part of the Work.

.8 Submit certificate validating seismic assessment and field review of this part of the Work.

.4 Certification:

.1 Where metal fabrications require engineering design, submit certification, from a registered structural Professional Engineer as specified in this Section, stating that the structure is capable of supporting its own weight and specified live loads.

.5 Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Delivery and Acceptance Requirements:

.1 Coordinate deliveries to comply with the Construction Schedule and arrange ahead for strategic off-the-ground, undercover storage locations. Do not load areas beyond designed limits.

.2 Handle and store metal materials at Site to prevent damage to other materials and to adjacent construction.

.2 Storage and Handling Requirements: Handle components with care and provide protection for surfaces against marring or other damage. Ship and store members with cardboard or other resilient spacers between surfaces. Use lifting chokers of material which will not damage surface of metal members.

PART 2 - PRODUCTS

2.1 DESCRIPTION

.1 Regulatory Requirements:

.1 The Work of this Section that functions to resist forces imposed by dead and live loads shall conform to latest requirements of the OBC and those of jurisdictional Authorities.

.2 Design and Performance Requirements:

.1 Architectural Drawings and details are diagrammatic and are only intended to show design concept, aesthetics, interfacing requirements, configuration, components and arrangements. They are not intended to identify or solve completely problems of thermal and structural movements, assembly framing, engineering design, fixings and anchorages.

.2 Design work of this Section to withstand within acceptable deflection limitations, specified tolerances in vertical and horizontal planes, its own weight, forces applied by movements of building structure and attached adjacent components, and maximum design loads due to pressure and suction of wind, snow, ice, rain and hail.

.3 Design load bearing structures in accordance with the requirements of the OBC and Provide miscellaneous steel supports, connections and anchors to suit design. Conform to the requirements of CAN/CSA-S16.1 and CAN/CSA-S136.

.4 Design stairs and railings in accordance with the OBC, CSA A23.3, CAN/CSA-B651 and other requirements of the Authorities Having Jurisdiction.

.5 Design free standing handrails and guardrails to the requirements of the OBC, CAN/CGSB 12.1-M90, and CAN/CGSB 12.20-M89 and CAN/CSA B651. Ensure handrails and guard rails connections are made of welded constructions unless indicated otherwise.

.6 Ensure metal fabrications conform to Class 1, Class 2 and Class 3 as defined in NAAMM AMP 555, paragraph 8.3 of Section 8, Quality Control or Assurance and as follows:

.1 Class 1 Workmanship: Items that are exposed to view in finished spaces in completed Work.
.2 Class 2 Workmanship: Items that are exposed to view in utility areas of the completed Work.
.3 Class 3 Workmanship: Items that are concealed from view in the completed Work.

.7 Ensure metal stairs conform to NAAMM AMP 555, Section 1, Classification of Stairs, and Classes of Stairs as follows:

.1 Metal Pan Stairs Class Designation: Commercial Class.
.2 Metal Grating Stairs Class Designation: Industrial Class.

.8 Design ladders and fabricate capable of withstanding the effects of loads and stresses within limits and under conditions specified in ANSI A14.3, AISC S310, *Occupational Health and Safety Act*, R.S.O. 1990 C.O.1, *Regulations for Industrial Establishments*, R.R.O. 1990, O. Regulation 851 as amended by O. Regulation 516/92 and all other Authorities Having Jurisdiction.

.9 Weld connections where possible, otherwise bolt connections. Countersink exposed fastenings, cut off bolts flush with nuts. Make exposed connections of the same material, colour and finish as the base material on which they occur.

.10 Welding of any structural component related to work of this Section shall be executed by a fabricator having certification in accordance with Division 3, CSA W47.1.

.11 Fabricate components carefully and accurately to enable erection within required limits so as not to induce excessive stresses, deflection, or distortion into the structure. Do not allow contact between dissimilar materials. Finished components to be rigid, free from discolouration and marks.

.12 Ensure railings conform to Class 1, Class 2 and Class 3 as defined in NAAMM AMP 555, Section 8, Quality Control or Assurance and as follows:

.1 Class 1 Workmanship: Items that are exposed to view in finished spaces in completed Work.

.2 Class 2 Workmanship: Items that are exposed to view in utility areas of the completed Work.
.3 Class 3 Workmanship: Items that are concealed from view in the completed Work.

.13 Allow for thermal and structural movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

.1 Temperature Change: 120°F (67°C), ambient; 180°F (100°C), material surfaces.

.14 Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

.15 Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, Provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.2 MATERIALS

.1 Steel:

.1 Structural Shapes, Plates, and similar components: New material conforming to CSA G40.20 and CSA G40.21, Grade 300W.

.2 Hollow Structural Sections: New material conforming to CSA G40.20 and CSA G40.21, Grade 350W, Class H.

.3 Uncoated, Cold-Rolled Steel Sheet: ASTM A1008/A 1008M, structural steel, Grade 170, new material, unless another grade is required by design loads; exposed.

.4 Uncoated, Hot-Rolled Steel Sheet: ASTM A1011/A 1011M, structural steel, Grade 205, new material, unless another grade is required by design loads.

.5 Steel Pipe:

.1 Handrails: Conforming to ASTM A53/A53M, Type E or S, Grade A or B, Standard Weight, Schedule 40 and Schedule 80, new material.
.2 Bumpers and Bollards: Conforming to ASTM A53/A53M, Schedule 80, new material.

.6 Steel Tubing: ASTM A500, cold-formed steel tubing.

.7 Galvanized Sheet Steel: 0.91 mm (20 ga) core thickness commercial quality to ASTM A653M, Grade A, with Z275 (G90) zinc coating designation to ASTM A653M

.8 Hardware: Hot dipped galvanizing with minimum zinc coating of 600 g/m2 in accordance with requirements of ASTM A153/A153M.

.2 Aluminum:

.1 Aluminum Extrusions: ASTM B221M size accurately formed as shown on Drawings, extruded aluminum alloy AA-6063- T5 or T6.

.2 Aluminum Plate and Sheet: ASTM B209M, minimum thickness 3 mm (1/8"); of type and characteristics to match finished extrusions.

.3 Structural aluminum: to CSA HA series - M, Type 6061-T6, clear anodized.

.3 Stainless Steel: Ensure finished surfaces exposed to view are free of pitting, seam marks, roller marks, oil-canning, stains, discolourations or other imperfections

.1 Stainless-Steel Sheet, Strip, and Plate: ASTM A167, ASTM A240/A 240M or ASTM A666.

.2 Stainless-Steel Bars and Shapes: ASTM A276.

.3 Stainless Steel Tubing: ASTM A554, Grade MT.

.4 Stainless Steel Pipe: ASTM A312M, Grade TP.

.5 Castings: ASTM A743M, Grade CF 8 or Grade CF 20.

.6 Unless otherwise indicated, Provide Type 304 stainless steel at interior locations and Type 316L at exterior locations.

.7 Finish:

.1 Concealed locations: AISI No. 2.
.2 Exposed locations: AISI No. 4.

2.3 ACCESSORIES

.1 Welding Materials: Conforming to CSA W48.1-M and CSA W59-M.

.2 Fasteners: Select fasteners for type, grade, and class required. Supply each type and size of bolt and nut of same manufacturer and of same lot.

.3 Butyl Tape: AAMA 800, extruded, non-drying, non-skinning, non-oxidizing, reinforced, polyisobutylene butyl tape of sufficient width and thickness, minimum 0.118 inch (3 mm) thick.

.4 Separator Sheet: ASTM D1330, 0.079 inch (2 mm) thick neoprene sheet.

.5 Cementitious Grout (Interior Applications Only):

.1 ASTM C1107, Grade B and C, pre-mixed, high strength, maximum bearing capacity, non-shrink, cementitious aggregate grout. Acceptable Products:

.1 ‘Sika Grout 212' by Sika Canada Inc.,
.2 ‘Non Shrink Structural Grout - Dry Pack Grout’ by Euclid Chemical Company
.3 ‘Sealtight CG 86 Construction Grout’ by W.R. Meadows.
.4 or Equivalent Products to the above.

.6 Epoxy Grout (For Exterior and Interior Applications):

.1 ASTM C579, multi-component, high strength, non-shrinking, non expanding, flowable epoxy grout having minimum 28 Day compressive strength of 13053 psi (90 MPa). Provide rapid set epoxy grout where required to suit conditions.

.1 Provide "Sika Anchor Fix" by Sika Canada Inc. or Equivalent.

2.4 FABRICATION

.1 Fabricate each item of work of this Section in accordance with following general requirements:

.1 members square and straight.

.2 members plumb and true.

.3 joints accurately and tightly fitted.

.4 intersecting members in true, flush planes.

.5 fasteners concealed.

.6 steel connections.

.2 Fabricate, fit and assemble work in shop where possible. Where shop fabrication is not possible, make trial assembly in shop.

.3 Provide hangers, rods, bars, bolts, anchors, brackets, rivets, bearing plates and bracing, fitting, drilling, stopping, and soldering as required for a complete assembly.

.4 Insulate dissimilar metals to prevent galvanic corrosion.

.5 Provide exposed metal fastenings and accessories of same material, texture, colour and finish as base metal to which they are applied or fastened.

.6 Welding:

.1 Weld connections unless otherwise indicated.

.2 Should there be, in the opinion of Consultant or inspection company, doubt as to the adequacy of welds, they shall be tested for efficiency and any work not meeting standards or requirements specified in this Section shall be removed and replaced with new work satisfactory to the Consultant.

.3 Carry out welding in accordance with following standards:

.1 CSA W48-M - for electrodes (if rods are used, only coated rods are allowed).
.2 CSA W59-M - for design of connections and workmanship.
.3 CAN/CSA W117.2 - for safety.

.4 Thoroughly clean welded joints and steel exposed for a sufficient space to properly perform welding operation. Ensure welds exposed to view and finish painted are continuous and ground smooth.

.7 Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

.8 Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

.9 Galvanize following members:

.1 members exposed to elements in final location;

.2 members embedded on exterior side of exterior walls;

.3 members embedded in concrete; and

.4 members specified in this Section or noted on Drawings.

2.5 FINISHES

.1 Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

.2 Unless otherwise indicated, galvanize metal fabrication items and supports at exterior locations; prime paint at interior locations.

.3 Shop Primers: Apply one shop coat of primer to metal items, with exception of galvanized or concrete encased items.

.1 Clean steel to SSPC SP6 and remove loose mill scale, weld flux and splatter. Clean surfaces to be field welded; do not paint.

.2 Non-galvanized steel: Conforming to CAN/CGSB-1.40.

.3 Galvanized steel: in accordance with CAN/CGSB-85.10.

.4 Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.

.5 Galvanizing Repair Paint: ASTM D520, Type III and CAN/CGSB-1.181, VOC compliant, high zinc-dust content paint for re-galvanizing welds in galvanized steel containing not less than 93% zinc dust by weight and compatible with topcoat. Conform to requirements of Section 09 91 00.

.6 Hot-dip galvanize members in accordance with requirements of ASTM A153/A153M with minimum coating weights or thicknesses as specified:

.1 Rolled, Pressed and Forged Steel Shapes, Plates, Bars and Strips: ASTM A123/A123M; average weight of zinc coating per sq ft of actual surface,

.1 For members having thickness of 4.8 mm (3/16") and less: 2 ounces
.2 For heavier members: 2.3 ounces.

.2 Iron and Steel Hardware: ASTM A153/A153M; minimum weight of zinc coating, in ounces per sq ft of surface in accordance with Table 1 of ASTM A153/A153M, for various classes of materials used on Project.

.3 Steel Sheet: ASTM A653/A653M; weight of zinc coating, per sq ft on both sides of sheet. Coating designation Z275 (G90) minimized spangle and chemically treated.

.7 Metal Filler: VOC compliant, polyester based metal filler designed for use over iron and steel substrates.

.8 Field Applied Steel Primer: 1 coat of Fast-curing, lead- and chromate-free, universal modified-alkyd primer conforming to Section 09 91 00. Minimum DFT: 0.025 mm (1 mil).

.9 Dielectric Separator: Acid and alkali resistant isolation coating to provide dielectric separation between masonry and metals. Provide best grade, quick drying, non-staining alkali resistant asphalt utility enamel by approved manufacturer to provide dielectric separation and which will dry to be tack-free and able to withstand high temperatures.

.1 Acceptable Products:

.1 “Carboline Bitumastic 50” by Carboline Canada,
.2 “Copper Creek Top Service 760 Black” by Sherwin Williams Company,
.3 “410-02” by Bakor Inc.
.4 equivalent.

.10 Aluminum Surfaces:

.1 Finish (Concealed locations): Utility Aluminum mill finished

.2 Finish (Exposed locations): Clear anodized coating AA-M12C22A31 (Architectural Class II), AAMA 611, Minimum 0.4 mils coating thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or contracts are acceptable for metal fabrications installation in accordance with manufacturer's written instructions.

3.2 ERECTION

.1 Erect work of this Section square, plumb, straight, and true, accurately fitted, with tight joints and intersections.

.2 Do welding work in accordance with CSA W59 unless specified otherwise.

.3 Securely anchor work of this Section and rivet, weld or bolt to structural framing of the building. Where secured to concrete, Provide bolts for setting in concrete. Provide expansion bolt supports to masonry.

.4 Provide necessary fitting, setting and cutting required in connection with the fitting of work of this Section to other parts of the Work.

.5 Exposed fastening devices to match finish and be compatible with material through which they pass.

.6 Supply components for work by other trades in accordance with Shop Drawings and Construction Schedule.

.7 Deliver items over for casting into concrete and building into masonry together with setting templates to appropriate location and construction personnel.

3.3 FINISHING

.1 Field Painting: Paint bolt heads, washers, nuts, field welds and previously unpainted items. Touch up with matching paint, shop primer damaged during transit and installation.

.2 Touch-up galvanized surfaces with zinc rich primer where burned by field welding.

3.4 CLEANING

.1 On completion of installation, carefully clean metal work. Remove surplus materials, rubbish, tools and equipment.

3.5 SCHEDULES

.1 Unless otherwise indicated, Provide metal fabrication items as detailed.

.2 SUPPORTS FOR OVERHEAD OPENINGS.

.1 Provide HSS, channel framing and 6 mm plate steel closures to profile as indicated.

.2 Provide inside jamb extensions, centre spring mount and motor supports in accordance with the manufacturer's instructions.

.3 SUPPORTS FOR ARCHITECTURAL WOODWORK ELEMENTS.

.1 Custom fabricate supports for architectural woodwork elements, using steel shapes and plates, as required to produce work of adequate strength and durability conforming to AWMAC requirements.

.2 Use proven details of fabrication, as required, to achieve proper assembly and alignment of the various components of the Work.

.3 Provide miscellaneous steel items required as part of the Work of Section 06 40 00 including but not limited to valance supports, vanity support brackets, bench supports and countertop supports.

.4 LATERAL SUPPORTS FOR MASONRY WALLS

.1 Interior walls: Supply 75 mm x 75 mm x 6 mm steel angles, 300 mm long to be secured to the underside of the structure as part of the Work of Section 04 22 00. Interior finish: prime painted.

.2 Exterior walls, inner wythe: Supply 100 mm x block width x 6 mm bent steel plate, 300 mm long to be secured to the underside of the structure as part of work of Section 04 22 00. Exterior Finish: Galvanized

.5 METAL LADDERS

.1 Stringers: 38 mm x 38 mm x 6 mm mm thick, angle.

.2 Platforms: 6 mm galvanized steel checkered plate

.3 Brackets: sizes and shapes as indicated, weld to stringers, complete with fixing anchors.

.4 Provide galvanized finish.

.5 Provide galvanized steel ladders for following locations:

.1 One ladder in each elevator pit from 1500 mm above last floor served to bottom of pit.
.2 On vertical exterior walls for roof access where indicated.

.6 Obtain exact locations of ladders from the Consultant where not otherwise indicated.

.6 METAL BOLLARDS.

.1 Bollards: 6 mm thick HSS. Refer to Drawings for bollard sizes and dimensions.

.2 Concrete fill and bases provided as part of work of Section 03 30 00. Bollards installed as part of this Section.

.3 Finish: galvanized.

.4 Bollard Protection: Provide bollard covers manufactured from UV-resistant, HPDE designed to be installed existing posts and sized to match bollard sizes.

.5 Color: To be selected by Consultant at a later date.

.6 Acceptable Products: "Post Guard" by Surguard; or equivalent.

.7 FLOOR TRENCH AND SUMP PIT COVER PLATES.

.1 Finish: Galvanized

.2 Fabricate from 6 mm thick steel plate set in L 55 x 55 x 6 frame. Include anchors at 1200 mm on centre for embedding in concrete. Supply trench covers in 1200 mm removable lengths.

.3 Provide perimeter gasket for air tight seal at pits connected with sanitary drainage piping.

.8 RAILINGS

.1 Minimum 3 mm (1/8”) nominal metal thickness, formed to shapes and sizes as indicated. Provide closed pipe ends and grind welds smooth.

.2 Outside diameter: as noted on the Drawings.

.3 Provide brackets and escutcheons in material and finish to match handrails.

.4 Unless otherwise indicated, galvanize exterior pipe railings after fabrication; shop coat prime interior railings after fabrication. Provide stainless steel material where noted.

.9 CHECKERED PLATE

.1 Rolled-Steel Floor Plate: ASTM A786/A 786M, rolled from plate complying with ASTM A36/A 36M or ASTM A283/A 283M, Grade C or D or CSA G40.20/G40.21.

.2 Aluminum-Alloy Rolled Tread Plate: ASTM B632/B 632M, Alloy 6061-T6.

.10 ROOFTOP ACCESS, STAIRS, RAILINGS AND PLATFORMS

.1 Provide freestanding railing and guard system, stair, platform and crossovers consisting of pipe, railings, uprights, bases, counterweights, and fittings conforming to requirements of *Occupations Health and Safety Act* (Ontario). All access, stairs, railings and platforms is to be non-penetrating types.

.2 Minimum 3 mm (1/8”) nominal outside diameter, formed to shapes and sizes as indicated. Provide closed pipe ends and grind welds smooth.

.3 Provide brackets and escutcheons in material and finish to match handrails.

.4 Unless otherwise indicated, Galvanize exterior pipe railings after fabrication;

.5 Fabricate metal tube railings and handrails in accordance with reviewed and accepted Shop Drawings and NAAMM AMP 555, but not less than that required to support structural loads in accordance with the OBC and CSA A500. As a minimum, conform to the following:

.1 Handrail, wall rail and guardrail assemblies and attachments shall withstand a minimum concentrated load of 200 pounds (0.89 kN) applied in any direction on the top rail.
.2 Infill area of guardrail system capable of withstanding a horizontal concentrated load of 200 psf (9.58 kPA) at any point in the system.

.6 Ensure railings conform to Class 1, Class 2 and Class 3 as defined in NAAMM AMP 555, paragraph 8.3 of Section 8, Quality Control or Assurance and as follows:

.1 Class 1 Workmanship: Items that are exposed to view in finished spaces in completed Work.
.2 Class 2 Workmanship: Items that are exposed to view in utility areas of the completed Work.
.3 Class 3 Workmanship: Items that are concealed from view in the completed Work.

.7 Stairs:

.1 Design stairs to carry stipulated live loads with maximum deflection of L/180.
.2 Fabricate stairs to NAAMM, Metal Stair Manual unless indicated otherwise.
.3 Weld connections where possible, otherwise bolt connections. Countersink exposed fastenings, cut off bolts flush with nuts. Make exposed connections of same material, colour and finish as base material on which they occur.
.4 Accurately form connections with exposed faces flush and mitres and joints tight. Make risers of equal height.
.5 Grind or file exposed welds and steel sections smooth.
.6 Shop fabricate stairs in sections as large and as complete as practicable.
.7 Form stairs using manufacturer's standard components but not less than the following:

.1 Form treads from minimum 6 mm thick steel plate to profile indicated, and secure to stringers with L 35 x 35 x 5 supports. Form landings from a minimum 6 mm thick steel plate, reinforced by L 55 x 55 x 6 spaced at minimum 600 mm on centre.
.2 Form steel grating treads and landings from metal bar grating to profile indicated and secure to stringers and supports as indicated. Form landings of steel grating and reinforce as required.
.3 Form stringers from MC 310 x 15.8.

.11 STEEL PAN STAIRS

.1 Refer to Section 05 51 00.

.12 METAL GRATING

.1 Provide standard steel rectangular bar grating and frame:

.1 Bearing Bars: Minimum 3/4" x 3/16" bars at 1-3/16" cc.
.2 Cross Bars: Maximum 4" cc, twisted.
.3 Free Area: 77.1%.
.4 Grating Anchorage to Frame: Welded.
.5 Finish: Galvanized and shop applied black paint.

.2 Acceptable Manufacturers:

.1 All American Grating.
.2 Fisher & Ludlow; Division of Harris Steel Limited.

.3 Borden Metal Products (Canada) Limited.
.4 or Equivalent manufacturers to the above.

.13 STEEL FRAMING AND SUPPORTS FOR GARBAGE ENCLOSURE.

.1 Frames: Fabricate frames from galvanized steel of profiles, and to sizes and shapes indicated. Miter frame members at corners and connect with concealed splice plates welded or brazed to back of frames. Provide minimum G90 coating or equivalent rust protection, for field painting.

.2 Gates: Fabricate gates as indicated with electrically welded joints, and finish to match grilles and frames.

.1 Furnish gates with hinges, latch and latch catch with provision for padlock which can be attached and operated from either side of installed gate.
.2 Furnish double gates with chain hook to hold gates open and centre rest with drop bolt for closed position.
.3 Provide rolling heavy-duty casters at each gate with minimum 45 kg (100 lbs) load rating for each caster as noted on Drawings.
.4 Ensure compatibility of metals to prevent galvanic action.
.5 Finish: Galvanized metal, G90 coating or equivalent, for field painting.

.3 Enclosure Panels: Composite material consisting of recycled linear low density polyethylene (LLDPE) and recycled wood, extruded into shapes. Thickness: Not less than 22 mm (0.875 inch).

.1 Basis-of-Design: “Trex Cladding” by Trex Company, Inc. or Equivalent
.2 Colour: To be selected by Consultant at a later date.

.14 PYLON SIGN FRAMING

.1 Provide pylon sign framing capable of withstanding the effects of gravity loads and the wind loads and stresses within limits and under conditions indicated:

.1 Wind Loads: Determine loads based on OBC for geographical location of Project.
.2 Base: Provide pylon signs with integral base consisting of channels, angles, plates, or other fittings. Drill holes in members for anchor-bolt connection.

.1 Provide anchor bolts of size required for connecting posts to concrete foundations.

.3 Provide nonferrous-metal or hot-dip galvanized anchors and inserts for exterior installations. Supply inserts, as required, to be set into concrete work.

.15 VEHICLE SAFETY GUARDS.

.1 Provide pipe guards of minimum 50 mm (2 inch) diam., extending from floor to 760 mm (30 inches) above floor, with 10 mm (3/8-inch) steel baseplates for bolting to floor

.2 Galvanize pipe guards after fabrication.

.16 FREE-STANDING PYLONS FOR DEVICES

.1 Base: Provide pylons with base consisting of channels, angles, plates, or other fittings. Drill holes in members for anchor-bolt connection.

.1 Provide anchor bolts of size required for connecting base to concrete. Where provide on roofs, provide sealing system composed of precast modular polyester curbs, polyester adhesive and 1-part moisture-cure, self-levelling, pourable sealer. Acceptable Products: “ChemCurb System” by Chem Link Inc.

.2 Internal Frames: Provide engineered internal steel framing system, designed to withstand wind pressures and other live loads. Provide welded construction using mitered joints. Cut, drill, and tap units to receive hardware, bolts, and similar items.

.1 Hot-dip galvanize steel framing system after fabrication to comply with ASTM A 123/A 123M.

.3 External Cladding: Provide external stainless steel cladding system designed to withstand design wind pressure and other live loads and for direct attachment of devices.

.1 Stainless-Steel Sheet: designed to withstand wind pressures and other live loads not less than 14 ga thick. Provide brushed stainless steel finish to match 'XL blend S' by Excelsior.
.2 Provide welded construction using mitered joints. Cut, drill, and tap units to receive hardware, bolts, and similar items.
.3 Provide preparation for surface-mounted devices at locations indicated on Drawings and at heights complying with requirements of AODA and authorities having jurisdiction. Coordinate with Division 26 and Division 28.
.4 Provide noncorroding anchors compatible with substrates encountered.

.17 MISCELLANEOUS SECTIONS AND FRAMING

.1 Supply and Install support elements and framing for all miscellaneous items. Construct supports from rolled steel sections assembled by welding.

.2 Design supports to withstand, within acceptable deflection limitations, their own weight, weight of items to be supported, loads imposed by motion of supported items, where applicable, and all live loads, static and dynamic which might be applied to supported items in the course of their normal function. Design supports with a safety factor of 3 or acceptable Limit States Design approach.

.3 Provide accessories, inserts and fixings necessary for attachment of supports to the building structure. Drill supports as required to receive attachment of supported items. Arrange supports to avoid conflicts with pipes, ducts, precast concrete connections, thermal, air and vapour barrier construction, framing provided under other Sections, and such that supports and their fixings are fully concealed from view within the finished work. Paint supports unless galvanizing is specified.

.4 Provide concealed support elements or framing as required for the following items:

.1 Provide miscellaneous steel sections which are not shown or identified on Drawings, or specified under another Section of the Specifications.
.2 Where items are required by other Sections of the Specifications to be built into masonry or concrete, Supply such members to such respective Sections.

END OF SECTION

PART 1 - GENERAL

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL INSTRUCTIONS

.1 Read and conform to:

.1 the General Conditions and the Supplementary Conditions of the Contract.

.2 Division 01 requirements and documents referred to therein.

1.3 SUMMARY

.1 Work Included: Provide labour, materials, Products, equipment and services to complete the metal stairs work specified herein. This includes, but is not necessarily limited, to following:

.1 Steel stairs with concrete-filled pans and non-slip treads.

.2 Industrial stairs with steel treads.

.3 Steel guardrails and handrails for metal stairs.

.4 Steel handrails for walls near metal stairs.

.5 Auxiliary materials required for complete installation.

.2 Related Requirements: Specifications throughout the entirety of Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.4 REFERENCES

.1 Reference Standards: Latest published editions of reference standards listed in this Section in effect as of the closing date and time of the Request for Tenders for the Contract, including any amendments adopted, are applicable unless otherwise indicated.

1.5 COORDINATION

.1 Installation of anchorages for metal stairs: Supply setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.6 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meetings:

.1 Project Meetings, generally: in accordance with Section 01 30 00, Project Meetings.

.2 Pre-installation Meetings: Schedule and hold a pre-installation meeting at the Project site at least one week before beginning work on this Section to coordinate activities with related Subcontractors.

.1 Required Attendance: Subcontractor performing work of this Section, representatives from manufacturers and fabricators involved in or affected by installation.

.2 Notification: Notify Consultant and Owner of scheduled meeting dates in advance; minimum 72 hour notice required.

.3 Agenda:

.1 Review progress of related construction activities and preparations for particular activity under consideration.

.2 Make note of required sequencing and coordination with materials and activities that have preceded or will follow.

.4 Reporting: Record significant discussions, agreements, and disagreements, including required corrective measures and actions.

.5 Distribution: Distribute minutes of the meeting to each party present and to other parties requiring information not more than 72 hours after meeting.

1.7 SUBMITTALS

.1 Submittals, generally: in accordance with Section 01 30 00, Submittal Procedures.

.2 Product Data: Submit manufacturer's product characteristics, catalogue cuts, installation instructions and other relevant information for each material and product used for metal stairs work specified in this Section.

.3 Safety Data Sheets (SDS): Submit SDS for inclusion in Operation and Maintenance Manual specified in Section 01 70 00, for adhesives, sealants and any other material designated by Consultant.

.4 Shop Drawings:

.1 Submit Shop Drawings indicating material layouts, details of construction, connections, and relationship with adjacent construction. As a minimum indicate following:

.1 Include plans, elevations, sections and details as applicable.

.2 Show field-measured dimensions on Shop Drawings.

.3 In addition to minimum requirements indicate following:

.1 Large scale views of members, materials, connections, attachments, reinforcing, anchorages, and exposed fastening locations.

.2 Jointing details.

.3 Setting, sealing, securing, and anchoring techniques.

.4 Field connection methods.

.5 Samples: Submit selection and verification samples for Products requiring colour, texture, or design selection. Submit manufacturer's list of finishes or colour swatches for Consultant's selection.

.1 As a minimum submit samples of abrasive nosings to be used in Project.

.6 Mill Certificates: Submit mill certificates or data from a qualified independent testing agency with calibrated test equipment indicating steel complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, ductility, and metallic-coating thickness.

.7 Welding Certificate: Submit certification for welding firms and welders to verify compliance with welding qualifications specified in this section.

1.8 CLOSEOUT

.1 Closeout Submittals, generally: in accordance with Section 01 70 00, Closeout Submittals.

.2 Operating and Maintenance Data: Submit care and maintenance instructions for metal stairs to be included in building operation and maintenance manual.

1.9 QUALITY ASSURANCE

.1 Manufacturer Qualifications: Provide Products for work of this Section by manufacturer with at least 10 years' experience manufacturing such materials.

.2 Installer Qualifications: Engage an entity with at least five years' experience installing, erecting, or assembling work similar in material, design, and extent to that shown on Drawings and Schedules, and whose work has resulted in construction with a track record of successful in-service performance.

.3 Welding Qualifications: Qualify procedures and personnel in accordance with the following:

.1 Steel: to CSA W47.1 and CSA W59

.2 Aluminum: to CSA W47.2 and CSA W59.2

.3 Stainless Steel: to CSA W47.1 (Annex K) and CSA W59.

.4 Professional Engineer's Qualifications: Employ Professional Engineer licensed to practice in Province of Ontario who carries professional liability insurance and has at least five years' experience providing engineering services of similar kind, scope, and complexity.

.1 Professional Engineer's Responsibility:

.1 production and review of Shop Drawings,

.2 design and certification of metal stairs, including attachments for building construction, in accordance with applicable codes and regulations,

.3 stamping and signing of each Shop Drawing and associated calculations.

.5 Single Source Responsibility: Obtain primary materials for this Section from a single source by a single manufacturer, and secondary materials from sources recommended by manufacturers of primary materials.

.6 Mock-Ups / First Installation Review: Construct mock-ups to verify selections made under submittals, demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

.1 Location: In-situ (i.e. first installation), as directed on site by Consultant.

.2 Purpose: To set benchmarks for installation and to judge subsequent work. Maintain Mock-ups during construction in undisturbed condition.

.3 Reviewed mock-ups: May become part of the completed work if undisturbed at the time of Substantial Performance of The work, provided they are undisturbed, and comply with requirements outlined in Contract Documents.

1.10 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle metal stairs materials in accordance with manufacturer's written instructions.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Store materials off-ground, in clean, dry, well-ventilated area.

.4 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 REGULATORY REQUIREMENTS

.1 Accessibility: Ensure the work of this Section complies with barrier-free requirements of the OBC, CAN/CSA-B651 and requirements of authorities having jurisdiction.

2.2 DESIGN AND PERFORMANCE REQUIREMENTS

.1 Professional Engineering Design and Certification: Design metal stairs, including comprehensive engineering analysis by a Professional Engineer licensed to practice in the Province of Ontario, in accordance with requirements of Ontario Building Code, and using performance requirements and design criteria indicated on Drawings and Schedules in this Section.

.2 Structural Performance of Stairs: Provide metal stairs capable of withstanding the effects of gravity loads and the following loads and stresses in accordance with OBC requirements (4.1.5. Live Loads Due to Use and Occupancy) within limits and under conditions indicated.

.3 Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.

.4 Limit deflection of treads, platforms, and framing members to L/360 or 6.4 mm (1/4 inch), whichever is less. Where stairs are intended to support tile, stone or other brittle materials, reduce deflection to L/720.

.5 Structural Performance of Guards and Handrails: Guards and railings and guards shall withstand the effects of gravity loads according to the minimum requirements of the Ontario Building Code, CSA A500 and the following loads and stresses within limits and under conditions indicated:

.1 Comply with requirements specified in OBC Clause 4.1.5.14. Loads on Guards and Handrails.

.6 NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," for class of stair designated, unless more stringent requirements are indicated on Drawings and Schedules.

.1 Preassembled Stairs – Exits and Similar Locations: Commercial class.

.2 Industrial Stairs - Service Spaces, Penthouses etc.: Industrial class.

.7 At exposed connections, finish exposed welds of stairs, railings and guards and guards to comply with NOMMA's "Voluntary Joint Finish Standards" as follows:

.1 Preassembled Stairs – Exits and Similar Locations: Type 2 welds; completely sanded joint, some undercutting and pinholes okay

.2 Industrial Stairs - Service Spaces, Penthouses etc.: Type 3 welds; partially dressed weld with spatter removed.

.8 Material Finish: Provide materials with smooth, flat surfaces unless otherwise indicated on Drawings and Schedules. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

.9 Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

.10 Exterior Elements: fabricate and install to prevent buckling, opening up of joints and overstressing of welds and fasteners under the following temperature conditions:

.1 Temperature Change: ambient temperature cycling of - 30 deg C (-22 deg F) to 82 deg C (180 deg F) over a 12-hour period.

.11 VOC Content and Emissions:

.1 VOC Emissions: For applicable items in this Section, comply with CDPH Standard Method v1.2–2017 (CA Spec 01350) and ensure products are certified per UL 2818, SCS Global Gold, or equivalent.

.2 VOC Content Requirements: Wet-applied materials used in scope of this Section must conform to the following:

.1 Paints and Coatings: SCAQMD Rule 1113 or CARB SCM.

.2 Adhesives and Sealants: SCAQMD Rule 1168.

.3 Methylene chloride and perchloroethylene must not be intentionally added in paints, coatings, adhesives, or sealants.

.3 Composite Wood (if applicable): must be ULEF or NAF type per CARB ATCM. Do not adhesives that contain urea-formaldehyde.

2.3 METALS

.1 Steel Plates, Shapes, and Bars: ASTM A 36/A 36M or equivalent to CSA G40.20/G40.21.

.2 Steel Tubing: ASTM A 500 (cold formed) or ASTM A 513.

.3 Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or equivalent to CSA G40.20/G40.21 or ASTM A 283/A 283M, Grade C or D.

.4 Uncoated, Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, structural steel, Grade 170 (Grade 25), unless another grade is required by design loads; exposed.

.5 Uncoated, Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, structural steel, Grade 205 (Grade 30), unless another grade is required by design loads.

.6 Galvanized-Steel Sheet: ASTM A 653/A 653M, Z275 (G90) coating, structural steel, Grade 230 (Grade 33), unless another grade is required by design loads.

.7 Aluminum Extrusions: ASTM B 221M (ASTM B 221), Alloy 6063-T6.

.8 Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.

2.4 PREFILLED CONCRETE TREADS

.1 Concrete Materials and Properties: Comply with requirements in Section 03 30 00 "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with minimum 28-day compressive strength of 20 MPa (3000 psi) and maximum aggregate size of 13 mm (1/2 inch) unless otherwise indicated.

.2 Nonslip-Aggregate Concrete Finish: Factory-packaged abrasive aggregate made from fused, aluminum-oxide grits or crushed emery; rustproof and nonglazing; unaffected by freezing, moisture, or cleaning materials.

.1 Plain Steel Welded-Wire Reinforcement: ASTM A1064/A10645M, galvanized steel, 152 by 152 mm (6 by 6 inches), W1.4 by W1.4, unless otherwise indicated on Drawings.

.3 Reinforcement Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening welded-wire reinforcement in place.

.1 Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete.

.4 For galvanized reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.

2.5 FABRICATION

.1 Provide complete stair assemblies, including metal framing, hangers, struts, railings and guards, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.

.1 Join components by welding unless otherwise indicated on Drawings and Schedules.

.2 Use connections that maintain structural value of joined pieces.

.3 Fabricate treads and platforms of exterior stairs so finished walking surfaces slope to drain.

.2 Preassembled Stairs: Assemble stairs in shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

.3 Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1 mm (1/32 inch) unless otherwise indicated on Drawings and Schedules. Remove sharp or rough areas on exposed surfaces.

.4 Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

.5 Form exposed work with accurate angles and surfaces and straight edges.

.6 Weld connections to comply with the following:

.1 Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

.2 Obtain fusion without undercut or overlap.

.3 Remove welding flux immediately.

.4 Weld exposed corners and seams continuously unless otherwise indicated on Drawings and Schedules.

.7 Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated on Drawings and Schedules. Locate joints where least conspicuous.

.8 Fabricate joints that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

2.6 FASTENERS

.1 General: Provide zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941M (ASTM F 1941), Class Fe/Zn 12 for exterior use, and Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.

.2 Bolts and Nuts: Regular hexagon-head bolts, ASTM F 568M, Property Class 4.6 (ASTM A 307, Grade A); with hex nuts, ASTM A 563M (ASTM A 563); and, where indicated on Drawings and Schedules, flat washers.

.3 Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated on Drawings and Schedules; with nuts, ASTM A 563M (ASTM A 563); and, where indicated on Drawings and Schedules, flat washers. Provide mechanically deposited or hot-dip, zinc-coated anchor bolts for exterior stairs.

2.7 STEEL-PAN STAIRS

.1 Fabricate stringers of steel channels, MC shapes, in sizes as required to support loadings. Provide closures for exposed ends of stringers where exposed.

.2 Construct platforms of steel plate and miscellaneous framing members as needed to comply with performance requirements and to support loadings.

.3 Weld stringers to headers; weld framing members to stringers and headers.

.4 Form risers, subtread pans, and subplatforms to configurations shown from steel sheet of thickness needed to comply with performance requirements but not less than 3 mm (1/8 inch) thick. Weld to stringers.

.5 Form landings from minimum 3 mm (1/8 inch) thick steel plate, reinforced by L-shaped members spaced at minimum 400 mm (16 inches) on centre.

.6 Directly weld metal pans to stringers; locate welds on top of subtreads where they will be concealed by concrete fill. Do not weld risers to stringers.

.7 Provide clip angles for fastening of furring channels, where applied finish indicated for underside of stairs and landings.

.8 Extend stringers around mid landings to form steel base.

.9 Shape metal pans to include nosing integral with riser.

2.8 METAL FLOOR PLATE STAIRS

.1 Form treads and platforms to configurations shown from abrasive-surface floor plate of thickness needed to comply with performance requirements indicated in this Section, but not less than 6 mm (1/4 inch).

.1 Form treads with integral nosing and back edge stiffener. Form risers of same material as treads.

.2 Form treads with integral nosing and back edge stiffener. Form risers from steel sheet not less than 3 mm (1/8 inch) thick, welded to tread nosings and stiffeners and to platforms.

.3 Form treads with integral nosing and back edge stiffener, and with open risers.

.4 Form landings from minimum 6 mm (1/4 inch) thick steel plate, reinforced by L-shaped members spaced at minimum 400 mm (16 inches) on centre.

.5 Weld steel supporting brackets to stringers and weld treads to brackets.

.6 Fabricate platforms with integral nosings matching treads and weld to platform framing.

.2 Metal Bar-Grating Stairs: form treads and platforms to configurations shown from metal bar grating; fabricate to comply with NAAMM MBG 531, "Metal Bar Grating Manual."

.1 Fabricate treads and platforms from welded steel grating with 25-by-3-mm (1-by-1/8-inch) bearing bars at 11 mm (7/16 inch) o.c. and crossbars at 100 mm (4 inches) o.c.

.2 Fabricate treads and platforms from welded steel grating with openings in gratings no more than 12 mm (1/2 inch) in least dimension.

.3 Surface: Serrated.

.4 Finish: Galvanized.

.5 Fabricate grating treads with rolled-steel floor plate nosing and with steel angle or steel plate carrier at each end for stringer connections. Secure treads to stringers with bolts.

.6 Fabricate grating platforms with nosing matching that on grating treads. Provide toeplates at open-sided edges of grating platforms. Weld grating to platform framing.

2.9 RAILINGS AND GUARDS

.1 Steel Tube Railings and guards and Guards: Fabricate railings and guards to comply with requirements indicated on Drawings and Schedules for design, dimensions, details, finish, and member sizes, including wall thickness of tube, post spacings, and anchorage, but not less than that needed to withstand loads indicated in this Section and in Ontario Building Code.

.1 Handrails: Pipe - 38 mm dia. x 2.4 mm wall thickness (1-1/2" dia. x .095" wall thickness) and conforming to OBC 3.4.6.5(5) unless otherwise indicated on Drawings.

.2 Close exposed ends of railing members with prefabricated end fittings.

.3 Provide wall returns at ends of wall-mounted handrails unless otherwise indicated on Drawings and Schedules. Close ends of returns unless clearance between end of rail and wall is 6 mm (1/4 inch) or less.

.2 Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work. Supply inserts and other anchorage devices for connecting to concrete or masonry work.

.1 Connect posts to stair framing by direct welding unless otherwise indicated on Drawings and Schedules.

.2 For galvanized railings and guards, provide galvanized fittings, brackets, fasteners, sleeves, and other ferrous-metal components.

.3 For nongalvanized railings and guards, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanized anchors embedded in exterior masonry and concrete construction.

.3 Fillers: Provide fillers made from steel plate, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.

2.10 STAIR NOSINGS

.1 Provide aluminum nosings with integral abrasive, featuring as-cast finish from aluminum oxide, silicon carbide, or both. Ensure units fit openings or conditions accurately in necessary lengths.

.1 Basis-of-Design: “Supergrit® Series” by Wooster Products Inc. or approved equivalent by one of the following:

.1 American Safety Tread Co., Inc.

.2 Balco Inc.

.3 Safe-T-Metal Company, Inc.

.2 Provide anchors for embedding units in concrete, either integral or attached to units, per manufacturer standards.

.3 Apply bituminous paint to concealed surfaces of cast-metal units set into concrete.

.4 Coat hidden surfaces of extruded units set into concrete with clear lacquer.

2.11 AUXILIARY MATERIALS

.1 Welding Rods and Bare Electrodes: Select according to CSA specifications for metal alloy welded.

.2 Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

.3 Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

.4 Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

2.12 FINISHES

.1 Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

.2 Finish metal stairs after assembly.

.3 Galvanizing: Hot-dip galvanize items exterior components to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M or equivalent to CAN/CSA-G164for other steel and iron products.

.1 Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

.2 Fill vent and drain holes that will be exposed in finished Work, unless indicated on Drawings and Schedules to remain as weep holes, by plugging with zinc solder and filing off smooth.

.4 Shop Primer:

.1 Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

.2 Universal Shop Primer (interior components): Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

.1 Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

.3 Epoxy Zinc-Rich Primer (exterior components, not otherwise galvanized): Complying with MPI#20 and compatible with topcoat.

.1 Acceptable Products: “Zinc Clad IV” by Sherwin Williams or approved equivalent.

.5 Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

.1 Stripe paint corners, crevices, bolts, welds, and sharp edges.

.2 Apply one coat of shop primer except interior surfaces of pans.

.3 Apply two coats of primer of different colours to parts inaccessible after final assembly.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions:

.1 Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation. Commencement of work implies acceptance of previously completed work.

3.2 INSTALLATION OFSTAIRS

.1 Installation, generally: Install work of this Section in strict accordance with manufacturer's written installation instructions and reviewed Shop Drawings. Supplement manufacturer's installation instructions with additional installation requirements specified in this Section to produce specified work results.

.2 Install in accordance with NAAMM, Metal Stair Manual.

.3 Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.

.4 Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.

.5 Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated on Drawings and Schedules.

.6 Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

.7 Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

.8 Field Welding: Comply with requirements for welding in this Section.

.9 Place and finish concrete fill for treads and platforms to comply with Section 03 30 00, Cast-in-Place Concrete.

.1 Install abrasive nosings with anchors fully embedded in concrete. Center nosings on tread width.

.10 Install plumb and true in exact locations, using welded connections wherever possible to provide rigid structure. Provide anchor bolts, bolts and plates for connecting stairs to structure.

.11 Hand items over for casting into concrete or building into masonry to appropriate trades together with setting templates.

.12 Do welding work in accordance with CSA W59 unless specified otherwise.

.13 Touch up shop primer to bolts, welds, and burned or scratched surfaces at completion of erection.

3.3 INSTALLING RAILINGS AND GUARDS

.1 Adjust railing systems before anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated on Drawings and Schedules or, if not indicated on Drawings and Schedules, as required by design loads. Plumb posts in each direction. Secure posts and rail ends to building construction by anchoring posts to steel by welding directly to steel supporting members.

.2 Attach handrails to wall with wall brackets. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt. Provide brackets with 50-mm (2-inch) clearance from inside face of handrail and finished wall surface.

.3 Locate brackets as indicated on Drawings and Schedules or, if not indicated on Drawings and Schedules, at spacing required to support structural loads.

3.4 PROTECTION

.1 Protect metal stairs from damage, soiling and contaminating substances resulting from construction activities or caused by work of other trades.

.2 Where soiling or spills have occurred, remove spills and soiling from adjacent surfaces using cleaning procedures recommended in writing by the affected material's manufacturer. Do not use materials or processes that can damage finishes, surfaces, or construction.

.3 Promptly replace metal stairs work damaged during construction that cannot be satisfactorily repaired.

3.5 CLEANING AND WASTE MANAGEMENT

.1 Cleaning and Waste Management, generally: in accordance with Division 01.

.2 Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

.1 Apply by brush or spray to provide a minimum 0.05-mm (2.0-mil) () dry film thickness.

.3 Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

.4 Cleaning: Maintain clean construction area at the end of each day. When the activities of this Section are complete, remove materials, tools, equipment and rubbish.

.5 Waste Management and Disposal: sort waste for reuse, recycling, or disposal, as specified. Remove recycling bins and containers from site and dispose of contents at the appropriate waste disposal facilities.

END OF SECTION

PART 1 - GENERAL

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL INSTRUCTIONS

.1 Read and conform to:

.1 the General Conditions and the Supplementary Conditions of the Contract;

.2 Division 1 requirements and documents referred to therein.

1.3 SUMMARY

.1 Work Included: Provide rough carpentry including but not limited to the following:

.1 framing with dimension lumber.

.2 roofing carpentry including nailers, rooftop equipment bases and support curbs.

.3 wood blocking.

.4 wood furring and grounds.

.5 plywood backing panels.

.6 preservative treatment of wood.

.7 fire retardant treatment of wood

.8 temporary wood treads on steel stairs and landings.

.2 Related Requirements: Specifications throughout the entirety of Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.4 REFERENCES

.1 Reference Standards: Latest published editions of reference standards listed in this Section in effect as of the closing date and time of the Request for Tenders for the Contract, including any amendments adopted, are applicable unless otherwise indicated.

1.5 SUBMITTALS

.1 Product Data: Submit manufacturer's literature and data sheets for each type of material provided under this Section for the Project in accordance with requirements of Section 01 30 00. Ensure data sheets provide required information including detailed instructions for installing as well as maintaining, preserving and keeping materials in clean and safe conditions. Provide adequate warning of maintenance practices or cleaning agents detrimental to specified materials.

.1 Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.

.2 Safety Data Sheets (SDS): Submit SDS for inclusion in Operation and Maintenance Manual specified in Section 01 70 00, for adhesives, sealants and any other material designated by Consultant.

1.6 QUALITY ASSURANCE

.1 Installer Qualifications: Provide work of this Section executed by competent installers with a minimum 5 years' experience in the application of the Products, systems and assemblies specified in this Section and with the approval and training of the Product manufacturers.

.2 Single Source Responsibility: Ensure primary materials provided in this Section are obtained from 1 source by a single manufacturer and secondary materials are obtained from sources recommended by primary materials manufacturers

1.7 DELIVERY, STORAGE AND HANDLING

.1 Storage and Handling Requirements:

.1 Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

.2 Deliver interior wood materials that are to be exposed to view only after building is enclosed and weatherproof, wet work other than painting is dry, and HVAC system is operating and maintaining temperature and humidity at occupancy levels.

PART 2 - PRODUCTS

2.1 DESCRIPTION

.1 Regulatory Requirements;

.1 Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to Authorities Having Jurisdiction.

.2 Performance Requirements:

.1 Do not use Products containing added urea formaldehyde.

.2 Visual Characteristics: Measure knots, checks, shakes and slope of grain in visually graded lumber in accordance with ASTM D245 with exceptions as noted under NLGA 120d.

.3 For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes

.4 Grading:

.1 Lumber identification: by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board conforming to the Standard Grading Rules for Canadian Lumber published by the National Lumber Grades Authority.
.2 Plywood and wood based composite panel construction identification: by grade mark in accordance with applicable CSA standards. Ensure plywood grading agency is certified by APA The Engineered Wood Association; http://www.apawood.org
.3 Preservative Pressure-Treated and Fire-Retardant-Treated Wood and Plywood identification: by grade mark in accordance with the Canadian Wood Preservers Bureau and applicable ULC standards.
.4 Identify lumber by grade stamp of an agency certified by Canadian Lumber Standards Administration Board.
.5 Provide roof sheathing bearing manufacturer's grading stamp for identification.

2.2 MATERIALS

.1 Lumber:

.1 Unless specified otherwise in the Contract Documents, use No. 2 White Pine, No. 2 Red Pine, or No. 1 Construction S-P-F (spruce-pine-fir), lumber with moisture content of 19% or less, kiln dried, free from sap, shakes, splits, knots and other defects in accordance with following standards:

.1 CAN/CSA O141.
.2 NLGA Standard Grading Rules for Canadian Lumber.

.2 Furring, blocking, nailing strips, grounds, rough bucks, curbs, fascia backing and sleepers:

.1 Board sizes: "standard" or better grade.
.2 Dimension sizes: "standard" light framing or better grade.
.3 Post and timbers sizes: "standard" or better grade.

.3 Appearance Lumber: Graded in accordance with NLGA Para 125.

.4 Studs: Conforming to NLGA Para 121.

.5 Light Framing: Conforming to NLGA Para 122.

.6 Structural Light Framing: NLGA Para 124.

.7 Consultant reserves the right to select species and appearance grades to suit the Project's design requirements.

.2 Panels:

.1 Exterior Plywood: 19 mm (3/4") thick, waterproof, grade stamped exterior grade Douglas Fir plywood, select grade, un-sanded conforming to CSA O121-M.

.2 Interior Locations: minimum 19 mm (3/4") thick, unless otherwise indicated.

.1 Douglas Fir Plywood: Conforming to CSA O121-M, G1S or G2S.
.2 Canadian softwood plywood: Conforming to CSA O151; G1S or G2S.

2.3 ACCESSORIES

.1 Rough Hardware and Fastening Accessories:

.1 Supply rough hardware to frame and fix rough carpentry including but not limited to bolts, anchors, nails, expansion shields and other fastenings required.

.1 Wire Nails, Spikes and Staples: Conforming to CSA B111.
.2 Exterior locations and treated lumber: Stainless steel nails, type 316. Plain galvanized or electroplated nails are not acceptable. Do not use aluminum nails in conjunction with galvanized building components.
.3 Provide spiral thread nails except as indicated otherwise in the Contract Documents.
.4 Bolts: ASTM A307, minimum 12 mm (½") complete with nuts and washers.
.5 Connecting Hardware: Pre-engineered, pre-drilled, purpose made galvanized joist hangers, framing fasteners and anchors meeting structural requirements and pre-approval.
.6 Connection Steel: Mild structural steel, conforming to CSA G40.20/G40.21, Grade 300W.
.7 Proprietary fasteners (toggle bolts, expansion shields, screws, organic fibre plugs etc.): recommended for purpose by manufacturers.
.8 If stainless steel fasteners are used, use only Type 316 fasteners.

.2 Corrosion-resistant treatments:

.1 Exterior locations, interior high humidity locations and hardware in contact with wood preservative treatments: hot dip galvanized in accordance with ASTM A123.

.1 Minimum weight of zinc coating: 600 g/m² (185 ounces per sq.ft.) in accordance with ASTM A153M.
.2 Do not use electroplated galvanized fasteners in contact with wood preservatives.
.3 Other locations: cadmium plated hardware.

.2 Preservative Treatments:

.1 Preservative Pressure-Treated Wood and Plywood: in accordance with CSA O80.1

.1 Maximum moisture content: kiln dried, 19%. Do not use material that is warped or does not comply with requirements for untreated material.
.2 Treatment:

.1 Provide chemical treatment acceptable to Authorities Having Jurisdiction and containing no arsenic or chromium from one of the following manufacturers:

.1 Timber Specialties Company
.2 Wolmanized Wood;.
.3 or Equivalent to the above.

.2 For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.

.3 Application: Pressure treat the following wood elements and other items indicated on the Drawings:

.1 Wood nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.

.2 Fire-Retardant-Treated Wood and Plywood:

.1 Maximum moisture content: kiln dried, 19%. Do not use material that is warped or does not comply with requirements for untreated material.
.2 Surface Burning Characteristics: Conforming to CAN/ULC-S102 and UL FR-S rating.

.1 Flame Spread: ≤ 25
.2 Smoke Developed: ≤ 50

.3 Treatment:

.1 Provide chemical treatment acceptable to Authorities Having Jurisdiction and containing no arsenic or chromium from one of the following manufacturers:

.1 Dricon;
.2 FireFree;
.3 or Equivalent to the above

.2 Do not resurface or rip fire treated wood if it affects the ULC label.
.3 For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.

.4 Application: Provide fire-retardant-treatment for following wood elements and other items indicated on the Drawings:

.1 Plywood backing panels.

.3 Adhesives: waterproof in accordance with CSA O 112 and CAN/CGSB-71.26 requirements with VOC limit acceptable to Authorities Having Jurisdiction.

PART 3 - EXECUTION

3.1 VERIFICATION

.1 Site Verification of Conditions: Verify actual Site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation. Commencement of work implies acceptance of previously completed work.

3.2 PREPARATION

.1 Treat surfaces with wood preservative or fire retardant treatments before installation.

.2 Apply preservative by dipping or by brush to completely saturate and maintain wet film on surface for a minimum 3 minute soak for lumber and 1 minute soak for plywood.

.3 Provide pressure treatment to all material exterior and material within an envelope wall or exterior floor assembly.

.4 Coordinate with other Sections of the Specifications providing blocking, nailing strips and trims as required for installation of work.

3.3 INSTALLATION

.1 Properly frame together parts of the Work with members accurately cut to size, closely fitted, well spiked, and erected in a substantial manner, plumb, level, square and true to dimension.

.2 Locate joints over bearing or supporting surfaces.

.3 Provide running members full length wherever possible.

.4 Design for expansion and contraction of the materials.

.5 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.

.6 After cutting, drilling and fitting of "treated" wood and plywood but before installation, apply 1 full coat of wood preservative to exposed surfaces, including ends of blocking, furring, nailers and rough carpentry. Retreat surfaces exposed by cutting, trimming or boring with liberal brush application of preservative or fire retardant before application

.7 Provide fasteners and rough hardware for a rigid and secure installation. In addition to mechanical fasteners, place continuous adhesive bead where appropriate in accordance with manufacturer’s instructions.

.8 Countersink bolts where necessary to Provide clearance for other work.

.9 Select exposed framing for appearance. Install lumber and panel materials so that grade-marks and other defacing marks are concealed or are removed by sanding where materials are left exposed.

.10 Use dust collectors and high quality respirator masks when cutting or sanding wood panels.

.11 Mix intumescent paint coating Product to manufacturer's recommendations. Do not thin or strain. Apply primer and paint coating providing fire resistant barrier in accordance with manufacturer's recommendations to achieve the requirements of Authorities Having Jurisdiction.

.12 Miscellaneous Interior Carpentry:

.1 Provide plywood, blocking, furring, nailers, rough carpentry, grounds and nailing strips, as required for the proper installation and to support miscellaneous work indicated on the Drawings to meet the design requirements.

.2 This non-exhaustively includes the following: support for fascia, composite wood panels, wall mounted equipment, crash rails, bumpers and wood blocking required for wall-mounted items, wood blocking required for roofing and exterior walls and other similar locations.

.13 Equipment Mounting Panels:

.1 Provide “fire treated” plywood.

.2 Install wood panels required for mechanical, electrical and communication trades for mounting of items including but not limited to control boards, panel boards, pull boxes, splitters, switches, wall mounted switch gear, junction boxes, electrical cabinets, data control equipment, disconnect switches, fire alarm control equipment, lighting control equipment, sound/communication equipment and other similar devices.

.3 Provide 19 mm (3/4") thick exposed plywood backboard panels in one piece screw-fastened and securely mounted to wall surfaces by use of fire-retardant treated wood strapping.

.4 Ensure panel size and mounting height suit mechanical and electrical requirements and are acceptable to respective consultants. Apply to all surfaces and edges of plywood panels 1 coat of fire retardant wood preservative.

.14 Roof Carpentry:

.1 Install continuous wood nailers along roof control joints, building and roof expansion joints and around roof perimeters, curbs and roof openings at edges of insulation as shown on the Drawings.

.2 Use cadmium plated self tapping screws for securing wood to metal deck, and lead shields and cadmium plated lag screws for securing wood to concrete as indicated. Install cut cant strips and continuous nailers on copings and curbs as detailed.

.3 Secure using fasteners as specified herein.

.15 Temporary Wood Treads:

.1 Install and secure 50 mm x 250 mm (2" x 10") full length, temporary spruce treads and landings on steel stairs shown to receive concrete fill. Exposed stair components to have eased edges.

3.4 PROTECTION

.1 Protect installed Products and components from damage during construction.

.2 Repair damage to adjacent materials caused by rough carpentry installation.

END OF SECTION

PART 1 - GENERAL

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL INSTRUCTIONS

.1 Read and conform to:

.1 the General Conditions and the Supplementary Conditions of the Contract;

.2 Division 01 requirements and documents referred to therein.

1.3 SUMMARY

.1 Work Included: Provide exterior gypsum sheathing work including but not limited to the following:

.1 exterior gypsum sheathing boards

.2 joint treatments

.3 auxiliary materials

.2 Related Requirements: Specifications throughout the entirety of Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.4 REFERENCES

.1 Reference Standards: Latest published editions of reference standards listed in this Section in effect as of the closing date and time of the Request for Tenders for the Contract, including any amendments adopted, are applicable unless otherwise indicated.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meetings:

.1 Prior to starting work of this Section, convene a pre-installation meeting at Project site to review Project requirements and site conditions with pertinent parties. Conform to requirements of Division 01.

1.6 SUBMITTALS

.1 Product Data: Submit manufacturer's literature and data sheets for each type of material provided under this Section for the Project in accordance with requirements of Division 01. Ensure data sheets provide required information including detailed instructions for installing as well as maintaining, preserving and keeping materials in clean and safe conditions. Provide adequate warning of maintenance practices or cleaning agents detrimental to specified materials.

.2 Safety Data Sheets (SDS): Submit SDS for inclusion in Operation and Maintenance Manual specified in Section 01 70 00, for adhesives, sealants and any other material designated by Consultant.

.3 Shop Drawings: Submit Shop Drawings indicating material characteristics, details of construction, in particular locations of construction joints, connections and relationship with adjacent construction. Take field measurements prior to preparation of Shop Drawings and fabrication to ensure proper fitting of work.

1.7 QUALITY ASSURANCE

.1 Applicator Qualifications: Provide work of this Section executed by competent installers with minimum of 5 years' experience in application of the Products, systems and assemblies specified herein.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Products of following manufacturers may be acceptable subject to conformance to requirements of Drawings, schedules and Specifications:

.1 CertainTeed Gypsum Canada Inc.

.2 CGC Inc.

.3 Georgia-Pacific Canada, Inc.

.2 Substitution Limitations: Comparable Products from manufacturers listed herein offering functionally and aesthetically equivalent Products in Consultant's opinion and subject to Consultant's review, will be considered provided they meet the requirements of this Specification.

2.2 MATERIALS

.1 Exterior Gypsum Sheathing Board: 12.7 mm (1/2") or 15.9 mm (5/8") (Type X) thick (as noted on Drawings) glass mat reinforced, weather and sag resistant exterior gypsum ceiling panel conforming to ASTM C1177M with the following characteristics:

.1 Mold Resistance Rating: 10 with no mold growth after 4 weeks exposure in accordance with ASTM D3273.

.2 Fire-performance: non combustible according to CAN/ULC-S114; flame spread: 0, smoke developed: 0 in accordance with CAN/ULC-S102-M.

.3 Boards containing paper or other organic materials in their composition are not acceptable.

.4 Acceptable Products:

.1 "DensGlass Exterior Sheathing" by Georgia-Pacific Canada, Inc.

.2 "GlasRoc® Sheathing" by CertainTeed Gypsum, Canada Inc.

.3 "Securock Glass Mat Sheathing" by CGC Inc.

.4 of Equivalent to the above.

.2 Gypsum Exterior Soffit Board: 12.7 mm (1/2") or 15.9 mm (5/8") (Type X) thick (as noted on Drawings) glass mat reinforced, weather and sag resistant exterior gypsum ceiling panel conforming to ASTM C1177M with the following characteristics:

.1 Mold Resistance Rating: 10 with no mold growth after 4 weeks exposure in accordance with ASTM D3273.

.2 Fire-performance: non combustible according to CAN4-S114-M; flame spread: 0, smoke developed: 0 in accordance with CAN/ULC-S102-M.

.3 Boards containing paper or other organic materials in their composition are not acceptable.

.4 Acceptable Products:

.1 “DensGlass Exterior Sheathing” by Georgia-Pacific Canada, Inc.,

.2 “GlasRock® Sheathing” by CertainTeed Gypsum, Canada Inc.

.3 “Securock Glass Mat Sheathing” by CGC Inc.

.4 or Equivalent to the above.

.3 Joint Treatments

.1 Conforming to ASTM C475 and exterior gypsum sheathing board manufacturer’s recommendations. Confirm all Products with board manufacturer prior to application.

.2 Sheathing Tape: 50 mm (2") and 100 mm (4") wide fibreglass mesh tape as recommended by panel manufacturer with pressure sensitive adhesive on 1 side, of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing and with a history of successful in-service use.

2.3 ACCESSORIES

.1 Provide auxiliary materials that comply with ASTM C1280.

.2 Provide fasteners of size and type indicated that comply with requirements specified in this Section for material and manufacture. For sheathing, Provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M or of Type 304 stainless steel.

.1 Provide steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

.3 Sealant for Glass-Mat Gypsum Sheathing: Silicone emulsion sealant complying with ASTM C834, compatible with sheathing tape and sheathing and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Examine substrate for compliance with applicable requirements, including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with the requirements of this Section and other conditions affecting performance.

.2 Do not proceed until unsatisfactory conditions have been corrected. Beginning of installation shall indicate acceptance of substrate conditions.

3.2 INSTALLATION

.1 Comply with requirements in ASTM C1280 that apply to application of exterior gypsum panel Products.

.1 Fasten gypsum sheathing to cold-formed metal framing with screws.

.2 Install boards with a 3/8-inch (9.5-mm) gap where non-load-bearing construction abuts structural elements.

.3 Install boards with a 1/4-inch (6.4-mm) gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.

.2 Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

.3 Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

.4 Securely attach to substrate by fastening as indicated. Coordinate sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and in a manner that prevents exterior moisture from passing through completed assembly.

.5 Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

.6 Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecasted.

.7 Install board vertical edges centered over studs. Abut ends and edges of each board with those of adjacent boards. Attach boards at perimeter and within field of board to each stud.

.8 Space fasteners approximately 200 mm (8 inches) o.c. and set back a minimum of 9.5 mm (3/8 inch) from edges and ends of boards.

.9 Seal sheathing joints according to the sheathing manufacturer's written instructions.

.1 Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel silicone emulsion sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

.2 Sealing and taping of joints may be omitted provided exterior sheathing boards have square edges and are installed tightly butted together (maximum 6 mm (1/4 inch)). Provide taping in locations where tight butting of joints cannot be achieved.

.3 Consultant reserves the right to request that joints be taped should the aforementioned quality control not be maintained.

3.3 CLEANING

.1 Cooperate and coordinate with the work of other Sections to obtain satisfactory exterior gypsum sheathing board finish work. Do all cutting, patching and Make Good as required by the installation requirements applicable to such work of other Sections.

.2 Clean droppings and similar items and remove surplus materials and rubbish on completion of the work in this Section and as directed.

END OF SECTION

Updated through ADD#10

PART 1 - GENERAL

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL INSTRUCTIONS

.1 Read and conform to:

.1 the General Conditions and the Supplementary Conditions of the Contract.

.2 Division 1 requirements and documents referred to therein.

1.3 SUMMARY

.1 Work Included: Provide architectural woodwork including but not limited to following:

.1 architectural cabinet casework.

.2 architectural cabinet casework drawers and doors.

.3 edgebanding for architectural cabinet casework and doors.

.4 edgebanding for architectural cabinet shelves on visible and semi-exposed edges.

.5 Countertops with integral sinks.

.6 architectural cabinet casework hardware.

.7 closet and utility shelving.

.8 trim and mouldings.

.2 Related Requirements: Specifications throughout the entirety of Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.4 REFERENCES

.1 Definitions:

.1 In the context of architectural cabinetry, the following definitions apply (and shall be used in this Section) in accordance with North American Architectural Woodwork Standards (NAAWS), Section 10 and amended as follows:

.1 Exposed Surfaces: Defined as all surfaces exposed to view in open casework or behind transparent doors. These include:

.1 Surfaces visible when doors and drawers are closed, including knee spaces.
.2 Underside of cabinet bottoms over 1067 mm (62”) above finished floor level, including cabinet bottoms behind light valances and bottom edge of light valances.
.3 Cabinet tops under 2032 mm (80”) above finished floor, or if 2032 mm (80”) and over and visible from an upper building level or floor.
.4 Front edges of stretchers, ends, divisions, tops and bottoms.
.5 Sloping tops of cabinets that are visible.
.6 Shelves (including edgebanding).
.7 Divisions and partitions.

.8 Interior face of ends (sides), backs, and bottoms (including pull-outs). Also included are the interior surfaces of cabinet top members 914 mm (36") or more above the finished floor.
.9 Interior face of door and applied drawer fronts.

.2 Semi-Exposed Surfaces: Defined as those interior surfaces only exposed to view when doors or drawers are opened. These include:

.1 Tops and bottoms shelves, including front edgebanding (front edge is considered exposed).
.2 Divisions and partitions (front edge is considered exposed).
.3 Interior face of ends (sides), backs, and bottoms (including pull-outs). Also included are the interior surfaces of cabinet top members 914 mm (36") or more above the finished floor.
.4 Drawer sides, sub-fronts, backs, and bottoms.
.5 The underside of cabinet bottoms between 610 mm (24") and 1067 mm (42") above the finished floor.
.6 Security and dust panels or drawer stretchers.
.7 The faces of cabinet ends of adjoining units that butt together.

.3 Concealed Surfaces: Defined as those exterior or interior surfaces that are covered or not normally exposed to view. These include:

.1 Toe space unless otherwise specified.
.2 Sleepers, stretchers, and solid sub-tops.
.3 The underside of cabinet bottoms less than 610 mm (24") above the finished floor.
.4 The flat tops of cabinets 2032 mm (80") or more above the finished floor, except if visible from an upper floor or building level.
.5 The three non-visible edges of adjustable shelves.

.2 Reference Standards: Latest published editions of reference standards listed in this Section in effect as of the closing date and time of the Request for Tenders for the Contract, including any amendments adopted, are applicable unless otherwise indicated.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meetings:

.1 Prior to starting work of this Section, convene a pre-installation meeting at the Project site to review Project requirements and site conditions with pertinent parties. Conform to requirements of Section 01 30 00.

.2 Coordination:

.1 Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that architectural woodwork and related items can be supported and installed as indicated.

.2 Perform pre-wiring and partial mounting of electrical and audio/visual equipment and concealed wiring required. Finalize location of outlets and similar items with the Consultant prior to installation.

.3 Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings.

.4 Coordinate fabrication schedule with construction progress and the Construction Schedule to avoid delaying the Work.

.5 Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.

1.6 SUBMITTALS

.1 Product Data: Submit manufacturer's literature and data sheets for each type of material provided under this Section for the Project in accordance with requirements of Section 01 30 00. Ensure data sheets provide required information including detailed instructions for installing as well as maintaining, preserving and keeping materials in clean and safe conditions. Provide adequate warning of maintenance practices or cleaning agents detrimental to specified materials.

.2 Safety Data Sheets (SDS): Submit SDS for inclusion in Operation and Maintenance Manual specified in Section 01 70 00, for adhesives, sealants and any other material designated by Consultant.

.3 Shop Drawings:

.1 Submit Shop Drawings indicating material characteristics, details of construction, connections and relationship with adjacent construction.

.2 Indicate locations and sizes of cutouts and holes for plumbing and electrical fixtures, lavatories and similar items required in architectural woodwork; coordinate with appropriate trades.

.3 Clearly indicate material being supplied and show connections, attachments, reinforcing, anchorage and location of exposed fastenings in accordance with NAAWS Section 1.

.4 Field Measurements: Take field measurements prior to preparation of Shop Drawings and fabrication to ensure proper fitting of work. Do not proceed with fabrication until Shop Drawings have been reviewed.

.4 Samples: Submit samples in accordance with Section 01 30 00 in following sizes:

.1 minimum 300 mm (12") long x 460 mm (18") wide x 25 mm (1") thick solid wood.

.2 minimum 300 mm (12") square and of specified thickness, plastic laminate or wood veneer as applicable, mounted on 19 mm (3/4") core and finished as specified. Submit samples for Consultant's approval prior to fabrication.

.1 For each colour of plastic laminate or wood veneer species selected (as applicable), submit manufacturer's standard 300 mm x 460 mm (12” x 18”) chips.

.3 minimum 300 mm (12") square x 13 mm (1/2”) thick countertop materials.

.4 each type of hardware.

~~.5 Certificates:~~

~~.1 Submit Architectural Woodwork Manufacturers Association of Canada (AWMAC) Guarantee Certificate which covers replacing, reworking and refinishing of defects due to faulty workmanship or defective materials which become apparent within 2 years following date of Substantial Performance of the Work.~~

~~.2 Submit final inspection report prepared by AWMAC inspection under Guarantee Inspection Service (GIS).~~

1.7 QUALITY ASSURANCE

.1 Qualifications:

.1 Manufacturers: Provide Products for Work of this Section by manufacturer with minimum 10 years’ experience in the manufacture of such materials.

.2 Installers: Provide Work of this Section executed by competent installers with minimum 5 years' experience in the application of the Products, systems and assemblies specified and be a member of AWI/AWMAC in good standing for the previous 2 years.

.3 Metal Fabricator: Provide metal work of this Section performed by firm capable of producing the required Shop Drawings of quality levels that are necessary to meet the requirements specified herein. Ensure the retained fabricator possesses modern architectural metal fabricating equipment capable of doing cutting, fitting, bending and installing of steel and stainless steel finishes.

.4 Welders: Welding shall be performed by welders having minimum certification requirements of CSA W47.1 to suit the type of welding performed. Ensure welders are familiar with welding procedures for welding steel and aluminum.

.2 Single Source Responsibility: Engage a qualified woodworking firm to assume undivided responsibility for production and installation for the Work described in this Section.

~~.3 Guarantee and Inspection Service (GIS):~~

~~.1 Subject architectural wood work of this Section to inspection at plant and at Site by appointed inspector approved by local AWMAC Chapter. All costs attributable to GIS shall be included in the Contract Price.~~

~~.2 The GIS process non-exhaustively includes the following:~~

~~.1 review of Shop Drawings to determine methods and materials conform to specified standards;~~
~~.2 review of mock-ups to establish quality control standards;~~
~~.3 detailed inspection of manufactured components to verify their adherence to Shop Drawings, approved mock-ups and conformance to AWMAC - NAAWS.~~

.4 Mock-ups: Provide mock-ups in locations designated by the Consultant and as required to demonstrate quality of workmanship. Maintain mock-ups during construction in an undisturbed condition as a standard for judging the completed work. Approved mock-ups may become part of completed work if the mock-up remains undisturbed at the time of Substantial Performance of The Work. Provide mock-ups for following items:

.1 Basic cabinetry consisting of one base cabinet, one wall hung cabinet, and one countertop. Base cabinet to have minimum one drawer.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Delivery and Acceptance Requirements:

.1 Do not deliver finished Products during rainy or damp weather.

.2 Do not deliver Work of this Section until the building and storage areas are sufficiently dry to ensure Products will not be damaged by changes in relative humidity and moisture content. Deliver, store and handle Products of this Section in accordance with NAAWS Section 2.

.3 Do not deliver and Install damaged Products. Replace damaged Products in accordance with requirements of this Section.

.4 Storage and Handling Requirements: Cover and protect finished surfaces with heavy Kraft paper and other acceptable means. Put in cartons for protection. Do not remove protective covers until immediately prior to final cleaning.

1.9 SITE CONDITIONS

.1 Ambient Conditions: Ensure conditions conform to requirements of NAAWS Section 2 and moisture contents of wood for interior locations at time of installation are at established Optimum Moisture Content and Optimum Indoor Relative Humidity as outlined in NAAWS Section 2.

1.10 WARRANTY

.1 The Contractor warrants the work of this Section for period of 3 years from the date of Substantial Performance of the Work against defects and deficiencies in accordance with General Conditions of the Contract. Promptly correct defects or deficiencies which become apparent within this warranty period, to the satisfaction of the Consultant and at no expense to the Owner. Defects include but are not limited to: delamination of plastic laminate, opening of seams, warpage and extensive colour fading.

PART 2 - PRODUCTS

2.1 DESCRIPTION

.1 Regulatory Requirements:

.1 Provide work of this Section in accordance with North American Architectural Woodwork Standards (NAAWS), except as specified otherwise herein. Any reference in this Section to grades and any use of terminology that is capitalized herein but not otherwise defined in the Contract Documents shall have the definitions given to such grades and terminology in “NAAWS” (and such definitions are hereby, by reference, made a part of this Section). The requirements of this Section govern and modify NAAWS.

.2 Fire-Test-Response Characteristics:

.1 Where fire-retardant materials are indicated, Provide materials with specified fire-test-response characteristics as determined by a testing and inspecting agency acceptable to Authorities Having Jurisdiction.

.2 Identify materials with appropriate markings of applicable testing and inspecting agency on surfaces of materials that will be concealed from view after installation.

.3 Flame-spread index shall be in accordance with OBC requirements when tested according to CAN/ULC-S102.

.2 Design and Performance Requirements:

.1 Architectural Drawings and details are diagrammatic and are only intended to show design concept, aesthetics, interfacing requirements, configuration, components and arrangements. They are not intended to identify or solve completely problems of thermal and structural movements, assembly framing, engineering design, fixings and anchorages.

.2 Ensure millwork casework (e.g. countertops, wall cabinets, cabinet drawers and similar items) are capable of supporting structural loads without deflection in accordance with Casework Integrity Tests in Appendix A of AWMAC- NAAWS Standard Manual of the current edition as at the closing date and time of the Request for Tenders for the Contract.

.3 All composite wood Products and laminating adhesives used in millwork shall not contain added urea-formaldehyde resins.

~~.4~~ Adhesives shall be non-toxic, low VOC, non-solvent glue to comply with AWMAC Quality Standards Manual, ~~Canadian Eco-Logo' program, and LEED requirements.~~

.5 All cabinets shall be flush overlay construction.

.6 Design millwork so that no sharp edges are exposed. Provide minimum 25 mm radiused corner to countertops.

.7 All cabinets doors and drawers shall be provided with locks as indicated on the Drawings. Key in accordance with the requirements to be provided by the Owner to the Contractor.

.8 Incorporate all required mechanical, electrical and communication services into millwork so that wires and pipes are hidden from view. Provide access panels to all services to allow for future adjustment.

.9 Provide built-in valance lighting underneath all upper cupboards over counter tops.

.10 All architectural woodwork hardware shall be stainless steel of durable quality to meet standards of AINSI/BHMA grade 1 Cabinet Hardware.

.11 All door, drawer and other exposed millwork edges shall have applied appropriately sized PVC edge strip, heat applied.

.12 Plastic laminate-to-plastic laminate edges are not permitted.

.13 Provide marine-grade plywood to all bottoms of sink cabinet boxes and areas that may come into contact with water.

.14 Minimum nominal thickness and material for cabinet components and shelf deflection, type of materials, thicknesses, span width and total load distribution: In accordance with AWMAC-NAAWS Standard Manual Section 10, current edition.

.15 Minimum nominal thickness and material for cabinet components and shelf deflection, type of materials, thicknesses, span width and total load distribution: In accordance with NAAWS Section 10.

.3 Framing Lumber (Concealed Framing): Softwood or hardwood lumber as specified in this Section of uniform grain and colour, free from sap, shakes, knots, splits and other defects with grade marked by NLGA and meeting CAN/CSA O141 requirements as applicable. No cross grain permitted. Provide concealed wood of the most appropriate grade required to satisfy fabrication, utility and structural requirements.

.4 Architectural Lumber (Exposed framing, solid members and trim): Clear, straight, kiln dried, hardwood lumber as specified in this Section, of species indicated on Drawings. Provide lumber kiln-dried to moisture content recommended by AWS, free from blemishes that would be apparent after finish is applied. Where species are not indicated on the Drawings, provide:

.1 Transparent Finish: Maple, quarter sawn, Premium grade, matched for compatibility of grain and colour.

.2 Opaque Finish: Natural Birch, quarter sawn, Premium grade.

.5 Panel Products: Conform to the requirements of AWMAC AWS Section 4.

.1 Medium Density Fibreboard Core (MDF): All wood core substrates shall be MDF unless used in areas subject to moisture. Provide MDF Products manufactured from 100% recycled materials, without the use of added formaldehyde resins and with the following characteristics:

.1 Minimum density: 770 kg/m^3 (48 lb. /cu ft.)
.2 Surface characteristics: In accordance with ANSI/NPA A208.2
.3 Grade: Minimum 155.
.4 Finish and Texture: To match the Consultant's sample.
.5 Where indicated, Provide industrial grade MDF certified to meet Class 1 surface burning characteristics of CAN/ULC-S102 and UL 723 with maximum Flame Spread rating of 25 and maximum Smoke Developed of 200.

.6 Acceptable Products:

.1 Medium Density Fibreboard Core (MDF): Decorative panels, “Medite II®“ by Sierra Pine Ltd; or equivalent Products manufactured by Flakeboard Company Limited; Uniboard Canada Inc.; or Tafisa Canada and Company, Ltd.; (or Equivalent)

.2 Veneer Core (Plywood): Provide exterior grade, veneer core (plywood) at countertop cores and splashes where sinks are scheduled to be installed and at other locations as required to meet design requirements. Provide fire-retardant treatment as required to meet OBC stipulations. Conform to AWS Section 4.

.1 Softwood plywood (rough framing and rough carpentry only):

.1 Premium Grade, Douglas Fir plywood - CSA O121, or Western Softwood Plywood - CSA O151 or Poplar plywood - CSA O153-M. Provide Grade G2S where exposed on two sides and Grade G/Solid where exposed on one side. Consider fitment doors exposed on both sides.

.2 Hardwood Plywood (wood cores): Conforming to the requirements of ANSI/HPVA HP-1.

.1 Water-resistant plywood “PureBond™” by Columbia Forest Products; or “HyBrid Panel – SkyPly” by Rosenburg Forest Products; (or Equivalent).

.3 Provide veneer core (plywood) for following applications:

.1 millwork cores subject to moisture,
.2 cabinet bases in contact with floor, and
.3 countertop cores in other locations designated on the Drawings.

.6 Facings:

.1 Facing Adhesive: As recommended by the manufacturer and containing no added urea-formaldehyde. Provide water-resistant adhesive for areas subject to moisture.

.2 High Pressure, Paper Base, Decorative Laminates:

.1 Fire-Test Response Characteristics: Ensure decorative laminates meet flame spread requirements for Class A (Class I) rating in accordance with CAN/ULC S102.2. Flame spread index: < 25; Smoke developed Index: 0.

.2 Provide following types and thicknesses conforming to ANSI/NEMA LD3 and ANSI/NEMA LD3.1 and AWS Section 4:

.1 Horizontal General Purpose: HGS - 1.2 mm (0.048").
.2 Vertical General Purpose: VGS - 0.7 mm (0.028").
.3 Postforming Horizontal: HGP - 1.0 mm (0.039").
.4 Postforming Vertical: VGP - 0.7 mm (0.028").
.5 Backer Sheet: BKM - 1.0 mm (0.039").

.3 Plastic Laminate Types (PLAM):

.1 Products of the following manufacturers (or Equivalent manufacturers) are acceptable subject to conformance to the requirements of the Contract Documents:

.1 Arborite High Pressure Laminates;
.2 Pionite Decorative Laminates

.2 Colours and Finishes: To be selected by the Consultant at a later date from the manufacturer's full colour range including solid and woodgrain patterns, including cross-grain patterns and printed patterns in suede or matte finishes.

.1 Maximum Number of Colours, Finished and Patterns: 5.

.7 Architectural Woodwork Hardware and Accessories:

.1 Provide hardware meeting or exceeding the applicable ANSI/BHMA A156 Series (Grade 1) standards.

.2 Slides:

.1 Heavy Duty Drawer Slides – more than 610 mm (24") wide, Capacity: 68.04 kg (150 lbs)

.1 Side Mounted Telescoping Ball Bearing drawer slide with full extension and 25 mm (1") overtravel (length as required to suit the drawer size). Provide one of the following (or Equivalent):

.1 Model No. Accuride – 3640 by Hafele America Company
.2 Model No. 8505 by Knape & Vogt Canada Inc.
.3 Model No. KA 555 by Hettich Canada Ltd.

.3 Cabinet Door Hinges and Stays:

.1 Ensure cabinet hinge pin is not removable (tack weld or cap). Provide hinges complete with one-piece non-removable pin with tapered tips

.2 Wood Door Hinges:

.1 Frameless Concealed Hinges (European Type) – 165° to 170° opening: Self-closing concealed hinges with integrated soft close. Manufacturer's recommended number of hinges shall suit the door size and thickness. Provide one of the following:

.1 "Salice Concealed Wide Angle Hinges - No. 329.07 Series" by Hafele America Company.
.2 "Blum Concealed - Clip-Top Hinge" by Richelieu Hardware Ltd.
.3 "Intermat 9943" or "Intermat 9956" by Hettich Canada Ltd.
.4 or Equivalent to the above.

.2 Piano Hinges: Stainless steel. Provide hinges in the manufacturer's recommended size and length to suit door size and thickness.

.1 "Model No. 351.10 series" by Hafele America Company or Equivalent. Finish: AISI No. 4, Satin Finish.

.4 Door and Drawer Locks:

.1 Lock locations are noted Drawings. Provide locks in accordance with the Owner's keying requirements unless otherwise indicated in the Contract Documents**.**

.2 Wood Framed Doors and Drawers:

.1 Cylinder Locks: Provide adjustable locking system with lock throw, orientation and size to suit cabinet size. Provide one of the following:

.1 "Cylinder Module System; Model No. 232 Series" by Hafele America Company complete with cam locks or deadbolt locks and cores as required to suit applications indicated.

.2 "Disc Tumbler Furniture Locks - Removacore" by CompX International Inc. complete with cam locks or deadbolt locks and cores as required to suit applications indicated .

.5 Handles (Doors and Drawers):

.1 D-Pulls: Provide one of the following:

.1 “Model No. “Furniture Handle 10 mm 562.10.96” by Hewi or Equivalent.
.2 Finish: to be selected by Consultant at a later date.

.6 Recessed Shelf Pilasters, Standards and Clips:

.1 Provide required accessories to mount wood shelves. Provide one of the following:

.1 “KV255" pilaster and “KV256" adjustable clip supports by Knape & Vogt Canada Inc.
.2 “120-10 Series” pilasters and “1903-2G” clip supports by Richelieu Hardware Ltd.

.7 Door and Drawer Stops, Bumpers and Catches:

.1 Drawer and Hinged Door Bumpers: Provide two clear resilient, press-fit bumpers per door or drawer.
.2 Built-in Drawer Stops: Resilient type recommended by the manufacturer.
.3 Magnetic Door Catch: Holding Power: 3 kg to 4kg (6.6 lbs to 8.8 lbs) Finish: Heavy duty cast aluminum. Provide one of the following (or Equivalent):

.1 Model No. 246.26 Series by Hafele America Company
.2 Model No. 918 by Knape & Vogt Canada Inc.

.8 Spring Latch (workstation 155):

.1 Provide Steel and Nylon spring catch and strike where indicated on Drawings; “Spring Catch, 32 mm, Press-In Strike – 245.07.711” by Hafele (or Equivalent).

.8 Cable Management Grommets: Provide 54 mm (2-1/8”) diameter grommets in numbers indicated at locations shown on reviewed Shop Drawings. Finish: to be selected at a later date.

.1 "Flip Top Series", by Mockett;

.2 "Round Plastic Cable Grommets; Model No. 429.9 Series" by Hafele.

.3 or Equivalent to the above.

.9 Waste Receptacle Ring:

.1 Provide 200mm diameter, Stainless Steel surface mounted waste chute where indicated on drawings; “61436171” by Richelieu or TM1B – 6” Trash Grommet by Mockett (or Equivalent).

.10 Closet Coat Rods: “KV660" by Knape and Vogt Manufacturing Company (or Equivalent), 27 mm (1-1/16") od stainless steel rod complete with “KV734 – Full Circle" polished chrome flanges. Size rods to suit closet widths.

.11 Solid Polymer Surfacing (SPS): Section 06 61 16.

.12 Fastenings:

.1 Include the necessary fastenings, anchors and accessories required for fabrication and erection of the Work of this Section.

.2 Fastenings include non-exhaustively: anchor bolts, machine bolts, toggle bolts, male/female bolts, lag screws, expansion shields, sleeves, brackets, washers and nuts.

.3 Provide exposed fasteners, where approved and shown on reviewed Shop Drawings, of the same texture, colour and finish as the base material on which they occur unless otherwise shown or noted in the Contract Documents. Use only stainless steel fasteners with stainless steel components.

.4 Supply bolts complete with washers and nuts required for complete installation. Provide lock washers where vibration may loosen bolted fastenings.

.5 Ensure thread dimensions are such that nuts and bolts fit without rethreading or chasing threads.

.6 Bevelled hexagon head bolts: ASTM A307.

.7 Bonding Cements: Achieve with solvents or adhesives, suitable for use with Product and application.

2.2 COMPONENTS

.1 Casework and Frames Construction: Conforming to AWS Section 10 unless otherwise indicated in the Contract Documents. Provide Premium grade quality construction and finishing unless otherwise indicated in the Contract Documents.

.1 Standing and Running Trim:

.1 Species For Transparent Finishing: Maple
.2 Species For Opaque Finishing: Birch

.2 Provide Premium Grade quality construction and finishing unless otherwise indicated in the Contract Documents.

.3 Casework Construction Type: Type A – Frameless construction with edge banded front edges.

.4 Interface Style: Style 1 – Flush Overlay unless otherwise indicated in the Contract Documents.

.5 Exposed Surfaces Core: Medium Density Fiberboard Core (MDF) unless otherwise indicated in the Contract Documents.

.6 Semi-Exposed and Concealed Surfaces Core: Medium Density Fiberboard Core (MDF) unless otherwise indicated in the Contract Documents.

.7 Edge Banding: Minimum 0.5 mm (0.02”) thick ABS or PVC edgebanding, per AWS Section 10, Rule 4.4.26. Provide edgebanding for exposed (visible) and semi-exposed edges of the type specified in this Section.

.1 Case bodies: minimum 0.5 mm (0.0197”) thick.
.2 Doors, drawer fronts, and false fronts: minimum 3 mm (1/8”) thick.
.3 Pattern: wood grain to match door faces unless otherwise indicated in the Contract Documents.

.8 Facing: Plastic Laminate as specified in this Section.

.9 Plastic Laminates:

.1 Exposed Surfaces Finish: HGS for horizontal surfaces and VGS for vertical surfaces in accordance with AWS Section 4, Rule 4.2c.

.1 Finish: To be selected by Consultant from manufacturer’s full range at a later date.

.2 Semi-Exposed Surfaces Finish: Plastic laminate; HGS for horizontal surfaces and VGS for vertical surfaces in accordance with AWS Section 4, Rule 4.2c.

.1 Finish: Identical to exposed surfaces finish.

.3 Concealed Surfaces Finish: Backing sheet; Provide BKV at vertical locations and BKH at horizontal locations; unless otherwise indicated in the Contract Documents.

.2 Stainless Steel Countertops and Backsplashes: Refer to Section 12 35 71, Stainless Steel Casework.

2.3 FINISHES

.1 Factory Finishing: Defer only final touch up, cleaning, and polishing until after installation. As far as practical, ensure casework is factory finished unless otherwise indicated or unavoidable:

.1 Apply finishes in accordance with AWS Section 5.

.2 Transparent Wood Finishing:

.1 Exposed parts: AWS System – 5, Varnish, Conversion or System – 7, Vinyl, Catalyzed.
.2 Semi-Exposed parts: AWS System – 5, Varnish, Conversion or System – 7, Vinyl, Catalyzed.
.3 Staining: Match the Consultant's sample.
.4 Sheen: Satin in accordance with ASTM D523.

.3 Opaque Wood Finishing:

.1 Exposed parts: AWS System – 5, Varnish, Conversion.
.2 Semi-Exposed parts: AWS Exposed parts: AWS System – 5, Varnish, Conversion.
.3 Staining: Match the Consultant's sample.
.4 Sheen: Satin in accordance with ASTM D523.

.4 Field Touch-Up: Ensure that field touch-up is performed by the installing trade and that the architectural woodwork manufacturer will perform factory finishing. Field touch-up includes filling and touch-up of exposed job-made nail and screw holes, refinishing of raw surface resulting from job fitting, repair of job-inflicted scratches and mars and final cleaning up of finished surfaces.

2.4 FABRICATION

.1 Fabricate joints accurately fitted, coped where possible, and well glued up. Fabricate joints mitred to perfect fit and alignments carefully matched.

.2 Fabricate finished woodwork in one piece where possible. Fabricate running members in the longest lengths obtainable.

.3 Fabricate to conceal fastenings.

.4 Provide plastic laminate Work in shop in accordance with ANSI/NEMA LD3. Provide backer sheets to panels to ensure balance.

.5 Fabricate exposed gables to match the required exposed finishes.

.6 Exposed wood construction:

.1 Fabricate joints carefully matched for grain and colour.

.2 Fabricate millwork with slow fed machines free from sticker and/or sander markings, with sections and moulding work cut accurately to profiles.

.3 Sandpaper woodwork, smooth removing burrs, feathers, sleeves, raised grain and sharp arises and leave exposed surfaces perfectly clean and smooth ready for finishing.

.4 Provide edges noted to be solid, as minimum 6 mm (1/4") thick wood to match the exposed veneer to visible and semi-exposed edges, glued to the core prior to the application of face veneers. Provide plastic laminate or elastomeric edges to plastic laminate work visible or semi-visible edges.

.7 Countertops:

.1 Fabricate and assemble countertops and side and back splashes in shop to profiles and lengths required.

.2 Fabricate cutouts for services penetrations as required.

.3 Verify governing dimensions before fabricating items which abut wall surfaces.

.4 Provide cutouts required and round internal corners, chamfer edges and seal exposed core.

.5 Provide sidesplashes at abutting ends of counters and at adjoining walls, unless otherwise indicated on the Drawings.

.6 Provide a 6 mm (1/4") drip groove approximately 13 mm (1/2") in from the underside edge.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: Verify actual Site dimensions and location of adjacent materials prior to commencing the Work. Notify the Consultant in writing of any conditions which would be detrimental to the installation.

.2 Evaluation and Assessment: The commencement of work constitutes the Contractor's acceptance of previously completed work.

3.2 PREPARATION

.1 Wood Surface Preparation for Finish:

.1 Verify and determine wood species, grain direction and structure, properties of finish, application method and exposure to elements. Check moisture content to avoid movement of wood caused by expansion and contraction due to changes in moisture content. Verify grain cut as it may interfere with adhesion of finish.

.1 Apply wood finishing Product in following order and as needed for specific appearance and application specified in this Section. Sanding sealer to control penetration of subsequent coats to create more uniform finish. Stain to colour wood and highlight grain for final finish. Filler to fill pores of wood and control penetration of subsequent coats. Apply filler across grain forcing it into pores followed with rubbing and sanding when dried. For staining requirements mix stain with filler before applying for uniform finish. Finish coats to Provide protection to wood.

.2 Woodwork for Clear Finish or Stain:

.1 Sand smooth all woodwork to be finished using 150 grit paper followed by a second sanding using 220 grit paper and clean surfaces free of dust using brush, compressed air or tack rags before applying first coat. Abrade surfaces with stiff brush to remove loose fibers and splinters. Fill nail holes, splits and scratches with non-shrinking filler tinted to match local grain condition after first coat is dry. Sand lightly between coats with No. 220 sandpaper and remove dust.

.3 Wood Surface Preparation for Opaque Coating:

.1 Seal knots and sapwood in surfaces to receive paint with alcohol-based primer-sealer. Seal door edges. Sand smooth rough surfaces of woodwork to be finished using 150 grit paper followed by a second sanding using 220 grit paper. Sand in the direction of the grain. Clean surfaces free of dust before applying the first coat using brush, compressed air or tack rags. Fill nail holes, splits and scratches with non-shrinking filler after the first coat is dry. Remove salt deposits that may appear on wood surfaces treated with fire retarder.

.2 Prepare plywood surface by removing dirt and debris. Fill screw and nail holes or minor imperfections with recommended filler and sand properly to receive finish coating. Plywood requiring stained or painted finish shall be primed with top quality alkyd primer. Use only penetrating quality stain over plywood.

.3 Woodwork for Clear Finish or Stain: Sand smooth all woodwork to be finished using 150 grit paper followed by a second sanding using 220 grit paper and clean surfaces free of dust using brush, compressed air or tack rags before applying first coat. Abrade surfaces with stiff brush to remove loose fibers and splinters. Fill nail holes, splits and scratches with non-shrinking filler tinted to match local grain condition after first coat is dry. Sand lightly between coats with No. 220 sandpaper and remove dust.

.4 Remove salt deposits that may appear on wood surfaces treated with fire retarder.

.5 Ensure resilient flooring under millwork cabinets are provided prior to proceeding with the Work of this Section.

3.3 INSTALLATION

.1 Install the Work of this Section in accordance with the corresponding Product section of the AWMAC AWS.

.2 Grade: Install woodwork to comply with requirements for grade specified in this Section for fabrication of type of woodwork involved.

.3 Assemble woodwork and complete fabrication at Site to comply with requirements for fabrication specified in this Section and to the extent that it was not completed in shop.

.4 Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 3 mm in 2400 mm (1/8" in 8'-0").

.5 Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

.6 Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated in the Contract Documents..

.7 Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to Provide unencumbered operation. Complete installation of hardware and accessory items as indicated in the Contract Documents.

.8 Install cabinets with no more than 3 mm in 2400 mm (1/8" in 8'-0") sag, bow, or other variation from a straight line.

.9 Maintain veneer sequence matching of cabinets with transparent finish.

.10 Fasten wall cabinets through back, near top and bottom, at ends and not more than 400 mm (16") o.c. with No. 10 wafer-head screws sized for 25 mm (1") penetration into wood framing, blocking, or hanging strips.

.11 Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop. Install countertops with a maximum of 3 mm in 2400 mm (1/8" in 8'-0") sag, bow, or other variation from a straight line.

.12 Align adjacent solid-surfacing-material countertops and form seams to comply with the manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean the entire surface.

.13 Secure backsplashes to tops with concealed metal brackets at 400 mm (16") o.c. and to walls with adhesive.

.14 Touch up finishing work specified in this Section after the installation of woodwork. Fill nail holes with matching filler where exposed.

.15 Install solid polymer counter top surfaces at locations indicated on the Drawings in accordance with the manufacturer's recommendations to meet design requirements.

.16 Provide the Work of this Section true and straight and securely fastened in place.

.17 Mitre exposed corners and butt joints.

.18 Provide plastic laminate countertops plumb and true, neatly scribed to adjoining surfaces.

.19 Thoroughly fix and anchor the Work of this Section into position.

.20 Mechanical and Electrical Fittings:

.1 Provide openings required to accommodate mechanical and electrical fittings as part of the Work of this Section and provide a core sealant to protect counter cores which are exposed to accommodate:

.1 mechanical services and fittings.
.2 washroom accessories.

.2 Locate and Install lenses where indicated on the Drawings. Carefully align lenses, shown in continuous lines, so that they appear as straight lines. Mount lenses perfectly level or plumb. Lenses shall fit tightly without showing space or light leak between frame and lenses. Remove improperly installed lenses and reinstall at no cost to the Owner.

.3 Mechanical and electrical fittings and services will be provided as part of the Work of Divisions 21, 22 23, 26, 27 and 28.

.21 Installation of Architectural Woodwork Hardware:

.1 Install architectural woodwork hardware in accordance with AWMAC, AWS and manufacturer's requirements and templates. Adjust architectural woodwork hardware to Provide smooth operation and ensure clearances are maintained. Repair damage to adjacent surfaces resulting from failure to conform with this requirement.

.2 Provide lubricants required and use in a manner to ensure smooth function of hardware consistent with the manufacturer's recommendations.

.3 Verify that fastening components are tightened securely. Align screws, bolts and similar fastenings such that relationship of screw head indentations, similar surfaces and slots are perpendicular to the matching vertical or horizontal position when on the same surface. Do not burr or otherwise mar edges of surfaces of hardware components. Repair the defects caused by the Work of this Section to the satisfaction of the Consultant.

.4 Conform to keying requirements specified in this Section.

3.4 FINISHING

.1 Prime unexposed surfaces including the backs of fitments against walls and underside of fitments.

.2 Before priming, treat knots and sap streaks, with a coat of shellac and then prime with a wood primer.

.3 Shop finish natural finished wood surfaces.

3.5 ADJUSTING AND CLEANING

.1 Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork.

.2 Adjust joinery for uniform appearance.

.3 Clean, lubricate, and adjust hardware.

.4 Clean woodwork on exposed and semi-exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION

PART 1 - GENERAL

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL INSTRUCTIONS

.1 Read and conform to:

.1 the General Conditions and the Supplementary Conditions of the Contract;

.2 Division 1 requirements and documents referred to therein.

1.3 SUMMARY

.1 Work Included: Provide solid polymer fabrications including but not limited to following:

.1 window sills.

.2 millwork countertops with non-integral and integral sinks and cove backsplashes.

.3 auxiliary materials required for complete installation.

.2 Related Requirements: Specifications throughout the entirety of the Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them

1.4 REFERENCES

.1 Definitions:

.1 Solid Polymer Surface (SPS): Nonporous, homogeneous material maintaining the same composition throughout the part with a composition of acrylic polymer, aluminum trihydrate filler and pigment.

.2 Reference Standards: Latest published editions of reference standards listed in this Section in effect as of the closing date and time of the Request for Tenders for the Contract, including any amendments adopted, are applicable unless otherwise indicated.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meetings:

.1 Prior to starting work of this Section, convene a pre-installation meeting at Project site to review Project requirements and site conditions with pertinent parties. Conform to requirements of Section 01 30 00.

.2 In particular, address the following items:

.1 Coordinate colours, patterns, and finishes; Provide materials and Products that result in colours of solid-surfacing material complying with Project requirements, either as indicated by manufacturer's designations or match approved sample or as selected later by Consultant from manufacturer's full range; one piece top with approved edges, approved backsplashes, place in position with manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing. Countertop with drilled holes for plumbing fittings, soap dispensers and integral sink bowls as specified.

1.6 SUBMITTALS

.1 Product Data: Submit manufacturer's literature and data sheets for each type of material provided under this Section for Project in accordance with requirements of Section 01 30 00. Ensure data sheets provide required information including detailed instructions for installing as well as maintaining, preserving and keeping materials in clean and safe conditions. Provide adequate warning of maintenance practices or cleaning agents detrimental to specified materials.

.2 Safety Data Sheets (SDS): Submit SDS for inclusion in Operation and Maintenance Manual specified in Section 01 70 00, for adhesives, sealants and any other material designated by Consultant.

.3 Shop Drawings: Submit Shop Drawings in accordance with Section 01 30 00, indicating material characteristics, details of construction, connections and relationship with adjacent construction.

.1 Indicate plans, sections, dimensions, component sizes, edge details, thermosetting requirements, fabrication details, attachment provisions, sizes of furring, blocking including concealed blocking, and coordination requirements with adjacent work. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers, waste receptacles and other items installed in solid polymer fabrications.

.2 Coordination Drawings: Submit coordination Drawings indicating plumbing and miscellaneous steel work indicating locations of wall (rated or non-rated), blocking requirements, recessed wall items and similar items.

.3 Field Measurements: Take field measurements prior to preparation of Shop Drawings and fabrication to ensure proper fitting of work. Do not fabricate work unless Shop Drawings have been reviewed.

.4 Samples: Submit minimum 150 mm x 150 mm (6" x 6") samples in accordance with Section 01 30 00. Cut sample and seam together for representation of inconspicuous seam. Indicate full range of colour and pattern variation.

.5 Test and Evaluation Reports:

.1 Submit flammability test reports confirming material compliance with requirements of, NFPA 255, UL 723 and CAN/ULC S102-M.

.2 Submit test reports confirming that the Product conforms to requirements of NSF/ANSI 51 for use in food preparation zones for all types of food.

1.7 MAINTENANCE MATERIALS SUBMITTALS

.1 Submit manufacturer's care and maintenance data, including repair and cleaning instructions. Provide commercial care and maintenance kit and video. Review maintenance procedures and warranty details with Owner upon completion. Include information in Project closeout documents.

1.8 QUALITY ASSURANCE

.1 Qualifications:

.1 Manufacturers: Provide Products for Work of this Section by manufacturer with minimum 10 years' experience in the manufacture of such materials

.2 Installers: Provide Work of this Section executed by competent installers with minimum 5 years' experience in the application of the Products, systems and assemblies specified herein and with the approval and training of the Product manufacturers. Ensure fabricator and installer are approved by the solid polymer manufacturer.

.2 Mock-ups:

.1 Prior to final approval of Shop Drawings, erect 1 full size mock-up of each component at the Project site demonstrating quality of materials and execution for the Consultant's review. Rework or remake rejected mock-ups until approval is granted. Remove rejected units from the Project site.

.2 Approved mock-up will be used as standard for acceptance of subsequent work and may remain as part of finished work if left undisturbed at the time of Substantial Performance of The Work.

.3 Single Source Responsibility: Ensure primary materials provided in this Section are obtained from 1 source by a single manufacturer and secondary materials are obtained from sources recommended by primary materials manufacturers.

1.9 DELIVERY, STORAGE AND HANDLING

.1 Delivery and Acceptance Requirements: Deliver no components to the Project site until areas are ready for installation. Store components indoors prior to installation.

.2 Storage and Handling Requirements: Handle materials to prevent damage to finished surfaces. Provide protective coverings to prevent physical damage or staining following installation for duration of Project.

1.10 WARRANTY

.1 The Contractor warrants the work of this Section for period of 10 years after Substantial Performance of the Work against defects and deficiencies in accordance with General Conditions of the Contract. Promptly correct defects or deficiencies which become apparent within this warranty period, to the satisfaction of the Consultant and at no expense to the Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Products of following manufacturers may be acceptable subject to conformance to requirements of Drawings, schedules and Specifications:

.1 Solid Polymer Fabrications:

.1 Corian
.2 Wilsonart Canada
.3 LG Hausys

.2 Comparable Products from manufacturers listed herein will be considered provided they meet the requirements of this Specification, offering functionally, aesthetically equivalent Products in Consultant's opinion and subject to Consultant's review.

2.2 DESCRIPTION

.1 Regulatory Requirements:

.1 Ensure materials used comply with requirements of, NFPA 255, UL 723 and CAN/ULC S102-M as follows:

.1 Flame spread: <25
.2 Smoke developed: <25

.2 Ensure materials used comply with use in food preparation zones and conform to requirements of NSF/ANSI 51 for following food zones: all food types.

.2 Solid Polymer Surfaces Design and Performance Requirements:

.1 Provide cast, nonporous, filled polymer fabrications, not coated, laminated or of composite construction with through body colours meeting referenced standards herein and having minimum physical and performance properties as specified herein.

.2 Ensure surfaces do not prevent use of electronic devices that function with optical or tactile sensors.

.3 Ensure superficial damage to a depth of 0.25 mm (0.010") is repairable by sanding and polishing.

.4 Mechanical and Structural Properties:

.1 Tensile Strength: 6000 psi min. per ASTM D638

.2 Tensile Modulus: 1.5 x 10^{-6} psi min. per ASTM D638

.3 Flexural Strength: 10000 psi min. per ASTM D790

.4 Flexural Modulus: 1.2 x 10^{-6} psi min. per ASTM D790

.5 Elongation: 0.4% min. per ASTM D638

.6 Hardness: >85-Rockwell "M" scale min. per ASTM D785

.7 Thermal Expansion: 3.02 x 10^{-5} in/in/deg C. max. per ASTM D696

.8 Ball Impact Resistance Sheets:

.1 1/4" sheet: 36" min, 1/2 lb ball, no failure per NEMA LD3, Method 3.8

.2 1/2" sheet: 144" min, 1/2 lb ball, no failure per NEMA LD3, Method 3.8

.3 3/4" sheet: 200" min, 1/2 lb ball, no failure per NEMA LD3, Method 3.8

.9 Weatherability: E^*_{94}<5 in 1,000 hrs 1000 hours per ASTM G155

.10 Fungi and Bacteria Resistance: Does not support microbial growth per ASTM G21 & GREENGUARD, Microbial Resistance Program

2.3 MATERIALS

.1 Solid Polymer Fabrications: Homogeneous sheets composed of minimum 30% acrylic resin (Polymethyl Methacrylate) and +/- 70% blend of natural minerals meeting ANSI Z124.3 &.6, Type 4 and Fed. Spec. WW-P-541E/GEN. Solid polymer fabrications containing blends with polyester-based materials are not acceptable. Ensure material has minimum physical and performance properties as specified herein. Provide solid polymer fabrications complete with following materials as recommended by Product manufacturer:

.1 Joint Adhesive: Manufacturer's standard 2-part adhesive kit to create inconspicuous, non-porous joints, with a chemical bond.

.2 Panel Adhesive for Tub and Shower Systems: Manufacturer's recommended standard neoprene-based panel adhesive meeting ANSI A136.1. UL® listed, Greenguard Certified.

.3 Adhesive for Bonding to Other Products: One component silicone as recommended by Product manufacturer conforming to ASTM C920.

.4 Sealant: Manufacturer's standard mildew-resistant, FDA/UL® and NSF/ANSI 51 compliant, recognized silicone sealant in colour matching components or clear formulations.

.5 Sink/Bowl Mounting Hardware: Manufacturer's approved bowl clips, brass inserts and fasteners for attachment of undermount sinks/bowls, where applicable.

.6 Conductive Tape: Manufacturer’s standard aluminum foil tape, with required thickness, for use with cutouts near heat sources.

.7 Insulating Felt Tape: Manufacturer's standard for use with conductive tape in insulating solid polymer material from adjacent heat source.

.2 Integral Bowls: ADA compliant bowls manufactured from solid polymer material specified herein. Provide solid polymer solid surfacing bowls fabricated to desired profiles and sizes, having edge details as selected by Consultant.

.1 Mounting: Integral seamless molding.

.3 Solid Polymer Fabrication Cores and Supports: Provide structurally adequate, continuous perimeter support frames to ensure flatness and levelness of solid polymer fabrications. Ensure materials are capable of providing support to inside corners and across spans. Following substrates are acceptable (Refer to Section 06 40 00 for wood core and supports Specifications. Refer to Section 05 50 00 for metal frames and supports Specifications):

.1 Medium Density Fibreboard (MDF) or Solid Wood Lumber or Galvanized Metal Tubing: At all locations unless otherwise indicated. MDF to be minimum 19 mm (3/4") thick unless otherwise indicated.

.2 Veneer Core Plywood or Galvanized Metal Tubing: At locations scheduled to receive sinks or otherwise exposed to moisture.

.3 In addition:

.1 conform to Section 06 40 00 for wood core and supports Specifications.
.2 coordinate with Section 05 50 00 for Specifications for metal frames and supports.

2.4 COMPONENTS

.1 Window Sills (SPS): Surfaces of material adhesively joined with inconspicuous seams and edge details as indicated on Drawings.

.1 Vertical Thickness: minimum 12 mm (1/2") thick.

.2 Horizontal Thickness: minimum 12 mm (1/2") thick.

.3 Edge Details: waterfall.

.4 Colour: To be selected by Consultant at a later date from manufacturer's full colour range of Price Group 1.

.5 Finish: satin or matte as selected by Consultant at a later date.

.2 Countertops and Work Surfaces (SPS): Surfaces of material adhesively joined with inconspicuous seams fabricated to desired profiles and sizes having edge details, back splash and end splashes as indicated on Drawings.

.1 Vertical Thickness: minimum 12 mm (1/2") thick

.2 Horizontal Thickness: minimum 12 mm (1/2") thick

.3 Edge Details: waterfall

.4 Colour: To be selected by Consultant at a later date from manufacturer's full colour range of Price Group 1.

.1 Basis-of-Design: "Linen Corian"

.5 Finish: satin or matte as selected by Consultant at a later date.

.6 Backsplash: radius coved with inconspicuous seams

.7 Sidesplash: radius coved with inconspicuous seams

.3 Integral Sinks (SPS):

.1 Sinks: Provide ADA compliant sink “Rectangular Lavatory with Front to Back Slope Sink 8252 Lavatory” by Corian (or Equivalent)**.** Provide solid polymer solid surfacing sinks fabricated to desired profiles and sizes, having edge details as indicated on Drawings.

.2 Mounting: Integral molding as indicated on reviewed Shop Drawings.

.3 Colours: To be selected by Consultant at a later date from manufacturer’s full colour range of Price Group 1.

2.5 FABRICATION

.1 Fabricate components in shop to greatest extent practical to sizes and shapes indicated, in accordance with approved Shop Drawings and solid polymer manufacturer requirements. Form joints between components using manufacturer’s standard joint adhesive without conspicuous joints. Reinforce with strip of solid polymer material 50 mm (2") wide. Provide factory cutouts for plumbing fittings and bath accessories as indicated on Drawings.

.2 Inlays: Fabricate using manufacturer’s approved method. Route 3 mm (1/8") deep maximum groove for inlay to pattern indicated on Drawings. Fill groove using manufacturer’s recommended method avoiding air bubbles and/or voids. Overfill inlay areas and allow it to cure fully. Sand smooth without overheating inlay areas while sanding. Finish and touch up to uniform appearance.

.3 Thermoform corners and edges to shapes and sizes indicated on Drawings, prior to seaming and joining. Front faces shall have micro bevel edges. Cut components larger than finished dimensions and sand edges to remove nicks and scratches. Heat entire component uniformly prior to forming.

.4 Ensure no blistering, whitening and cracking of components during forming.

.5 Form backsplashes from solid surfacing material with radius cove where counter and backsplashes meet as indicated on Drawings.

.6 Form joints between components using manufacturer's standard joint adhesive. Ensure joints are inconspicuous in appearance and without voids. Attach 100 mm (4") wide reinforcing strip of solid polymer material under each joint.

.7 Provide holes and cutouts for plumbing and bath accessories as indicated on Drawings.

.8 Rout and finish component edges to a smooth, uniform finish. Rout cutouts, then sand edges smooth. Repair or reject defective or inaccurate Work.

.9 Finish: Provide surfaces with uniform finish:

.1 Matte: gloss rating of 5 - 20.

.2 Semi-gloss: gloss rating of 25 - 50.

.3 Polished: gloss rating of 55 - 80.

.10 Allowable Tolerances:

.1 Variation in Component Size: ± 3 mm (1/8").

.2 Location of Openings: ± 3 mm (1/8") from indicated location.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Examine substrates and conditions, with fabricator present for compliance with requirements for installation tolerances and other conditions affecting performance of work. Proceed with installation only after unsatisfactory conditions have been corrected.

.2 Site Verification of Conditions: Verify actual site dimensions and location of adjacent materials prior to commencing Work.

.3 Examine cabinets upon which countertops are to be installed. Verify cabinets are level to within 3 mm in 3 m (1/8" in 10' - 0").

.4 Notify Consultant in writing of any conditions which would be detrimental to installation. Commencement of work implies acceptance of previously completed work.

3.2 INSTALLATION

.1 Install components plumb, level, rigid, scribed to adjacent finishes in accordance with reviewed Shop Drawings and Product installation details.

.2 Form field joints using manufacturer's recommended adhesive, with joints being inconspicuous in finished Work. Exposed joints/seams are not permitted. Keep components and hands clean when making joints. Reinforce field joints with solid polymer strips extending a minimum of 25 mm (1") on either side of seam with strip being same thickness as top. Cut and finish component edges with clean, sharp returns.

.3 Route radii and contours to template. Anchor securely to base component or other supports. Align adjacent components and form seams to comply with manufacturer’s written recommendations using adhesive in colour to match Work. Carefully dress joints smooth, remove surface scratches and clean entire surface.

.4 Install countertops with no more than 3 mm (1/8") sag, bow or other variation from a straight line.

.5 Mount sinks/bowls to countertops using manufacturer's recommended adhesive, mounting hardware or color-matched silicone sealant as applicable. Secure seam mounted bowls and sinks to countertops using colour matched joint adhesive.

.6 Seal joints between wall and components with joint sealant as specified herein and in Section 07 92 00, as applicable.

.7 Provide backsplashes and end-splashes as indicated on Drawings. Fabricate radius cove at intersection of counters with backsplashes to dimensions shown on reviewed Shop Drawings. Where indicated, Provide CNC-cut rebates for coved backsplashes and side-splashes at walls and adjacent millwork. Do not attach backsplashes and side splashes to countertops with sealants unless specifically noted herein.

.8 Fabricate radius cove at intersection of counters with backsplashes to dimensions shown on reviewed Shop Drawings. Adhere to countertops using manufacturer’s standard color-matched joint adhesive.

.9 Keep components and hands clean during installation. Remove adhesives, sealants and other stains. Ensure components are clean and free of defects at Substantial Performance of The Work.

.10 Keep components and hands clean during installation. Remove adhesives, sealants and other stains. Ensure components are clean and free of defects at Substantial Performance of The Work.

.11 Coordinate connections of plumbing fixtures with Division 22 and ensure fittings and accessories are provided by Division 22.

3.3 ADJUSTING AND CLEANING

.1 Replace damaged Work which cannot be repaired to Consultant's satisfaction. Repair minor imperfections and cracked seams and replace areas of severely damaged surfaces in accordance with manufacturer's instructions.

.2 Clean surfaces in accordance with manufacturer's care and maintenance instructions.

END OF SECTION

PART 1 - GENERAL

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL INSTRUCTIONS

.1 Read and conform to:

.1 the General Conditions and the Supplementary Conditions of the Contract;

.2 Division 1 requirements and documents referred to therein.

1.3 SUMMARY

.1 Work Included: Provide general installations including but not limited to following:

.1 installation of pressed steel frames.

.2 installation of hollow metal doors.

.3 installation of flush wood core doors.

.4 continuous grouting of fire rated frames in concrete and concrete masonry walls.

.5 spot grouting of door frames in gypsum board partitions.

.6 installation of finish hardware.

.2 Related Requirements: Specifications throughout the entirety of the Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.4 REFERENCES

.1 Reference Standards: Latest published editions of reference standards listed in this Section in effect as of the closing date and time of the Request for Tenders for the Contract, including any amendments adopted, are applicable unless otherwise indicated.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meetings:

.1 Prior to starting work of this Section, convene a pre-installation meeting at Project site to review Project requirements and site conditions with pertinent parties. Conform to requirements of Section 01 30 00.

1.6 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's literature and data sheets for each type of material provided under this Section for the Project in accordance with requirements of Section 01 30 00.

.2 Ensure data sheets provide required information including detailed instructions for installing as well as maintaining, preserving and keeping materials in clean and safe conditions.

.2 Safety Data Sheets (SDS): Submit SDS for inclusion in Operation and Maintenance Manual specified in Section 01 70 00, for adhesives, sealants and any other material designated by Consultant.

.3 Inspection Reports: After installation of fire-rated assemblies, submit inspection reports from an approved independent inspection and testing agency specified in this Section, certifying fire-rated assemblies comply with requirements of Authorities Having Jurisdiction and applicable standards specified.

1.7 QUALITY ASSURANCE

.1 Installers: Provide work of this Section executed by competent installers with minimum 5 years' experience in the application of the Products, systems and assemblies specified herein and with the approval and training of the Product manufacturers.

PART 2 - PRODUCTS

2.1 DESCRIPTION

.1 Regulatory Requirements:

.1 Ensure fire rated doors and frames are listed and labeled for ratings specified and noted by organization accredited by the Standard Council of Canada in conformance with CAN4-S104 and CAN4-S105, NFPA 80 and NFPA 252.

.2 Ensure doors and frames are labeled at manufacturing plant by means of metal tags or embossing. Site applied and stamped fire-labelling is not acceptable.

2.2 MATERIALS

.1 Doors, Frames and Hardware: Refer to the following Sections for Products to be installed as part of the Work of this Section:

.1 Section 08 11 13, Steel Doors and Frames.

.2 Section 08 14 16, Flush Wood Core Doors.

.3 Section 08 71 00, Finish Hardware.

.2 Spot Grout (Metal Stud Partitions): High density setting-type taping, low shrinkage type compound.

.1 Acceptable Products:

.1 "Durabond 90 Compound" by CGC Inc.,
.2 "High Density 90 - ProRoc" by CertainTeed Canada Inc., and
.3 or Equivalent to the above.

.3 Continuous Grout (Masonry Partitions): Non-shrink, non-metallic, cementitious grout, containing no chlorides, conforming to ASTM C1107 for Grade C type grouts;

.1 Acceptable Products:

.1 "Sika Grout 212" by Sika Canada Inc.,
.2 "CG-86 Construction Grout" by W.R. Meadows of Canada Ltd.,
.3 Equivalent by Euclid Admixture Canada Inc. or CPD Construction Products
.4 or Equivalent to the above.

.4 Batt Insulation: Preformed gall fibre or rockwool batt or roll insulation, conforming to CAN/ULC-S702, of type, minimum thickness, width to suit metal framing spacing and other miscellaneous spacings as indicated on the Drawings.

.1 Mineral Wool: CAN/ULC-S702, Type 1; ASTM C553 (Type VII) and non-combustible in accordance with requirements of CAN/ULC-S114. Acceptable Products:

.1 "ROXUL AFB" by Roxul Inc.
.2 “Thermafibre Sound Attenuation Blankets” by CGC Inc
.3 “MinWool Sound Attenuation Fire Batts” by Johns Manville.
.4 or Equivalent to the above.

.2 Mineral Glass Fibre: CAN/ULC-S702, Type 1; ASTM C553 (TYPE VII) and non-combustible in accordance with requirements of ULC CAN/ULC-S114. Acceptable Products:

.1 “EcoTouch™ QuietZone® PINK™ FiberGlas® Acoustical Batts” by Owens Corning Canada LP
.2 “NoiseReducer Sound Attenuation Batts” by CertainTeed.
.3 “Sound-Shield Formaldehyde-Free Fiber glass Insulation” by Johns Manville.
.4 Equivalent.

.5 Threshold Sealant: As recommended by the installer of the work of this Section and in accordance with the requirements of Section 07 92 00.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Site Verification of Conditions: Verify actual Site dimensions and location of adjacent materials prior to commencing the Work of this Section. Examine substrates, areas, and conditions, with installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

.2 Examine roughing-in, electrical power systems for embedded and built-in anchors to verify actual locations before frame installation.

.3 Prepare written report, endorsed by installer, listing conditions detrimental to performance of the Work.

.4 Proceed with installation only after unsatisfactory conditions have been corrected.

.5 Notify Consultant in writing of any conditions which would be detrimental to the installation the work of this Section. Commencement of work constitutes Contractor’s acceptance of previously completed work.

3.2 PREPARATION

.1 Hollow Metal Doors and Frames:

.1 Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

.2 Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:

.1 Squareness: +/- 1.6 mm (1/16”), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.

.2 Alignment: +/- 1.6 mm (1/16") measured at jambs on a horizontal line parallel to plane of wall.
.3 Twist: +/- 1.6 mm (1/16"), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
.4 Plumbness: +/- 1.6 mm (1/16"), measured at jambs on a perpendicular line from head to floor.

.3 Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 GENERAL INSTALLATION REQUIREMENTS

.1 Install work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

.2 Fire-rated doors and frames:

.1 Install fire-rated labeled doors and frames in accordance with manufacturer's printed instructions and NFPA 80.

.2 Verify that labeled doors and frames are placed in their designated openings. Review, inspect and certify where required by Authorities Having Jurisdiction.

3.4 INSTALLATION OF HOLLOW METAL FRAMES

.1 Install hollow metal frames of size and profile indicated. Comply with HMMA 840 and manufacturer's instructions.

.2 Brace frames rigidly in position while being built in. Provide vertical supports and horizontal spreaders to prevent deflection and warping.

.3 Allow for deflection to prevent structural loads from being transmitted to frame.

.4 Provide batt insulation to completely fill pressed steel frames of exterior doors and adjacent cavities.

.5 Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

.1 At fire-protection-rated openings, Install frames according to NFPA 80.

.2 Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.

.3 Install frames with removable glazing stops located on secure side of opening.

.4 Install door silencers in frames before grouting.

.5 Remove temporary braces necessary for installation only after frames have been properly set and secured.

.6 Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.

.7 Field apply bituminous coating to backs of frames that are filled with grout containing antifreezing agents.

.6 Secure anchorages and connections to adjacent construction:

.1 Locate each wall anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb.

.2 Provide two anchors for rebate opening heights up to and including 1500 mm (5') and one additional anchor for each additional 760 mm (30") of height or fraction thereof, unless otherwise indicated in Contract Documents.

.3 Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.

.7 Metal-Stud Partitions

.1 New construction:

.1 Solidly pack mineral-fiber insulation behind frames.

.2 Anchorages:

.1 Provide frame Products installed in steel stud and drywall partitions with 20 ga. steel snap-in or "Z" stud type anchors.

.2 Supply frame anchors to gypsum board installers with directions for installing steel door frames in gypsum board partitions.

.3 Locate anchor preparations and guides immediately above or below intermediate hinge reinforcing and directly opposite on strike jamb. Provide each preparation with 16 ga. anchor bolt guides.

.4 Provide anchor bolts and expansion shell anchors for above preparations by the Subcontractor responsible for installation.

.3 Spot Grout: Coordinate installation of frames with Section 09 21 16 to allow for spot grouting of frames.

.1 Provide spot grout to increase rigidity of frame and improve resistance to frame rotation caused by weight of door.

.2 Comply with manufacturer's recommendations for surface preparation, cleaning, forming, mixing, placement and curing of grout.

.3 Proportion spot grout as follows: 1 part hardwall plaster to not more than 2-1/2 parts perlite by weight, with enough water added for `hand pack' consistency and use.

.4 Provide spot grout at strike and hinge side jambs of frames set in gypsum board partitions. Do not use pumped slurry method to perform spot grouting.

.5 Provide spot grout at strike jambs after studs are installed but before gypsum boards are erected.

.6 After grouting is applied, immediately insert gypsum panels into jamb and attach to framing. Do not terminate gypsum board against trim.

.2 In-Place Gypsum Board Partitions: Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.

.8 Masonry and Concrete Walls:

.1 Masonry (new construction):

.1 Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.

.2 Provide frame Products for installation in new masonry walls with steel adjustable wall anchors of T-strap, stirrup or wire. Wire Gauge: 16 gauge minimum or 0.156" diameter wire. Provide corrugated or perforated straps not less than 50mm (2") x 254mm (10") in size.

.2 Concrete Walls (new construction): Solidly fill space between frames and concrete with grout. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.

.3 In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.

.1 For frames in previously placed concrete, masonry or structural steel; Provide anchors located not more than 150 mm (6") from top and bottom of each jamb and intermediate anchors at 660 mm (26") o.c. maximum.

.2 Punch and dimple jambs of frames in previously placed concrete, masonry or structural steel to accept machine bolt anchors, 6.4mm (0.25") diameter, located not more than 150 mm (6") from the top and bottom of each jamb.

.9 Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to Provide flush contact for securing to supporting construction. Provide adjustable wedged or bolted anchorage to frame jamb members.

.1 Provide channel extensions from top of frame assembly to underside of structure above on sidelights or windows exceeding 3m (9'-10") in width when installed in stud partitions. Fabricate extensions from 2.66 mm (12 ga) steel formed channels, mounting angles and adjusting brackets, with mounting angles welded to inside of frame head. Deliver loose formed adjusting brackets and fasteners. Connect channels mechanically to mounting angles and adjusting brackets with supplied fasteners, on Site, by the Subcontractor responsible for installation.

3.5 INSTALLATION OF HOLLOW METAL DOORS

.1 Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.

.1 Non-Fire-Rated Standard Steel Doors:

.1 Jambs and Head: 3 mm (1/8”).
.2 Between Edges of Pairs of Doors: 3 mm (1/8).
.3 Door Bottom:

.1 maximum 19 mm (3/4") to unfinished floor
.2 maximum 16 mm (5/8") to finished floor unless indicated to be undercut.

.2 Fire-Rated Doors: Install doors with clearances according to NFPA 80. Provide maximum 6 mm (1/4") at door bottom and not more than 3 mm (1/8") at sides and top.

.3 Glazing: Comply with installation requirements in Section 08 80 00 and with hollow metal manufacturer's written instructions.

.1 Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 230 mm (9”) o.c. and not more than 50 mm (2”) o.c. from each corner.

3.6 INSTALLATION OF FLUSH WOOD CORE DOORS

.1 Install doors to comply with manufacturer's written instructions and as indicated.

.2 Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.

.3 Cut, drill and prepare doors to template to receive hardware.

.4 Drill pilot holes before installing hinges. Check and verify with screw manufacturers’ recommendations for size of pilot holes required.

.5 Clearances: Install in accordance with following clearances unless otherwise indicated:

.1 Between doors and frames at head and jambs: 3 mm (1/8") maximum.

.2 Between meeting edges of pairs of doors: 3 mm (1/8") maximum.

.3 At door bottom:

.1 Non rated doors: 19 mm (3/4") maximum to unfinished floor, 16 mm (5/8") maximum to finished floor unless indicated to be undercut;

.2 Fire-Rated Doors: Install doors with clearances according to NFPA 80. Provide maximum 6 mm (1/4") and not more than 3 mm (1/8") at the sides and top.

.4 Bevel:

.1 Bevel non-fire-rated doors 3 mm in 50 mm (1/8” in 2”) at lock and hinge edges.

.2 Bevel fire-rated doors 3 mm in 50 mm (1/8” in 2”) at lock edge; trim stiles and rails only to extent permitted by labeling agency.

.5 Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.7 FINISH HARDWARE

.1 Install hardware to doors and frames in accordance with manufacturer's packaged installation, template, and adjusting instructions.

.2 Preparation:

.1 Steel Doors and Frames: Comply with DHI A115 Series.

.2 Surface-Applied Door Hardware: Drill and tap doors and frames according to ANSI A250.6.

.3 Wood Doors: Comply with DHI A115-W Series.

.3 Adjust hardware to Provide smooth operation of doors and ensure clearances are maintained. Provide lubricants to allow smooth function of hardware consistent with manufacturer's recommendations.

.4 Tighten fastening components snugly. Do not burr or otherwise mar the edges of surfaces of hardware components. Repair defects resulting from work of this Section in accordance with the Consultant's review.

.5 Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to Install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 09 Sections. Do not Install surface-mounted items until finishes have been completed on substrates involved.

.1 Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.

.2 Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

.6 Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.

.7 Boxed Power Supplies: Locate power supplies as indicated. Verify location with Consultant.

.1 Configuration: Provide the least number of power supplies required to adequately serve doors with electrified door hardware.

.8 Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant to prevent water and air intrusion beneath the sill and to comply with requirements specified in Section 07 92 00.

.9 Mounting Heights:

.1 Mount door hardware units at heights indicated as follows unless otherwise indicated on Drawings or required to comply with governing regulations and requirements of Authorities Having Jurisdictions.

.1 Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."

.2 Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

3.8 FIELD QUALITY CONTROL

.1 Owner reserves the right to inspect at random, edge finishing of field-cut flush wood core doors.

.1 Non-Conforming Work: Replace damaged work and/or non-conforming work which cannot be satisfactorily repaired, restored or cleaned, to the satisfaction of the Consultant at no cost to the Owner.

.2 Hardware:

.1 Provide services of an architectural hardware consultant (AHC) familiar with type of work being performed for preparation of hardware Shop Drawings (construction Finish Hardware Schedule), keying, coordination with other trades, consultation with Owner and Consultant and for performing on-site inspections

.1 AHC will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

.2 Verify hardware listed in Finish Hardware Schedule is of proper selection for its apparent function and required fire rating or submit alternative proposals.

.3 Ensure hardware for fire-rated openings complies with requirements of Authorities Having Jurisdiction, with door and frame manufacturer's tested and labeled assemblies and that hardware items bear certification labels.

.4 Ensure hardware for fire rated door and frame assemblies conforms to CAN/ULC S104-M, CAN/ULC S105-M and NFPA 80. Ensure electronic hardware such as magnetic locks, power supplies, key switches and alarm panic bolts is ULC labeled.

.5 Ensure hardware for doors in fire separations and exit doors are certified by a Canadian Certification Organization accredited by Standards Council of Canada.

.6 Ensure mortise locks, exit devices and door closers conform to both BMHA certified ANSI A156 Series Grade I classifications, conform to OBC, CAN/CSA B651, requirements and to ADA (*American Disabilities Act*) standards.

.7 Inspect to verify hardware has been properly installed and is functioning satisfactorily.

.8 Recommend adjustments.

.9 Replace defective hardware.

.10 Check door closers after installation to ensure adjustment such as backchecking degree has been properly made and if not, make such adjustments or instruct those installing hardware to make these adjustments.

.3 Installation Tolerances (Hollow Metal Frames): Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:

.1 Squareness: +/- 1.6 mm (1/16”), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.

.2 Alignment: +/- 1.6 mm (1/16”), measured at jambs on a horizontal line parallel to plane of wall.

.3 Twist: +/- 1.6 mm (1/16”), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.

.4 Plumbness: +/- 1.6 mm (1/16”), measured at jambs at floor.

3.9 ADJUSTING AND CLEANING

.1 Check and readjust operating hardware items immediately before final inspection, leaving doors and frames undamaged and in proper operating condition. Remove and replace defective work, including doors and frames that are warped, bowed, or otherwise unacceptable.

.2 Hardware:

.1 Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

.3 Clean grout and other bonding material off detention doors and frames immediately after installation. Carefully wipe clean doors of dust created due to work of this Project.

.4 Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

.5 Touch-ups:

.1 Immediately after erection clean and repair surfaces in accordance with manufacturer's written instructions

.2 Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

.3 Touch up damaged finishes with compatible coating after sanding smooth.

3.10 DEMONSTRATION

.1 Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. Refer to Section 01 77 00.

END OF SECTION

PART 1 - GENERAL

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL INSTRUCTIONS

.1 Read and conform to:

.1 the General Conditions and the Supplementary Conditions of the Contract;

.2 Division 1 requirements and documents referred to therein.

1.3 SUMMARY

.1 Work Included: Provide dampproofing including but not limited to following:

.1 asphalt dampproofing and required primers.

.2 Related Requirements: Specifications throughout the entirety of the Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.4 REFERENCES

.1 Reference Standards: Latest published editions of reference standards listed in this Section in effect as of the closing date and time of the Request for Tenders for the Contract, including any amendments adopted, are applicable unless otherwise indicated.

1.5 SUBMITTALS

.1 Product Data: Submit the manufacturer's literature and data sheets for each type of material provided under this Section in accordance with the requirements of Division 01. Ensure data sheets provide required information including detailed instructions for installing as well as maintaining, preserving and keeping materials in clean and safe conditions. Provide adequate warning of maintenance practices or cleaning agents detrimental to specified materials.

.2 Safety Data Sheets (SDS): Submit SDS for inclusion in Operation and Maintenance Manual specified in Section 01 70 00, for adhesives, sealants and any other material designated by Consultant.

1.6 QUALITY ASSURANCE

.1 Installer’s Qualifications: The Work of this Section shall be performed by competent installers with a minimum of 5 years experience in the application of the Products, systems and assemblies specified herein, and with the approval and training of the Product manufacturers.

.2 Source Limitations for System: Obtain bituminous dampproofing materials, protection board, and molded-sheet drainage boards from single source from single manufacturer.

.3 Mockups: Build mockups to verify selections made under sample submittals and to set quality standards for installation.

.1 Build for each typical installation, including accessories, to demonstrate surface preparation, crack and joint treatment, corner treatment, and protection.

.1 Size: 9.3 sq. m (100 sq. ft.) in area.
.2 Description: Each type of wall installation.

.2 Approval of mockups does not constitute approval of deviations from Contract Documents contained in mockups unless Consultant specifically approves such deviations in writing.

.3 Reviewed mockups may become part of completed work if left undisturbed at time of Substantial Performance of the Work.

1.7 SITE CONDITIONS

.1 Environmental Requirements:

.1 Do not proceed with work when wind chill effect would tend to set bitumen before proper curing takes place.

.2 Proceed with application only when existing and forecasted weather conditions permit bituminous dampproofing to be performed according to manufacturers' written instructions.

.3 Do not apply dampproofing in wet weather.

1.8 WARRANTY

.1 Manufacturer's Warranty: provide the manufacturer's standard materials-only warranty in which the manufacturer agrees to supply replacement waterproofing material for waterproofing that does not comply with requirements or that fails to remain watertight within specified warranty period.

.1 Warranty Period: Five years from date of Substantial Performance of the Work.

.2 Installer's Extended Warranty: Specified form, signed by the installer, covering the Work of this Section, for a warranty period of two years from the date of Substantial Performance of the Work.

.1 Warranty includes removing and reinstalling protection board, drainage boards, insulation, as required to perform repairs.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Products of following manufacturers are acceptable subject to conformance to the requirements of the Contract Documents:

.1 Henry Company Canada (Henry/Bakor)

.2 W.R.Meadows of Canada (W.R. Meadows)

.3 or Equivalent to the above.

2.2 DESCRIPTION

.1 Design and Performance Requirements:

.1 Extent of Bituminous Dampproofing:

.1 Provide bituminous dampproofing to footings and foundation walls, where indicated on Drawings and Schedules, applied from finished-grade line to top of footing; extend over top of footing and down a minimum of 150 mm (6 inches) over outside face of footing.

.2 Extend dampproofing 300 mm (12 inches) onto intersecting walls and footings, but do not extend onto surfaces exposed to view when the Project is completed.
.3 Refer to Section 01 83 16 for additional performance and testing requirements pertaining to the work of this Section.

2.3 MATERIALS

.1 Dampproofing Membrane (WPM-1):

.1 Cold-Applied, Cut-Back-Asphalt Dampproofing

.1 CAN/CGSB 37.16-M89, liquid applied medium consistency, solvent type waterproofing and dampproofing compound of selected asphalts and fibres.

.1 Asphalt for temperature below 5 deg C (40 deg F)
.2 Basis-of-Design: “710-11 Dampproofing and Waterproofing Asphalt Coating” by Henry Company Canada or equivalent as follows:

.1 “501 Sealmastic” by W.R. Meadows Inc., Canada.
.2 or Equivalent to the above.

.2 Cold-Applied, Emulsified-Asphalt Dampproofing

.1 CAN/CGSB 37.2, Liquid applied, dampproofing emulsion composed of vacuum-reduced asphalt dispersed in a mineral colloid emulsifier.

.1 Asphalt for temperature at, or above 5 deg C (40 deg F)
.2 Basis-of-Design: “700-01” by Henry Company Canada Canada or equivalent as follows:

.1 “520 Sealmastic” by W.R. Meadows Inc., Canada.
.2 or Equivalent to the above.

2.4 AUXILIARY MATERIALS

.1 Supply auxiliary materials recommended in writing by bituminous dampproofing manufacturer for intended use and compatible with bituminous dampproofing.

.2 Asphalt Primer: As recommended by bituminous dampproofing manufacturer for dampproofing type.

.3 Drainage board: Composite subsurface drainage board consisting of studded, nonbiodegradable, molded-plastic-sheet drainage core; with nonwoven, needle-punched geotextile facing with apparent opening size not exceeding 0.21-mm (No. 70) sieve laminated to one side of core and a polymeric film bonded to the other side; and with a vertical flow rate of 112 to 188 L/min. per m (9 to 15 gpm per ft.).

.1 Acceptable Products:

.1 “DB 6200” by Henry Canada
.2 “CCW MiraDRAIN 6000” by Carlisle Coatings & Waterproofing Inc.
.3 “Hydroduct 220” by GCP Applied Technologies Inc.
.4 “Mel-Drain” by W.R Meadows
.5 “Sopradrain 10G” by Soprema Inc.
.6 “Delta-drain 6000” by Cosella-Dorken Products Inc.
.7 “Aquadrain 15 XP” by CETCO Building Materials Group
.8 or Equivalent to the above.

.4 Fabric Reinforcement: Open weave glass fabric consisting of glass fibre yarn saturated with synthetic resins, having the following physical properties:

.1 Mesh Size: 20/10

.2 Weight: 85 g/sq. m

.3 Tensile Strength (per 25mm width): MD 0.33 Kn; XMD 0.33 Kn

.4 Basis of Design Product:

.1 “990-06 Yellow Jacket” by Henry Company Canada or equivalent.

.5 Metal Termination Bars: Aluminum bars, approximately 25 by 3 mm (1 by 1/8 inch) thick, predrilled at 229-mm (9-inch) centers.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Examine substrates, areas, and conditions with applicator present, for compliance with requirements for surface smoothness, surface moisture, and other conditions affecting performance of bituminous dampproofing work.

.2 Proceed with application only after substrate construction and penetrating work have been completed and unsatisfactory conditions have been corrected.

3.2 PREPARATION

.1 Mask or otherwise protect adjoining exposed surfaces from being stained, spotted, or coated with dampproofing. Prevent dampproofing materials from entering and clogging weep holes and drains.

.2 Clean substrates of projections and substances detrimental to the dampproofing work; fill voids, seal joints, and remove bond breakers if any, as recommended in writing by prime material manufacturer.

.3 Apply patching compound to patch and fill tie holes, honeycombs, reveals, and other imperfections; cover with asphalt-coated glass fabric.

3.3 APPLICATION

.1 Comply with manufacturer's written instructions for dampproofing application, cure time between coats, and drying time before backfilling unless more stringent requirements are indicated on Drawings and schedules.

.1 Apply dampproofing to provide continuous plane of protection.

.2 Apply additional coats if recommended in writing by manufacturer or to achieve a smooth surface and uninterrupted coverage.

3.4 COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

.1 Priming: Apply dampproof coating, diluted 20% by volume with clean water at rate of 0.5 l/sq. m and let dry, unless otherwise recommended by manufacturer.

.2 Waterproofing application:

.1 Apply fabric reinforcement into dampproof coating at not less than 1.0 l/sq. m (2.4 gal/100sq. ft.), unless otherwise recommended by manufacturer.

.2 Brush fabric reinforcement into place and eliminate wrinkles, air pockets or blisters and obtain full contact.

.3 Overlap fabric reinforcement at least 50mm (2”) at all joints.

.4 At all corners, angles and junctions, reinforce with two (2) extra coats of dampproof coating and fabric reinforcement, at least 100mm (4”) on each side of the junction.

.5 Apply a seal coat of dampproof coating over the entire area at not less than 1.0 l/sq. m (2.4 gal/100sq. ft.), unless otherwise recommended by manufacturer.

3.5 COLD-APPLIED, CUT-BACK-ASPHALT DAMPPROOFING

.1 Primer: Apply penetrating asphalt primer at a rate of approximately 2 to 8 l/sq. m and allow to cure.

.2 Waterproofing application:

.1 Apply fabric reinforcement into dampproof coating at not less than 1.0 l/sq. m (2.4 gal/100sq. ft.), unless otherwise recommended by manufacturer.

.2 Brush fabric reinforcement into place and eliminate wrinkles, air pockets or blisters and obtain full contact.

.3 Overlap fabric reinforcement at least 50mm (2 inches) at all joints.

.4 At all corners, angles and junctions, reinforce with two (2) extra coats of dampproof coating and fabric reinforcement, at least 100mm (4 inches) on each side of the junction.

.5 Apply a seal coat of dampproof coating over the entire area at not less than 1.0 l/sq. m (2.4 gal/100sq. ft.), unless otherwise recommended by manufacturer.

3.6 INSTALLATION OF INSULATION

.1 Coordinate with Section 07 21 00 for insulation materials.

3.7 CLEANING

.1 Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended in writing by manufacturer of affected construction

END OF SECTION

PART 1 - GENERAL

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL INSTRUCTIONS

.1 Read and conform to:

.1 the General Conditions and the Supplementary Conditions of the Contract;

.2 Division 1 requirements and documents referred to therein.

1.3 SUMMARY

.1 Work Included: Provide underslab vapour retarder including but not limited to following:

.1 plastic underslab vapour retarder,

.2 pipe boots.

.2 Related Requirements: Specifications throughout the entirety of the Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.4 REFERENCES

.1 Reference Standards: Latest published editions of reference standards listed in this Section in effect as of the closing date and time of the Request for Tenders for the Contract, including any amendments adopted, are applicable unless otherwise indicated.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meetings:

.1 Prior to starting work of this Section, convene a pre-installation meeting at Project site to review Project requirements and site conditions with pertinent parties. Conform to requirements of Section 01 30 00.

1.6 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's literature and data sheets for each type of material provided under this Section for the Project in accordance with requirements of Section 01 30 00.

.2 Ensure data sheets Provide required information including detailed instructions for installing as well as maintaining, preserving and keeping materials in clean and safe conditions.

.2 Safety Data Sheets (SDS): Submit SDS for inclusion in Operation and Maintenance Manual specified in Section 01 70 00, for adhesives, sealants and any other material designated by Consultant.

1.7 QUALITY ASSURANCE

.1 Installer's Qualifications: Provide work of this Section executed by competent installers with minimum 5 years' experience in the application of the Products, systems and assemblies specified herein and with the approval and training of the Product manufacturers.

.2 Single Source Responsibility: Ensure primary materials provided in this Section are obtained from 1 source by a single manufacturer and secondary materials are obtained from sources recommended by primary materials manufacturers.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials to the Site in manufacturer's, original, unopened containers, with labels and seals intact.

.1 Store materials in a clean dry area in accordance with manufacturer's instructions.

.2 Stack membrane on smooth ground or wood platform to eliminate warping.

.3 Protect materials during handling and application to prevent damage and/or contamination.

1.9 SITE CONDITIONS

.1 Ambient Conditions:

.1 Product is not intended for uses subject to abuse or permanent exposure to the elements.

.2 Do not apply on frozen ground

1.10 WARRANTY

.1 The Contractor warrants the work of this Section for a period of 10 years following Substantial Performance of the Work against defects and/or deficiencies in accordance with General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within this warranty period, to satisfaction of the Consultant and at no expense to the Owner. Defects include but are not limited to: material failing to remain in position and maintain vapour retardance.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Products of the following manufacturers may be acceptable subject to conformance to requirements of Drawings, schedules and Specifications:

.1 Carlisle Coatings & Waterproofing

.2 Grace Construction Products

.3 Stego Industries, LLC.

.4 W.R. Meadows of Canada

.2 Substitution Limitations: This Specification is based on W.R Meadow's Products. Comparable Products from manufacturers listed herein may be considered provided they meet the requirements of this Specification.

2.2 DESCRIPTION

.1 Design and Performance Requirements:

.1 Refer to Section 01 83 16 for additional performance and testing requirements pertaining to the work of this Section.

2.3 MATERIALS

.1 Underslab Vapour Retarder (AVB-2): Sheet membrane, underslab vapour retarder, minimum 0.38 mm (15 mils) thick; complete with manufacturer's approved tape Product for joints.

.1 Ensure vapor retarder meets or exceeds all requirements of ASTM E1745, Class A and has following characteristics:

.1 Water vapour permeance (ASTM E96 or ASTM F1249): ≤0.01 perms.
.2 Puncture resistance (ASTM D1709): ≥2,200 grams.
.3 Tensile strength (ASTM E154): ≥68 lbs force/inch.

.2 Acceptable Products:

.1 "Perminator" by W. R. Meadows of Canada
.2 "Florprufe 120 Vapor Barrier" by Grace Construction Products
.3 "Blackline 400" by Carlisle Coatings and Waterproofing
.4 "Stego® Wrap" Vapor Barrier" by Stego Industries, LLC
.5 or Equivalent to the above.

.3 Seam Tape: High density, polyethylene tape with pressure sensitive adhesive for joints. Minimum width 100 mm (4"). Acceptable Products:

.1 Perminator Tape" by W.R. Meadows
.2 "Preprufe Tape" by Grace Construction Products
.3 "Monobond Tape" by Carlisle
.4 "Stego Tape" by Stego Industries, LLC
.5 or Equivalent to the above.

.2 Pipe Boots: Construct pipe boots from vapour barrier material and pressure sensitive tape, in accordance with manufacturer's instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions:

.1 Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation. Examine substrates designated to receive underslab vapour barrier membrane. Notify the Consultant if substrates are not acceptable to the installation of this work. Do not begin surface preparation or application until unacceptable substrates and/or conditions have been corrected.

.2 Evaluation and Assessment: Commencement of work implies acceptance of previously completed work.

3.2 PREPARATION

.1 Surface Preparation: Prepare substrates in accordance with the manufacturer's recommendations.

3.3 APPLICATION

.1 Installation shall be in accordance with manufacturer's recommendations, reviewed Shop Drawings and the requirements of ASTM E1643.

.2 Unroll membrane with the long dimension parallel with the direction of the concrete pour.

.3 Lap membrane over footings and seal to foundation walls.

.4 Overlap joints in membrane minimum 150 mm (6") and seal with tape.

.5 Seal all penetrations (including pipes) with pipe boots.

.6 No penetration of the membrane shall be permitted, except for reinforcing steel and permanent utilities. Repair damaged areas by cutting patches of membrane, overlapping damaged area minimum 150 mm (6") and taping all four sides.

END OF SECTION

PART 1 - GENERAL

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL INSTRUCTIONS

.1 Read and conform to:

.1 the General Conditions and the Supplementary Conditions of the Contract.

.2 Division 01 requirements and documents referred to therein.

1.3 SUMMARY

.1 Work Included: Provide labour, materials, products, equipment and services to complete the building insulation work specified herein. This includes, but is not necessarily limited, to:

.1 board, batt, and loose insulation throughout building, except as specified under other Sections.

.2 Related Requirements: Specifications throughout the entirety of Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.4 REFERENCES

.1 Reference Standards: Latest published editions of reference standards listed in this Section in effect as of the closing date and time of the Request for Tenders for the Contract, including any amendments adopted, are applicable unless otherwise indicated.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meetings:

.1 Prior to starting work of this Section, convene a pre-installation meeting at Project site to review Project requirements and site conditions with pertinent parties. Conform to requirements of Section 01 30 00.

1.6 SUBMITTALS

.1 Product Data: Submit manufacturer's literature and data sheets for each type of material provided under this Section for Project in accordance with requirements of Section 01 30 00.

.1 Ensure data sheets provide required information including detailed instructions for installing as well as maintaining, preserving, and keeping materials in clean and safe conditions. Provide adequate warning of maintenance practices or cleaning agents detrimental to specified materials.

.2 Safety Data Sheets (SDS): Submit SDS for inclusion in Operation and Maintenance Manual specified in Section 01 70 00, for adhesives, sealants and any other material designated by Consultant.

1.7 QUALITY ASSURANCE

.1 Qualifications:

.1 Manufacturers: Provide Products for Work of this Section by manufacturer with minimum 10 years' experience in the manufacture of such materials.

.2 Installers: Provide work of this Section executed by competent installers with minimum 5 years' experience in the application of Products, systems and assemblies specified and with approval and training of the Product manufacturers.

.2 Single Source Responsibility: Ensure primary materials provided in this Section are obtained from 1 source by a single manufacturer and secondary materials are obtained from sources recommended by primary materials manufacturers.

.3 Mock-ups: Provide Mock-ups in locations designated by Consultant and as required to demonstrate quality of workmanship. Maintain Mock-ups during construction in an undisturbed condition as a standard for judging the completed work.

1.8 DELIVERY, STORAGE, AND HANDLING

.1 Delivery and Acceptance Requirements:

.1 Deliver materials to site in original wrappings with labels intact and store in dry areas.

.2 Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

.3 Storage and Handling Requirements:

.1 Store insulation on raised platforms and protect with waterproof covers. Prevent exposure of insulation to sun.

.2 Protect foam-plastic board insulation as follows:

.1 Do not expose to sunlight except to necessary extent for period of installation and concealment.

.2 Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site before installation time.

.3 Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Products of following manufacturers may be acceptable subject to conformance to requirements of Drawings, Schedules and Specifications:

.1 Extruded-polystyrene (XPS) board insulation (XPS)

.1 DuPont de Nemours Inc.

.2 Owens Corning.

.3 Soprema

.2 Expanded-Polystyrene Board Insulation (EPS):

.1 Plasti-Fab Expanded Polystyrene (EPS) Product Solutions

.2 DiversiFoam Products.

.3 Atlas Roofing Corporation

.3 Fibreglass Insulation:

.1 Johns Manville.

.2 Knauf Insulation.

.3 Owens Corning.

.4 CertainTeed

.4 Mineral-Wool Insulation

.1 Rockwool Inc.

.2 Thermafiber.

.3 Johns Manville.

.2 Comparable Products from manufacturers listed herein offering functionally and aesthetically equivalent products in Consultant's opinion, and subject to Consultant's review, will be considered provided they meet the requirements of this Specification.

2.2 REGULATORY REQUIREMENTS

.1 Provide insulation and related materials having surface-burning characteristics in accordance with Code requirements tested and inspected by agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

.2 Where combustible insulation or vapour barrier materials are specified herein, comply with applicable Code requirements including supply and installation of approved non-combustible backing and independently supported, non-combustible insulation covering except where these provisions are expressly specified as work of other Sections.

2.3 DESIGN AND PERFORMANCE REQUIREMENTS

.1 Refer to Drawings for thicknesses of insulation required. This Section establishes insulation and accessory Products and minimum performance criteria which apply to all board, batt, and loose insulation types used throughout this Project. Read and become familiar with insulation requirements of all Sections.

.2 Exterior envelope for this Project is based on design principle of "Rain Screen" as recommended by National Research Council of Canada. This principle requires that construction behind cladding act as an air barrier and vapour retarder to prevent passage of moisture laden air and diffusion of water vapour.

.3 It is part of responsibility of this Section to ensure continuity of the air barrier and vapour retarder system within construction specified herein and with adjacent construction.

.4 Material types (trade names), compatibility, sealing and adhesive qualities for each combination of insulation, adhesive, and substrate encountered in work shall be reviewed for compatibility and suitability prior to commencement of installation.

.5 Provide air sealing to supplement and provide continuity of primary air barrier/vapour retarder assembly including sealing and/or filling of perimeter of door and window openings, crevices, gaps, cracks in walls, roof/wall connections, mechanical and electrical penetrations in walls, floors, roofs, curtain wall mullions, beams, columns enclosures and other similar locations with polyurethane foam seal.

2.4 ACOUSTIC BATT AND SOUND ATTENUATION BLANKETS (INS-1)

.1 CAN/ULC-S702, Type 1 with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per CAN/ULC-S102/S102.2; passing CAN/ULC-S114 for combustion characteristics.

.1 Acceptable Products (Fiberglass):

.1 "EcoTouch™ QuietZone® PINK™ FiberGlas® Acoustical Batts" by Owens Corning Canada LP

.2 "NoiseReducer Sound Attenuation Batts" by CertainTeed.

.3 "Sound-Shield Formaldehyde-Free Fiber glass Insulation" by Johns Manville.

.2 Acceptable Products (Mineral Wool):

.1 "ROCKWOOL AFB evo" by Rockwool (a subsidiary of ROCKWOOL International A/S)

.2 Thermafiber® SAFB™ by Owens Corning/Thermafiber "MinWool Sound Attenuation Fire Batts" by Johns Manville.

.2 Locations: At STC-rated partitions as indicated on Drawings.

2.5 BELOW-GRADE POLYSTYRENE BOARD INSULATION (INS-2)

.1 Following types are acceptable:

.1 Extruded-polystyrene (XPS) board insulation complying with CAN/ULC-S701 Type 4 with following characteristics:

.1 Minimum compressive strength: 210 kPa (30 psi).

.2 Thermal Resistance per 25 mm (1 inch): not less than RSI 0.87 m^2 •°C/W (R5 ft^2 •h•°F/Btu)

.3 Edges: shiplapped (long edges); butt joints (short edges)

.4 Acceptable Products:

.1 "STYROFOAM™ SM" by DuPont de Nemours Inc.

.2 "Cel-Drain®" (drainage layer applications) by Owens Corning Canada LP

.3 Approved equivalent by Soprema.

.2 Graphite-enhanced expanded Polystyrene (EPS) Board Insulation complying with CAN/ULC- Type 3 with following characteristics:

.1 Minimum compressive strength: 210 kPa (30 psi).

.2 Thermal Resistance per 25 mm (1 inch): not less than RSI 0.82 m^2 •°C/W (R4.7 ft^2 •h•°F/Btu)

.3 Acceptable Products:

.1 "ThermalStar X-grade GX 30" by Atlas.

.2 "Ener-span 30" by Plasti-Fab.

.3 Approved equivalent.

.2 Location: At perimeter of foundation wall below grade as indicated on Drawings.

2.6 CONCRETE-FACED POLYSTYRENE BOARD INSULATION (INS-3)

.1 Extruded-polystyrene (XPS) board insulation complying with CAN/ULC-S701 Type 4 laminated to concrete facing with following characteristics:

.1 Insulation:

.1 Minimum compressive strength: 210 kPa (30 psi).

.2 Thermal Resistance per 25 mm (in.): not less than RSI 0.87 m^2 •°C/W (R5 ft^2 •h•°F/Btu)

.3 Edges: tongue and groove

.2 Facing: Minimum 8 mm (5/16 inch) thick glass-fiber-mesh-reinforced concrete panels

.1 Minimum Compressive Strength: 17.93 MPa (2600 psi)

.2 Minimum Flexural Strength: 10.34 MPa (1500 psi)

.3 Acceptable Products:

.1 "WallGuard" by T-Clear Corporation

.2 “Tech Crete Concrete Faced Insulated (CFI) Wall Panels" by Tech-Crete Processors Ltd.;

.3 approved equivalent

.2 Location: At perimeter of foundation wall above grade as indicated on Drawings.

2.7 HIGH DENSITY POLYSTYRENE BOARD INSULATION (INS-4)

.1 Following types are acceptable:

.1 Extruded-polystyrene (XPS) board insulation complying with CAN/ULC-S701 Type 4 with following characteristics:

.1 Minimum compressive strength: 276 kPa (40 psi).

.2 Thermal Resistance per 25 mm (1 inch): not less than RSI 0.87 m^2 •°C/W (R5 ft^2 •h•°F/Btu)

.3 Edges: shiplapped (long edges); butt joints (short edges)

.4 Acceptable Products:

.1 "HIGHLOAD 40" or "HIGHLOAD 60" or "HIGHLOAD 100" by DuPont de Nemours Inc. as required to carry stipulated loads.

.2 “Foamular® NGX C-400” or “Foamular® NGX C-600” or “Foamular® NGX C-1000” by Owens Corning Canada LP as required to carry stipulated loads.

.3 “Sopra-XPS40” or “Sopra-XPS60” by Soprema.

.2 Graphite-enhanced expanded Polystyrene (EPS) Board Insulation complying with CAN/ULC- Type 3 with following characteristics:

.1 Minimum compressive strength: 276 kPa (40 psi).

.2 Thermal Resistance per 25 mm (1 inch): not less than RSI 0.82 m^2 •°C/W (R4.7 ft^2 •h•°F/Btu)

.3 Acceptable Products:

.1 "ThermalStar X-grade GX 40" or "ThermalStar X-grade 60" by Atlas as required to carry stipulated live loads and dead loads.

.2 “Ener-span 40” or “Ener-span 60” by Plasti-Fab as required to carry stipulated live loads and dead loads.

.3 Approved equivalent.

.2 Location: Under slabs-on-grade and other locations as indicated on Drawings.

2.8 CAVITY BOARD INSULATION (INS-6)

.1 Mineral wool (rockwool or slag wool) insulation complying with CAN/ULC-S702 Type 1 or equivalent to ASTM C612; with maximum flame-spread and smoke-developed indexes of 15 and zero, respectively, per CAN/ULC-S102/S102.2; passing CAN/ULC-S114 for combustion characteristics.

.1 Nominal density: 64 kg/cu. m (4 lb/cu. ft.),

.2 Thermal Resistance per 25 mm (1 inch): not less than RSI 0.71 m^2 •°C/W (R4 ft^2 •h•°F/Btu)

.3 Acceptable Products:

.1 "CAVITYROCK" by Rockwool.

.2 "Thermafiber® RainBarrier™" by Owens Corning/Thermafiber

.3 "JM CladStone™ Water & Fire Block Insulation" by Johns Manville

.2 Location: At rain-screen cavity walls as indicated on Drawings.

2.9 CURTAIN WALL BACKPAN INSULATION (INS-7)

.1 Mineral wool (rockwool or slag wool) insulation complying with CAN/ULC-S702 Type 1 or equivalent to ASTM C612; with maximum flame-spread and smoke-developed indexes of 15 and zero, respectively, per CAN/ULC-S102/S102.2; passing CAN/ULC-S114 for combustion characteristics.

.1 Nominal density: 56 kg/cu. m (3.5 lb/cu. ft.),

.2 Thermal Resistance per 25 mm (1 inch): not less than RSI 0.71 m^2 •°C/W (R4 ft^2 •h•°F/Btu)

.3 Acceptable Products:

.1 "Curtainrock" by Rockwool.

.2 " MinWool Curtainwall" by Johns Manville

.3 Approved equivalent

.2 Location: At curtain wall back pans as indicated on Drawings.

2.10 ROOFING INSULATION (CONVENTIONAL) (INS-8)

.1 Refer to Roofing Specifications.

2.11 THERMAL BATT AND BLANKET INSULATION (INS-12)

.1 CAN/ULC-S702, Type 1 with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per CAN/ULC-S102/S102.2; passing CAN/ULC-S114 for combustion characteristics.

.1 Thermal Resistance per 25 mm (in.): not less than RSI 0.71 m^2 •°C/W (R4 ft^2 •h•°F/Btu)

.2 Acceptable Products (Fiberglass):

.1 "EcoTouch® PINK™ FiberGlas® Thermal Batts" by Owens Corning Canada LP. " by Owens Corning Canada LP

.2 "Unfaced Thermal & Sound Control Batts" by Johns Manville

.3 approved equivalent

.3 Acceptable Products (Mineral Wool):

.1 "ROCKWOOL® COMFORTBATT™" by Rockwool (a subsidiary of ROCKWOOL International A/S)

.2 "Thermafiber® UltraBatt™" by Owens Corning/Thermafiber

.3 “Johns Manville TEMPCONTROL” by Johns Manville

.2 Location: At parapets and exterior perimeter walls as indicated on Drawings.

2.12 ACCESSORIES

.1 Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

.2 Foamed-in-Place Air Barriers Insulating Foam Sealants: Low expansion, semi-rigid single-component polyurethane sealant, to CAN/ULC-S710 and CAN/ULC-S711; and having the following properties:

.1 Minimum Thermal Resistance (ASTM C518): RSI 0.73 per 25 mm (R4.2 per inch)

.2 Core Density (ASTM D1622): minimum 24.03 kg/m^3 (1.5 pcf).

.3 Fire Resistance (CAN/ULC S102/S102.2): Flame spread < 15, Smoke Developed < 20.

.4 Primer: As recommended by sealant manufacturer.

.5 Acceptable Products:

.1 “Handi-Foam®” by Fomo Products, Inc.;

.2 "GREAT STUFF PRO™ Series" Foam Sealant by DuPont de Nemours Inc.

.3 “Exo LEF” or “ExoAir Flex Foam” by Tremco Incorporated, an RPM company

.3 Air Barrier/Vapour Retarders: As specified in Section 07 27 14.

.4 Insulation Fasteners: High density polyethylene (HDPE) 60 mm (2-3/8 inch) holding diameter washer, zinc plated heat treated carbon steel pins, gas fired direct fasten type, pin depth length to suit insulation thicknesses in accordance with selection chart indicated below.

.1 Acceptable Products: “Ramset T3 Insulfast System” by ITW Construction Products; or approved equivalent by Hilti Inc.

.2 Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates indicated on Drawings and Schedules without damaging insulation, fasteners, and substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Site Verification of Conditions:

.1 Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation. Commencement of work implies acceptance of previously completed work.

3.2 PREPARATION

.1 Clean substrates of substances harmful to insulation or air/vapor retarders, including removing projections capable of puncturing vapor retarders or of interfering with insulation attachment.

.2 Ensure surfaces to receive adhesive or insulation are dry, firm, straight, and free from loose material, projections, ice, frost, slick, grease, oil or other matter detrimental to bond of adhesive or uniform bedding of insulation.

.3 Maintain surface and ambient temperatures during application and curing of adhesive at temperature recommended by manufacturer of type of adhesive used.

3.3 INSTALLATION - GENERAL

.1 Install materials in accordance with manufacturer's instructions. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

.2 Install insulation to maintain continuity of thermal protection to building elements and spaces as indicated on Drawings. Extend insulation in thickness indicated to envelop entire area to be insulated. Ensure integrity and continuity of insulation at juncture with different types of materials and seal in acceptable manner.

.3 Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice, rain, and snow. Use only insulation panels free from ripped backs or chipped or broken edges.

.4 Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement. Butt joints tightly, offset vertical joints. Stagger joints in row.

.5 Fit insulation tight to electrical boxes, plumbing and heating pipes and ducts, around exterior doors and windows and other projections or openings.

.6 For preformed insulating units, provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

.7 Do not cover insulation and air barrier/vapour retarder installed under this Section or other Sections until it has been reviewed by Consultant.

.8 Leave insulation board joints unbonded over line of expansion and control joints. Bond a continuous 150 mm wide 0.15 mm modified bituminous membrane over expansion and control joints using compatible adhesive and primer before application of insulation.

.9 Provide flexible insulation of equivalent thickness and thermal insulation to fit areas where application of rigid insulation is not possible to provide continuous coverage.

3.4 INSTALLATION OF PERIMETER FOUNDATION INSULATION

.1 On vertical surfaces, set insulation units in adhesive applied according to manufacturer's written instructions. Use adhesive recommended by insulation manufacturer.

.2 Unless otherwise indicated on Drawings to extend to footings, extend insulation a minimum of 1200 mm (48 inches) below exterior grade line/finished floor.

.3 Protect below-grade insulation on vertical surfaces from damage during backfilling by using 6 mm (1/4") thick pressure treated plywood or fibre-reinforced cement flat panels with joints butted. Set in adhesive according to insulation manufacturer's written instructions.

3.5 INSTALLATION OF UNDER-SLAB INSULATION

.1 On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions, on level compacted fill.

.2 Unless otherwise indicated on Drawings to extend for entire surface of slabs, extend insulation a minimum of 1200 mm (48 inches) from foundation wall.

.3 Protect top surface of horizontal insulation from damage during concrete work by applying protection course with joints butted.

3.6 INSTALLATION OF CAVITY-WALL INSULATION:

.1 Foam-plastic board insulation:

.1 On units of foam-plastic board insulation, install pads of adhesive spaced approximately 24 inches (610 mm) o.c. both ways on inside face, and as recommended by manufacturer. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions. Press units firmly against inside substrates indicated.

.2 Supplement adhesive attachment of insulation by securing boards with two-piece wall ties designed for this purpose and as specified in Section 04 05 19.

.3 Seal joints between foam-plastic insulation units by applying adhesive, mastic, tape, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.

.2 Semi-rigid Mineral-fiber insulation:

.1 Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.

.2 Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.

.3 Maintain 76 mm (3 inch) clearance of insulation around recessed lighting fixtures.

.3 Spandrel Insulation:

.1 Retain insulation in place by metal clips and straps or integral pockets within frames, spaced at intervals recommended in writing by insulation manufacturer to hold insulation securely in place without touching spandrel glass. Maintain cavity width of dimension indicated between insulation and glass.

.2 Install insulation where it contacts perimeter fire-containment system to prevent insulation from bowing under pressure from perimeter fire-containment system.

3.7 BATT INSULATION

.1 Install batt or roll insulations where indicated on Drawings. Fit batt between framing and press firmly into place. Butt tightly at joints, free of gaps.

3.8 MISCELLANEOUS APPLICATIONS

.1 Stuff glass-fiber or mineral wool loose-fill insulation into miscellaneous voids and cavity spaces where shown. Compact to approximately 40% of normal maximum volume.

.2 Insulation Behind Electrical, Mechanical and Plumbing Items:

.1 Insulate behind pipes, ducts, electric conduits and outlets or junction boxes. Cut insulation to fit around and behind obstructions and non-standard spaces.

.2 Behind Convectors: Apply insulation boards on wall with adhesive and impale over 4 insulation clips per 600 mm x 1200 mm (2 feet x 4 feet) board.

.3 Ensure areas exposed to outside air are insulated.

.3 Foamed In Place Air Barrier Sealants:

.1 Apply foamed-in-place air barrier sealants in strict accordance with manufacturer's installation guidelines. Conform to CAN/ULC-S710.2.

.2 Use one-component foam for cracks or openings 6 mm (1/4 inch) to 50 mm (2 inch) wide. Use two- component foam sealant for gaps over 50 mm (2 inch) wide, and for voids in hidden cavities.

.3 Install air seal insulating foam sealants materials to OBC requirements in accordance with manufacturer's instructions and acceptable to authorities having jurisdiction and Consultant to provide required air seal.

.4 Apply sealants within recommended application temperature ranges. Consult manufacturer when sealants cannot be applied within specified ranges.

.5 Seal following areas to Provide continuity of air barrier/vapour retarder for this Project:

.1 At Penetrations.

.2 At roof/wall junctions

.3 At window perimeters (heads, jambs and sills) in walls, parapets and at columns as applicable.

.4 At exhaust vents and soffits.

.5 At roof scuppers and other mechanical equipment located on roof.

.6 At penetrations made vertically through floors or horizontally through walls.

.7 At Intervals in cavity walls to achieve compartmentalization.

.8 In masonry, curtain wall systems and at metal panel interface locations.

.9 At door heads, jambs and thresholds.

END OF SECTION

PART 1 - GENERAL

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL INSTRUCTIONS

.1 Read and conform to:

.1 the General Conditions and the Supplementary Conditions of the Contract.

.2 Division 01 requirements and documents referred to therein.

1.3 SUMMARY

.1 Work Included: Provide labour, materials, products, equipment and services to complete the impermeable air barriers work specified herein. This includes, but is not necessarily limited, to:

.1 self-adhering, vapour impermeable, sheet air barriers.

.2 fluid-applied, vapour impermeable membrane air barriers.

.3 auxiliary materials and accessories required for a complete air barrier assembly installation.

.2 Related Requirements: Specifications throughout the entirety of Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.4 REFERENCES

.1 Definitions:

.1 Air barrier Material: A primary material that controls the movement of air into and out of a building.

.2 Air barrier Accessory: the materials or products which are used to connect different air barrier materials to form a continuous air barrier assembly.

.3 Air barrier Assembly: a collection of air barrier materials (ie. self-adhered sheet air barriers, liquid applied membranes, medium density sprayed polyurethane foam, mechanically fastened commercial building wraps and boardstock air barriers) and air barrier accessories (ie. sealants, tapes and transition membranes) assembled together to form a continuous barrier to air infiltration into the environmental separator.

.2 Reference Standards: Latest published editions of reference standards listed in this Section in effect as of the closing date and time of the Request for Tenders for the Contract, including any amendments adopted, are applicable unless otherwise indicated.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meetings:

.1 Prior to starting work of this Section, convene a pre-installation meeting at Project site to review Project requirements and site conditions with pertinent parties. Conform to requirements of Section 01 30 00.

.2 Agenda: As a minimum, discuss the following:

.1 sequence of construction, coordination with substrate preparation, air barrier materials approved for use, compatibility of materials, coordination with installation

of adjacent and covering materials, air leakage and bond testing, protection of installed materials and details of construction.

.2 Sequencing:

.1 Sequence work to permit installation of materials in conjunction with related materials and seals.

.2 Do not install air barrier material before the roof assembly has been sufficiently installed to prevent a buildup of water in the interior of the building.

1.6 SUBMITTALS

.1 Product Data: Submit manufacturer's literature and data sheets for each type of material provided under this Section for Project in accordance with requirements of Section 01 30 00.

.1 Ensure data sheets provide required information including detailed instructions for installing as well as maintaining, preserving, and keeping materials in clean and safe conditions. Provide adequate warning of maintenance practices or cleaning agents detrimental to specified materials.

.2 Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of products.

.2 Safety Data Sheets (SDS): Submit SDS for inclusion in Operation and Maintenance Manual specified in Section 01 70 00, for adhesives, sealants and any other material designated by Consultant.

.3 Shop Drawings: Submit Shop Drawings for work of this Section in accordance with Section 01 30 00. As a minimum, indicate the following:

.1 locations and extent of air barrier assemblies and details of all typical conditions,

.2 intersections with other envelope assemblies and materials,

.3 membrane counter-flashings,

.4 complete details showing how gaps in construction will be bridged, treatment of inside and outside corners, and sealing of miscellaneous penetrations such as conduits, pipes, electric boxes and similar items.

.5 Include details of interfaces with other materials that form part of air barrier.

.4 Product Certificates: Submit certificates from air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with air barrier.

.5 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.

1.7 QUALITY ASSURANCE

.1 Qualifications:

.1 Manufacturers: Provide Products for Work of this Section by manufacturer with minimum 10 years' experience in the manufacture of such materials.

.2 Installers: Provide work of this Section executed by competent installers with minimum 5 years' experience in the application of Products, systems and assemblies specified and with approval and training of the Product manufacturers.

.3 Manufacturer shall have a program of continuous quality management implemented conforming to the requirements of ISO 9001 or similar equivalent system. Submit proof of certification upon request.

.4 Ensure manufacturer has sufficient production capacity, organized quality control and testing procedures, and published written and illustrated installation manuals to produce and properly install assemblies required without causing delay in progress of the Work.

.2 Single Source Responsibility: Ensure primary materials provided in this Section are obtained from 1 source by a single manufacturer and secondary materials are obtained from sources recommended by primary materials manufacturers.

.3 Mockups: Build mockups to set quality standards for materials and execution and for preconstruction testing.

.1 Build integrated mockups of exterior wall assembly, 10 sq. m (100 sq. ft.) incorporating backup wall construction, cladding, window, storefront, door frame and sill, insulation, ties and other penetrations, and flashing to demonstrate surface preparation, crack and joint treatment, application of air barriers, and sealing of gaps, terminations, and penetrations of air-barrier assembly.

.1 Coordinate construction of mockups to permit inspection by Owner's testing agency of air barrier before external insulation and cladding are installed.

.2 Include junction with roofing membrane, building corner condition, and foundation wall intersection.

.3 If Consultant determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved.

.2 Review of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Consultant specifically approves such deviations in writing.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Avoid spillage: immediately notify Consultant if spillage occurs and start clean up procedures.

.3 Clean spills and leave area as it was prior to spill.

.4 Remove and replace liquid materials that cannot be applied within their stated shelf life.

.5 Protect stored materials from direct sunlight.

1.9 FIELD CONDITIONS

.1 Environmental Limitations:

.1 Install air barrier within range of ambient and substrate temperatures, and moisture content recommended by material manufacturer.

.2 Protect substrates from environmental conditions that affect air barrier performance.

.3 Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

.4 Do not leave membrane exposed to sunlight/UV for more than 30 days, unless otherwise recommended by manufacturer.

.2 Maintain temperature and humidity recommended by materials manufactures before, during and after installation.

1.10 WARRANTY

.1 Material Warranty: Provide material manufacturer's standard product warranty, for a minimum of five years from date of Substantial Performance of the Work.

.2 Installation Warranty: Provide a five-year installation warranty from date of Substantial Performance of the Work, including all materials of the air barrier assembly, against failures including loss of airtight seal, loss of watertight seal, loss of attachment, loss of cohesion/adhesion and failure to cure properly.

.3 Warranty: include coverage of installed materials which fail to achieve airtight and watertight seal; exhibit loss of adhesion or cohesion.; or do not cure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Products of following manufacturers may be acceptable subject to conformance to requirements of Drawings, Schedules and Specifications:

.1 Self-adhering Sheet Air Barriers:

.1 3M Canada

.2 Carlisle Coatings & Waterproofing Inc.

.3 GCP Applied Technologies Inc.

.4 Henry Company

.5 IKO Industries Ltd

.6 Lexcor.

.7 Soprema Inc.

.8 Tremco Canada;

.9 W.R. Meadows Inc., Canada

.2 Fluid-Applied Air Barriers:

.1 GCP Applied Technologies Inc.

.2 Henry Company

.3 Soprema Inc.

.4 Tremco Canada;

.5 W.R. Meadows Inc., Canada

.2 Comparable Products from manufacturers listed herein offering functionally and aesthetically equivalent products in Consultant's opinion, and subject to Consultant's review, will be considered provided they meet the requirements of this Specification.

2.2 DESIGN AND PERFORMANCE REQUIREMENTS

.1 Provide air-barrier assembly and seals with adjacent construction that can perform as a continuous air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies must be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, tie-ins to installed waterproofing, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

.2 Air Leakage Criteria (system): air leakage of air barrier assembly must not to exceed 0.2 L/(s·m^2) under a pressure differential of 75 Pa (0.04 cfm/ft2 @ 1.57 psf) when tested in accordance with CAN/ULC S742 (Minimum A1).

.3 Unless specifically noted otherwise, air barrier materials specified herein must be impermeable and must have maximum water vapour transmission not exceeding 5.72 ng/s.m^2.Pa (0.10 perms) when tested in accordance with ASTM E96 (Method B).

.4 Ensure assembly can accommodate movements of building materials by providing expansion and control joints as required. Provide appropriate accessory materials to accommodate expansion / control joints, changes in substrate and perimeter conditions at such locations.

.5 Ensure air barrier assembly is capable of withstanding combined design wind, fan and stack pressures (positive and negative) on building envelope without damage or displacement, and transfer required loads to structure.

.6 Join air barrier assembly in airtight and flexible manner to the air barrier materials of adjacent assemblies, allowing for relative movement of assemblies due to thermal and moisture variations, creep, and anticipated seismic movement as applicable.

.7 Connections to Adjacent Materials: Provide air barrier accessory materials to prevent air leakage at the following locations:

.1 Foundation and walls, including penetrations, ties and anchors.

.2 Walls, windows, curtain walls, storefronts, louvers and doors.

.3 Different assemblies and fixed openings within those assemblies.

.4 Wall and roof connections.

.5 Floors over unconditioned space.

.6 Walls, floor and roof across construction, control and expansion joints.

.7 Walls, floors and roof to utility, pipe and duct penetrations.

.8 Seismic and expansion joints.

.9 All other potential air leakage pathways in the building envelope.

.8 Unless otherwise noted, it is responsibility of this Section to Provide and maintain continuity of air seal to adjacent dissimilar materials. Provide materials to ensure positive support and continuity of air barrier.

.9 Material Compatibility:

.1 Ensure compatibility between various types of air barriers and other interfacing materials. Select combination of base materials, transition, bridging and reinforcing membranes, adhesives and accessories from various materials specified in this Section, so that when cured, they are compatible and give bonding characteristics equivalent to shear strength of selected air barrier materials used.

.2 Do not allow air barrier materials to come in contact with chemically incompatible materials.

2.3 IMPERMEABLE AIR BARRIER (AVB-1)

.1 Self-adhering Type: Minimum 1.0-mm- (40-mil-) thick, self-adhering sheet consisting of rubberized asphalt laminated to cross-laminated polyethylene film with release liner on adhesive side and formulated for application with primer that complies with VOC limits of authorities having jurisdiction OR Minimum 0.25-mm- (10-mil-) thick, self-adhering sheet consisting of elastomeric air-barrier film and minimum 0.13-mm- (5-mil-) thick, acrylic adhesive with release liner on adhesive side.

.1 Physical and Performance Properties:

.1 Air Permeance: Maximum 0.02 L/s x sq. m of surface area at 75-Pa (0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft.) pressure difference; CAN/ULC S741.

.2 Resistance to Puncture: Minimum 180 N (40 lbf); ASTM E154.

.3 Tensile Strength: Minimum 3.5 N/mm (20 lbs/inch); ASTM D882.

.4 Water Resistance: Minimum 550 mm; AATC 127.

.5 Peel Strength: Minimum 0.875 N/mm (5 lbs/inch); ASTM D903.

.6 Lap Adhesion: Minimum 0.875 N/mm (5 lbs/inch); ASTM D1876.

.7 Pull Adhesion: Minimum 110 kPa (16 psi) or substrate failure; ASTM D4541.

.8 Tear Propagation: Minimum 40 N (8.9 lbf); ASTM D4073

.9 Self-Sealability: Pass; ASTM D1970

.10 Crack Bridging: Pass at -26 deg C (-14.8 deg F)

.11 Low Temperature Flexibility: Pass at -30 deg C (-22 deg F)

.12 Ultimate Elongation: Minimum 200 percent; ASTM D412, Die C.

.13 Water Absorption: Maximum 0.15 percent weight gain after 48-hour immersion at 21 deg C (70 deg F); ASTM D570.

.14 Vapour Permeance: Maximum 2.9 ng/Pa x s x sq. m (0.05 perm); ASTM E96/E 96M (Method B).

.2 Acceptable Products:

.1 “Blueskin SA” by Henry Company

.2 “AquaBarrier™ AVB AIR & VAPOUR BARRIER” by IKO Industries Ltd.

.3 “CCW-705” by Carlisle Coatings & Waterproofing Inc.

.4 “ExoAir 110/110LT” by Tremco Incorporated, an RPM company

.5 “Perm-A-Barrier Wall Membrane” by GCP Applied Technologies Inc.

.6 “Air-Shield” by W.R. Meadows Inc., Canada.

.7 “Sopraseal Stick 1100T” by Soprema Inc.

.3 Acceptable Primerless Products:

.1 “LexShield SA” by Lexcor.

.2 “Self-Adhered Air and Vapor Barrier Membrane 3015" by 3M Canada

.2 Fluid-Applied Type: Elastomeric, modified bituminous or synthetic polymer membrane.

.1 Physical and Performance Properties:

.1 Air Permeance: Maximum 0.02 L/s x sq. m of surface area at 75-Pa (0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft.) pressure difference; CAN/ULC S741.

.2 Water Resistance: Minimum 550 mm; AATC 127.

.3 Pull Adhesion: Minimum 110 kPa (16 psi) or substrate failure; ASTM D4541.

.4 Self-Sealability: Pass; ASTM D1970

.5 Crack Bridging: Pass at -26 deg C (-14.8 deg F)

.6 Vapour Permeance: Maximum 5.72 ng/Pa x s x sq. m (0.1 perm); ASTM E96/E 96M (Method B).

.7 Ultimate Elongation: Minimum 500 percent; ASTM D412, Die C.

.2 Acceptable Products:

.1 “Air-Bloc 06 WB or “Air-Bloc 32MR” by Henry Company

.2 “Air-Shield LM” by W.R. Meadows Inc., Canada

.3 “ExoAir 120SP/R” by Tremco Incorporated, an RPM company

.4 "Sopraseal LM203" by Soprema Inc.

.5 “Perm-A-Barrier NPL 10” by GCP Applied Technologies Inc.

2.4 ACCESSORY MATERIALS

.1 Accessory materials recommended by air-barrier manufacturer to produce a complete air-barrier assembly and compatible with primary air-barrier membrane.

.2 Primer: Liquid waterborne or solvent-borne primer recommended for substrate by air-barrier material manufacturer.

.3 Counterflashing Strip (for metal flashings): Modified bituminous 1.0-mm- (40-mil-) thick, self-adhering sheet consisting of 0.8 mm (32 mils) of rubberized asphalt laminated to an 0.2-mm- (8-mil-) thick, cross-laminated polyethylene film with release liner backing.

.4 Butyl Strip (for termination at TPO with PVC, EPDM or non-compatible single ply roofing membranes): Vapour retarding, 0.76 to 1.0 mm (30 to 40 mils) thick, self-adhering; polyethylene-film-reinforced top surface laminated to layer of butyl adhesive, with release liner backing.

.5 Modified Bituminous Strip (for termination at compatible roofing membranes): Vapour retarding, 1.0 mm (40 mils) thick, smooth surfaced, self-adhering; consisting of 0.9 mm (36 mils) of rubberized asphalt laminated to a 0.1-mm- (4-mil-) thick, cross-laminated polyethylene film with release liner backing.

.6 Termination Mastic: Air-barrier manufacturer's standard cold fluid-applied elastomeric liquid; trowel grade.

.7 Substrate-Patching Membrane: Manufacturer's standard trowel-grade substrate filler.

.8 Adhesive and Tape: Air-barrier manufacturer's standard adhesive and pressure-sensitive adhesive tape.

.9 Stainless-Steel Sheet: ASTM A240/A 240M, Type 304, 0.5 mm (0.0187 inch) thick, and Series 300 stainless-steel fasteners.

.10 Sprayed Polyurethane Foam Sealant (for filling gaps, penetrations and openings): One- or two-component, foamed-in-place, polyurethane foam sealant, 24- to 32-kg/cu. m (1.5- to 2.0-lb/cu. ft.) density; flame-spread index of 25 or less according to ASTM E162; with primer and noncorrosive substrate cleaner recommended by foam sealant manufacturer.

.1 Acceptable Products:

.1 “Handi-Foam®” by Fomo Products, Inc.;

.2 "GREAT STUFF PRO™ Series" Foam Sealant by DuPont de Nemours Inc.

.3 “Exo LEF” or “ExoAir Flex Foam” by Tremco Incorporated, an RPM company

.11 Sealing and Termination Materials at Windows, Doors, Curtain Walls and Similar openings:

.1 Preformed Silicone-Sealant Extrusion: Manufacturer's standard system consisting of cured low-modulus silicone extrusion, sized to fit opening widths, with a single-component, neutral-curing, Class 100/50 (low-modulus) silicone sealant for bonding extrusions to substrates.

.2 Basis-of-Design: “Proglaze ETA” by Tremco Canada or approved equivalent as follows:

.1 “DOWSIL STS Silicone Transition Strip and System” by Dow Chemical of Canada ULC

.2 “Sil-Span” by Pecora Corporation

.12 Joint Sealant: ASTM C920, single-component, neutral-curing silicone; Class 100/50 (low modulus), Grade NS, Use NT related to exposure, and, as applicable to joint substrates indicated, Use O. Comply with Section 07 92 00, Joint Sealants.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Site Verification of Conditions:

.1 Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation. Commencement of work implies acceptance of previously completed work.

.2 Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.

.3 Verify that concrete has cured and aged for minimum time period recommended by manufacturer.

.4 Verify that concrete is visibly dry and free of moisture.

.5 Verify that masonry joints are flush and completely filled with mortar.

.2 Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

.1 Clean, prepare, and treat substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air-barrier application.

.2 Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.

.3 Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

.4 Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching membrane.

.5 Remove excess mortar from masonry ties, shelf angles, and other obstructions.

.6 Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D4258.

.1 Install modified bituminous strips or other tapes approved by manufacturer and center over treated construction and contraction joints and cracks exceeding a width of 1.6 mm (1/16 inch).

.7 Bridge and cover isolation joints, expansion joints and discontinuous wall-to-wall, deck-to-wall, and deck-to-deck joints with overlapping modified bituminous strips or other tapes approved by manufacturer.

.8 At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.

.9 Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

3.3 INSTALLATION – GENERAL

.1 Continuously connect, seal and tie primary air barrier material into vertical and horizontal planes of the following materials:

.1 roof air barrier,

.2 concrete below-grade structures,

.3 windows and exterior doors,

.4 curtain wall,

.5 storefront,

.6 louvers,

.7 exterior doors, and

.8 other intersection conditions.

3.4 INSTALLATION OF SELF-ADHERING SHEETS

.1 Install self-adhering sheets and accessory materials according to air-barrier manufacturer's written instructions and according to recommendations in ASTM D6135.

.1 When ambient and substrate temperatures range between minus 4 and plus 5 deg C (25 and 40 deg F), install self-adhering, modified bituminous air-barrier sheet produced for low-temperature application. Do not install low-temperature sheet if ambient or substrate temperature is higher than 16 deg C (60 deg F).

.2 Corners: Prepare, prime, and treat inside and outside corners according to ASTM D6135.

.1 Install modified bituminous strips or other flashing tapes approved by manufacturer centered over vertical inside corners. Install 19-mm (3/4-inch) fillets of termination mastic on horizontal inside corners.

.3 Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations with termination mastic and according to ASTM D6135.

.4 Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by air-barrier sheet on same day. Reprime areas exposed for more than 24 hours.

.1 Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.

.5 Apply and firmly adhere self-adhering sheets horizontally over area to receive air barrier. Accurately align sheets and maintain uniform lap widths and end laps. Overlap and seal seams, and stagger end laps to ensure airtight installation.

.1 Apply membrane sheets such that they shed water naturally without interception by a sheet edge, unless edge is sealed with termination mastic as specified in this Section. Install successive courses of membrane and provide minimum following overlaps:

.1 End laps: minimum 150 mm (6 inches)

.2 Side laps: aligned at 75 mm (3 inches)

.3 Roll all membrane seams with roller.

.6 Apply continuous self-adhering sheets over modified bituminous strips or other flashing tapes approved by manufacturer bridging substrate cracks, construction, and contraction joints.

.7 Concrete Masonry Units: Install air-barrier sheet horizontally against the CMU beginning at base of wall. Align top edge of air-barrier sheet immediately below protruding masonry ties or joint reinforcement or ties, and firmly adhere in place.

.1 Overlap horizontally adjacent sheets a minimum of 50 mm (2 inches) and roll seams.

.2 Apply overlapping sheets with bottom edge slit to fit around masonry reinforcing or ties. Roll firmly into place.

.3 Seal around masonry reinforcing or ties and penetrations with termination mastic.

.4 Continue the membrane into all openings in the wall, such as doors and windows, and terminate at points to maintain an airtight barrier that is not visible from interior.

.8 Seal top of through-wall flashings to air-barrier sheet with an additional 150-mm- (6-inch-) wide, counterflashing strip.

.9 Seal exposed edges of sheet at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.

.10 Install air-barrier sheet and accessory materials to form a seal with adjacent construction and to maintain a continuous air barrier.

.1 Coordinate air-barrier installation with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.

.2 Install compatible strip on roofing membrane or base flashing so that a minimum of 75 mm (3 inches) of coverage is achieved over each substrate.

.11 Connect and seal exterior wall air-barrier membrane continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.

.12 Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply preformed silicone-sealant extrusion so that a minimum of 75 mm (3 inches) of coverage is achieved over each substrate. Maintain 75 mm (3 inches) of full contact over firm bearing to perimeter frames with not less than 25 mm (1 inch) of full contact.

.1 Preformed Silicone-Sealant Extrusion: Set in full bed of silicone sealant applied to walls, frame, and membrane.

.13 Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, doors, and miscellaneous penetrations of air-barrier membrane with foam sealant.

.14 At end of each working day, seal top edge of air-barrier material to substrate with termination mastic.

.15 Apply joint sealants forming part of air barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

.16 Repair punctures, voids, and deficient lapped seams in air barrier. Slit and flatten fishmouths and blisters. Patch with air-barrier sheet extending 150 mm (6 inches) beyond repaired areas in all directions.

.17 Install transition membranes where required by design or construction sequence.

.18 Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.5 FLUID-APPLIED MEMBRANE INSTALLATION

.1 Joint Treatment:

.1 Concrete and Masonry: Prepare, treat, rout, and fill joints and cracks in substrate according to ASTM C1193 and air-barrier manufacturer's written instructions. Remove dust and dirt from joints and cracks complying with ASTM D4258 before coating surfaces.

.1 Prime substrate and apply a single thickness of air-barrier manufacturer's recommended preparation coat extending a minimum of 75 mm (3 inches) along each side of joints and cracks. Apply a double thickness of fluid air-barrier material and embed a joint reinforcing strip in preparation coat.

.2 Gypsum Sheathing: Fill joints greater than 6 mm (1/4 inch) with sealant according to ASTM C1193 and air-barrier manufacturer's written instructions. Apply first layer of fluid air-barrier material at joints. Tape joints with joint reinforcing strip after first layer is dry. Apply a second layer of fluid air-barrier material over joint reinforcing strip.

.3 Transition Strips: Install strips, transition strips, and accessory materials according to air-barrier manufacturer's written instructions to form a seal with adjacent construction and maintain a continuous air barrier.

.4 Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.

.5 Install termination strip on roofing membrane or base flashing so that a minimum of 75 mm (3 inches) of coverage is achieved over each substrate.

.6 Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by fluid air-barrier material on same day. Reprime areas exposed for more than 24 hours.

.7 Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.

.8 Connect and seal exterior wall air-barrier material continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.

.9 At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.

.10 Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

.11 Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply preformed silicone-sealant extrusion so that a minimum of 75 mm (3 inches) of coverage is achieved over each substrate. Maintain 75 mm (3 inches) of full contact over firm bearing to perimeter frames with not less than 25 mm (1 inch) of full contact.

.1 Set in full bed of silicone sealant applied to walls, frame, and air-barrier material.

.12 Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air-barrier material with foam sealant.

.13 Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.

.14 Seal top of through-wall flashings to air barrier with an additional 150-mm- (6-inch-) wide, termination strip.

.15 Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.

.16 Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 150 mm (6 inches) beyond repaired areas in strip direction.

.2 Application:

.1 Apply fluid air-barrier material to form a seal with strips and transition strips and to achieve a continuous air barrier according to air-barrier manufacturer's written instructions. Apply fluid air-barrier material within manufacturer's recommended application temperature ranges.

.2 Limit priming to areas that will be covered by fluid air-barrier material on same day. Reprime areas exposed for more than 24 hours.

.3 Apply a continuous unbroken air-barrier membrane to substrates in dry film thickness as recommended in writing by manufacturer to meet performance requirements, but not less than 1.0-mm (40-mil) dry film thickness, applied in one or more equal coats as recommended by manufacturer.

.4 Apply air-barrier membrane in full contact around protrusions such as masonry ties.

.5 Apply strip and transition strip over cured air-barrier material overlapping 75 mm (3 inches) onto each surface according to air-barrier manufacturer's written instructions.

.6 Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.6 CLEANING AND PROTECTION

.1 Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.

.1 Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer. If exposed to these conditions for more than 30 days, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed membrane according to air-barrier manufacturer's written instructions.

.2 Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.

.2 Clean spills, stains, and soiling from construction that would be exposed in the completed Work, using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

Deleted through ADD#8

PART 1 - GENERAL

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL INSTRUCTIONS

.1 Read and conform to:

.1 the General Conditions and the Supplementary Conditions of the Contract.

.2 Division 01 requirements and documents referred to therein.

1.3 SUMMARY

.1 Work Included: Provide labour, materials, products, equipment and services to complete the preformed metal cladding system work specified herein. This includes, but is not necessarily limited, to:

.1 preformed metal panels for rooftop screens and enclosures

.2 miscellaneous framing components,

.3 related trims and extrusions, including but not limited to flashings, splicers, end caps, trims and closures,

.4 transitions and connections between air barrier/vapour retarder membranes.

.2 Related Requirements: Specifications throughout the entirety of Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.4 REFERENCES

.1 Reference Standards: Unless otherwise stipulated by a specific publication date in this Section or the Ontario Building Code, the latest published editions of reference standards in force as of the Bid Closing Deadline for the Project, including adopted amendments, are applicable.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meetings:

.1 Prior to starting work of this Section, convene a pre-installation meeting at Project site to review Project requirements and site conditions with pertinent parties. Conform to requirements of Section 01 30 00.

.2 Review methods and procedures related to preformed metal panel installation, including manufacturer's written instructions.

.3 Examine support conditions for compliance with requirements of Contract Documents, including alignment between and attachment to structural members.

.4 Review flashings, special siding details, wall penetrations, openings, and condition of other construction that affect preformed metal panels.

.5 Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.

.6 Review temporary protection requirements for preformed metal panel assembly during and after installation.

.7 Review procedures for repair of panels damaged after installation.

.8 Document proceedings, including corrective measures and actions required, and Supply copy of record to each participant.

.2 Coordination:

.1 Coordinate metal panel assemblies with air barrier/vapour retarder, rain drainage work, flashing, trim, and construction of girts, soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

.2 Coordinate with related trades to maintain continuity of building air barrier/vapour retarder system at locations including but not limited to roofing, cladding and building openings.

1.6 SUBMITTALS

.1 Product Data: Submit manufacturer's literature and data sheets for each type of material provided under this Section for Project in accordance with requirements of Section 01 30 00.

.1 Ensure data sheets provide required information including detailed instructions for installing as well as maintaining, preserving, and keeping materials in clean and safe conditions. Provide adequate warning of maintenance practices or cleaning agents detrimental to specified materials.

.2 Safety Data Sheets (SDS): Submit SDS for inclusion in Operation and Maintenance Manual specified in Section 01 70 00, for adhesives, sealants and any other material designated by Consultant.

.3 Shop Drawings: Submit Shop Drawings for work of this Section in accordance with Section 01 30 00.

.1 Ensure Shop Drawings show fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, supports and anchorages, attachment system, insulation type and thickness, trim, flashings, air seals, closures, and accessories; and special details including paths of pressure equalization and cavity drainage.

.2 Distinguish between factory, shop, and field-assembled work.

.3 Show provisions for structural and thermal movement between metal cladding and adjacent materials.

.4 Samples: Submit samples in accordance with Section 01 30 00. Submit following samples:

.1 Manufacturer’s colour charts or chips illustrating full range of colours, finishes and textures.

.2 300 mm x 300 mm (12 inch x 12 inch) aluminum composite panel in thickness specified, including clips, anchors, supports, fasteners, closures and other panel accessories necessary for assembly.

.3 300 mm (12 inch) each of extruded and formed trims.

.5 Engineering Data:

.1 Submit engineering data substantiating that specified structural requirements of the metal cladding assembly meet minimum requirements of CSA S136.

.2 Submit design calculations signed and sealed by professional engineer registered in the province of Ontario, attesting to ability of preformed metal cladding system to withstand specified design loads including inward and outward pressures under fastenings to structure.

.6 Sample Warranties: Submit samples of extend warranties specified in this Section.

.7 Certificates:

.1 Submit written certification from manufacturer that the Products, systems, and assemblies have been installed in accordance with manufacturer's requirements.

.8 Maintenance Data:

.1 Provide maintenance data for cleaning and maintenance of aluminum finishes for incorporation into manual specified in Section.

.2 Submit instructions for touch-up, repair and removal of panels.

.9 Extra Materials: Submit sealed can of touch-up paint (minimum 1 l), properly identified for each panel colour provided.

1.7 QUALITY ASSURANCE

.1 Qualifications:

.1 Manufacturers: Provide Products for Work of this Section by manufacturer with minimum 10 years' experience in the manufacture of such materials.

.2 Installers: Provide work of this Section executed by competent installers with minimum 5 years' experience in the application of Products, systems and assemblies specified and with approval and training of the Product manufacturers.

.2 Single Source Responsibility: Ensure primary materials provided in this Section are obtained from 1 source by a single manufacturer and secondary materials are obtained from sources recommended by primary materials manufacturers.

.3 Welding: Companies engaged in welding must be certified by Canadian Welding Bureau to CSA W47.1. Companies are to have welding procedures approved and welders qualified for base material types and thicknesses that are to be welded.

.4 Mock-ups: Provide Mock-ups in locations designated by Consultant and as required to demonstrate quality of workmanship. Maintain Mock-ups during construction in an undisturbed condition as a standard for judging the completed work.

.1 Provide Mock-ups in locations designated by Consultant and as required to demonstrate quality of workmanship and displaying typical connections of the Project. Modify site mock-up detailing if necessary in accordance with Consultant's review.

.2 Maintain Mock-ups during construction in an undisturbed condition as a standard for judging the completed work.

.3 Reviewed Mock-ups may form part of finished Work if left undisturbed at time of Substantial Performance of the Work

.5 Licensed Professionals: Employ a professional structural engineer registered in the province of Ontario, carrying minimum of $2,000,000.00 professional liability insurance to:

.1 design the components of the work of this Section requiring structural performance and their attachments to building's structure,

.2 be responsible for full assemblies and connections,

.3 be responsible for determining sizes, yield strengths, gauge thicknesses and joint spacing to allow thermal movement and loading of components in accordance with applicable codes and regulations,

.4 be responsible for production and review of Shop Drawings,

.5 inspect the work of this Section during fabrication and erection,

.6 stamp and sign each shop drawing,

.7 Provide site administration and inspection of this part of the Work.

.8 **[Submit certificate validating seismic assessment and field review of this part of the Work].**

1.8 DELIVERY, STORAGE AND HANDLING

.1 Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.

.2 Protect finish and edges using a plastic film adhered to panel in accordance with panel manufacturer's recommendations. Retain strippable protective covering on preformed metal panels during installation.

.3 Deliver components, preformed metal panels, and other manufactured items so as not to be damaged or deformed. Package preformed metal panels for protection during transportation and handling.

.4 Unload, store, and erect preformed metal panels in a manner to prevent bending, warping, twisting, and surface damage.

.5 Stack preformed metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store preformed metal panels to ensure dryness, with positive slope for drainage of water. Do not store preformed metal panels in contact with other materials that might cause staining, denting, or other surface damage.

1.9 FIELD CONDITIONS

.1 Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of preformed metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.10 WARRANTY

.1 Warrant work of this Section against defects and/or deficiencies in accordance with General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of Consultant and at no expense to Owner.

.1 Materials and Installation: for period of 5 years from date of Substantial Performance of the Work. Defects include but are not limited to; buckling, opening of seams, and structural failure.

.2 Panel Finish: for period of 30 years from date of Substantial Performance of the Work. Defects include but are not limited to: discoloration, finish peeling, bond failure and extensive colour fading.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Products of following manufacturers may be acceptable subject to conformance to requirements of Drawings, Schedules and Specifications:

.1 Agway Metals Inc.;

.2 Morin; a Kingspan Group company;

.3 Vicwest;

.4 West-Form Metals;

.2 Substitution Limitations: This Specification is based on Vicwest's Products.

.3 Comparable Products from manufacturers listed herein offering functionally and aesthetically equivalent products in Consultant's opinion, and subject to Consultant's review, will be considered provided they meet the requirements of this Specification.

2.2 REGULATORY REQUIREMENTS

.1 System Fire Propagation Characteristics: Provide preformed metal panel system tested in accordance with CAN/ULC-S134 by an independent testing organization and approved for use in non-combustible construction.

.2 Panel Fire Performance: Flame spread less than 25 and smoke developed less than 450, in accordance with CAN/ULC S102/S102.2 (subject to approval by Authorities Having Jurisdiction).

2.3 DESIGN AND PERFORMANCE REQUIREMENTS

.1 Architectural Drawings and details are diagrammatic and are only intended to show design concept, aesthetics, interfacing requirements, configuration, components and arrangements. They are not intended to identify or solve completely problems of thermal and structural movements, assembly framing, engineering design, fixings and anchorages.

.2 Provide sheet steel cladding wall panels conforming to requirements of CSSBI 20M.

.3 Design, fabricate and install cladding system to prevent excessive condensation interior of wall when mechanical systems are functioning under designed operating conditions.

.4 Ensure systems provided include attachment, insulation, air barrier/vapour retarder systems, necessary framing and suspension systems to support and anchor panel systems from concrete and/or metal structural framework.

.5 Rain Screen Principle:

.1 Design exterior envelope cladding systems based on Rain Screen Principle advocated by NRCC and Provide for drainage of water entering building envelope wall systems.

.2 Design for compartments at corners to achieve appropriate pressure equalization in exterior cladding system.

.3 Provide gaskets, baffles, overlaps, seals and compartmentalization where required to achieve appropriate pressure equalization in exterior envelope cavity wall design. Maintain integrity of continuous air barrier/vapour retarder system with adjacent surrounding air barrier/vapour retarder.

.4 Incorporate means of draining moisture to exterior. Design drainage system to provide clear, internal paths of drainage of any trapped moisture within construction to exterior. Ensure weep water discharges in a manner that avoids staining of architectural finishes, collecting in puddles or formation of icicles.

.6 Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads in accordance with requirements of Ontario Building Code, and CAN/CSA-S136:

.1 Determine specified loads, principal and companion load factors, building importance category, and load distributions in accordance with requirements of Ontario Building Code.

.1 Wind Loads: Determined in accordance with OBC requirements for geographical location of project, with 1 in 50 year return probability, but not less than 0.9 kPA (20 psf) positive, and 0.5 kPA (12 psf) negative.

.2 Design steel cladding components to be adequately interconnected and adequately fastened to structural supports to sustain loads.

.3 Design expansion joints to accommodate movement in cladding and between cladding and structure to prevent permanent distortion or damage to the cladding.

.4 Design wall system to maintain the following erection tolerances.

.1 Maximum variation from plane or location shown on shop drawings: 20 mm in 10 m (3/4 inch in 30 feet).

.2 Maximum offset from true alignment between two adjacent members abutting end to end in line: 1 mm (0.04 inches).

.5 Deflection of sheet steel cladding components due to uniformly distributed specified loads (eg. wind, snow) shall not exceed L/180.

.6 Wherever structural framing permits, and subject to reasonable limitations for handling, design and fabricate cladding to span continuously over at least four structural supports (three spans).

.7 Design cladding to accommodate thermal movement caused by ambient temperature range in accordance with OBC requirements and to suit Project location, without causing noise, buckling, failure of joint sealants, undue stress on metal members and fasteners, of operating units, reduction of performance, and other detrimental effects.

.1 Thermal Movements: Provide assemblies that allow for thermal movements resulting from following maximum changes (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components and other detrimental effects:

.1 Temperature Change (range): 67 deg C (120 deg F), ambient; 100 deg C (180 deg F), material surfaces.

.8 Seismic Performance: Design work of this Section to withstand seismic motions determined in accordance with requirements of OBC and CAN/CSA S832.

2.4 MATERIALS

.1 Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet; minimum Grade 230 complying with ASTM A653/A 653M, Z275 (G90) coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A792/A 792M, Class AZM150 (Class AZ50) coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A755/A 755M.

2.5 PREFORMED METAL WALL PANELS - CONCEALED-FASTENERS (MP-#)

.1 Provide factory-formed metal panels designed to be field assembled by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners and factory-applied sealant in side laps. Include accessories required for weathertight installation.

.2 Provide flush-profile, concealed-fastener metal wall panels with following characteristics:

.1 Location: Rooftop Mechanical Screens and Equipment Enclosures

.2 Panel Coverage: 300 mm (11-13/16 inches)

.3 Panel Height: 40 mm (19/16 inch)

.4 Nominal Thickness: As determined by Project-specified loadings, not less than 0.86 mm (22 ga - 0.034 inch)

.5 Steel Structure Supports: Refer to Structural.

.6 Acceptable Products:

.1 "AD300R – Perforated" by Vicwest; or approved equivalent.

.2 "HF-12 (Ribbed)" by Agway Metals.

.3 Approved Equivalent.

.3 Exterior Finish: Siliconized Polyester system consisting of epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.005 mm (0.2 mil) for primer and 0.02 mm (0.8 mil) for topcoat.

.1 Basis-of-Design: "WeatherXL" by Vicwest or approved equivalent.

.2 Colour: Minimum of two colours to be selected by Consultant from manufacturer's full range.

2.6 AUXILIARY MATERIALS

.1 Miscellaneous Metal Subframing and Furring: Sub-Girts, Z-bars etc., ASTM C645, Manufacturer's standard C- or Z-shaped sections, conforming to ASTM A653M, Grade A Zinc coating to Z275 (G90) designation. Transfer grid may be hat bars, Z-bars, adjustable Z-bars or combination of clip and Z-bar.

.1 Minimum thickness: 1.219 mm (18 ga.).

.2 Material visible after assembly of panel shall be finished to match panels.

.2 Miscellaneous Steel Shapes including Plate and Hollow Sections: CSA G40.21, Grade 300W, or ASTM A36M complete with shop applied primer of either CPMA/CISC 1-73 or CGSB 1-GP-140M.

.3 Extrusions and extrusion clips for attaching panels to substructure: purpose made aluminum. Install a separator between extrusions and sub-girts.

.4 Thermally-Broken Sub-framing: Low-conductivity thermally-broken, intermittent structural attachment insulation clips designed maintain insulation effectiveness, with adjustable depth and suitable for vertical and horizontal sub-girts.

.1 Acceptable Products:

.1 "ISO Clip" by Northern Facades Ltd.

.2 "Cascadia Clip" by Cascadia Windows

.3 "TClip Thermally Broken Façade Substructure" by Engineered Assemblies

.4 "NVelope NV1 Cladding Attachment System" by SFS Group.

.5 Approved equivalent.

.5 Panel Accessories:

.1 Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of preformed metal panels unless otherwise indicated.

.2 Provide flashing and trim formed from same material as preformed metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent preformed metal panels.

.3 Match material, gauge thickness and finish of metal panels, unless otherwise indicated.

.6 Field Touch-Up Paint: of same colour as exterior panel and as recommended by manufacturer.

.7 Isolation Coating: Bituminous paint, alkali-resistant bituminous paint or epoxy resin solution to Provide dielectric separation which will dry to be tack-free and withstand high temperatures. Cold-applied asphalt mastic complying with SSPC-Paint 12, except containing no asbestos fibers.

.8 Sealants: ASTM C920, conforming to Section 07 92 00 as recommend by manufacturer.

.9 Fasteners: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten miscellaneous metal framing members to substrates.

.1 Exposed fasteners: Series 300 stainless steel and nylon colour coated head to match substrate colour.

.2 Concealed fasteners: stainless steel Type 304 screws in accordance with manufacturer's recommendations.

.10 Miscellaneous Splicers, End Caps, Trims and Closures:

.1 Provide components required for a complete metal panel assembly including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items.

.2 Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers.

.3 Match material, gauge thickness and finish of metal wall panels, unless otherwise indicated.

.4 Ensure items are galvanized in accordance with ASTM A653/A653M with minimum Z275 (G90) coating.

2.7 FABRICATION

.1 Prior to commencement of fabrication, obtain Consultant's final approval of colours. Fabricate to manufacturer's standard assembly line production methods, incorporating unique conditions of this Project.

.2 Fabricate metal panels for designated façade and trim sections to profiles and patterns indicated. Manufacture panels from sufficiently thick material in combination with backing and/or reinforcing to produce metal cladding required to suit design requirements indicated on Drawings. Fabricate all components of system in factory and ready for field installation.

.3 Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

.4 Carry out complete fabrication including welding, grinding, punching and like to finish Work. Make welds clean, sound and solid, free from defects. Grind smooth, free from marks.

.5 Finished cladding shall be free from visible defects and accurately manufactured to dimensions of reviewed Shop Drawings.

.6 Fabricate metal panels in a manner that eliminates condensation on interior side of panel and with joints between panels designed to form weathertight seals.

.7 Make connections rigid and fail-safe wherever practicable, and make completely concealed.

.8 Fabricate all flashing pieces associated with and in contact with wall panel system. Use same sheet stock as exposed face sheets, pre-finished to match.

.9 Include cold rolled framing, furring, brackets, clips, hangers and incidental components as required for secure fastening and Provide weathertight installation including non-corrosive fasteners.

.10 Consider condensation and allow for inner wall drainage at sill members and other shapes which would otherwise tend to trap water.

2.8 FINISHES

.1 Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

.2 Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

.3 Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.013 mm (0.5 mil).

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Site Verification of Conditions:

.1 Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation. Commencement of work implies acceptance of previously completed work.

.2 Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by preformed metal wall panel manufacturer.

.3 Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by preformed metal wall panel manufacturer.

.4 Notify Consultant in writing of any conditions which would be detrimental to the installation.

.5 Coordinate and verify job site dimensions affecting this Work. Submit in writing dimensions or conditions which vary from those on reviewed Shop Drawings or detrimental to installation. Obtain corrective measures from Consultant prior to installation.

.6 Verify that air-barriers/vapour-retarders have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

.7 Examine roughing-in for components and assemblies penetrating preformed metal panels to verify actual locations of penetrations relative to seam locations of preformed metal panels before installation.

.8 Commencement of Work implies acceptance of previously completed Work.

3.2 PREPARATION

.1 Framing: Install subgirts, base angles, sills, furring, and other miscellaneous panel support members and anchorages according to reviewed Shop Drawings, erection drawings, and manufacturer's installation instructions.

.1 Secure sub-girt units to structural supports with stainless steel or galvanized self-tapping screws. Install Work rigidly and securely.

.2 Fasten thermally broken structural clips through air barrier/vapour retarder to supporting structure in accordance with manufacturer's installation details and instructions.

.3 Weld all connections, unless otherwise permitted. For hot dipped galvanized items and where not possible, bolt or secure connections in a manner acceptable to Consultant.

.4 Erect Work true to dimensions, square, plumb, level and free from distortion or defects detrimental to appearance and performance.

.2 Insulation

.1 Install insulation to maintain continuity of thermal protection to building elements and spaces. Extend insulation in thickness indicated to cover entire wall. Comply with installation requirements in Section 07 21 00.

.2 Install insulation with adhesive and/or stick clips as specified in Section 07 21 00 to prevent movement of insulation in finished wall.

.3 Butt each insulation board against adjacent boards with joints staggered. Fit neatly with tight joints around obstructions, openings and corners. Fill voids behind flashings and trim with loose mineral wool insulation.

3.3 INSTALLATION

.1 Install preformed metal panels, fasteners, trims and related items according to manufacturer's written instructions and reviewed Shop Drawings in orientation, sizes, and locations indicated on Drawings.

.2 Install panels perpendicular to girts and subgirts unless otherwise indicated. Bring each unit to bear evenly on framing. Ensure complete nesting of flange frames.

.3 Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.

.4 Shim or otherwise plumb substrates receiving metal wall panels.

.5 Prepare openings for louvers, doors, windows where applicable as detailed. Install necessary formed closures and trim as applicable at openings and penetrations. Make cut-outs neatly by saw cutting.

.6 Flash and seal metal wall panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air barrier/vapour retarder and flashings that will be concealed by metal wall panels are installed. Install flashing and trim as metal wall panel work proceeds.

.7 Install screw fasteners in predrilled holes.

.8 Locate and space fastenings in uniform vertical and horizontal alignment in accordance with manufacturer's instructions.

.9 Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.

.10 Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete and elsewhere as indicated or, if not indicated, as necessary for waterproofing.

.11 Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.

.12 Provide weathertight escutcheons for pipe and conduit penetrating exterior.

.13 Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

.14 Joint sealing: Install gaskets, joint fillers, and sealants where indicated and where required for weathertight performance of metal wall panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal wall panel manufacturer.

3.4 FIELD QUALITY CONTROL

.1 Manufacturer's Field Service: Engage a factory-authorized service representative to provide training and supervision of Contractor's personnel in installation of panel system at commencement of installation. Factory-authorized service representative must also:

.1 meet and discuss installation procedures and unique conditions at the Place of the Work.

.2 inspect substrate surfaces and recommend solutions to accommodate adverse conditions.

.3 periodically visit and inspect the installation and report unsatisfactory conditions to Consultant.

.4 attend final inspection and submit written certification that Products, systems and assemblies have been installed in accordance with manufacturer's requirements.

3.5 CLEANING AND PROTECTION

.1 Remove temporary protective coverings and strippable films, if any, as preformed metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions.

.2 On completion of preformed metal panel installation, clean finished surfaces as recommended by preformed metal panel manufacturer. Maintain a clean condition during construction.

.3 After preformed metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

.4 Replace preformed metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SEE ADD#8
Q#269

PART 1 - GENERAL

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL INSTRUCTIONS

.1 Read and conform to:

.1 the General Conditions and the Supplementary Conditions of the Contract;

.2 Division 1 requirements and documents referred to therein.

1.3 SUMMARY

.1 Work Included: Provide labour, materials, products, equipment and services to complete the solid phenolic composite wall panels work specified herein. This includes, but is not necessarily limited, to:

.1 solid phenolic composite panel system for walls and soffits,

.2 miscellaneous framing components,

.3 related trims and extrusions, including but not limited to flashings, splicers, end caps, trims and closures,

.4 transitions and connections between air barrier/vapour retarder membranes.

.2 Related Requirements: Specifications throughout the entirety of Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.4 REFERENCES

.1 Definitions:

.1 Drained / back-ventilated rainscreen cladding (D/BV): System designed to drain off most of the rain water at the outermost surface of the wall. Joints are designed to protect against the kinetic energy of wind-driven rain. However, no specific attempt is made to minimize leakage through the effects of gravity or wind by means of pressure equalization.

.2 Reference Standards: Latest published editions of reference standards listed in this Section in effect as of the closing date and time of the Request for Tenders for the Contract, including any amendments adopted, are applicable unless otherwise indicated.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meetings:

.1 Prior to starting work of this Section, convene a pre-installation meeting at Project site to review Project requirements and site conditions with pertinent parties. Conform to requirements of Section 01 30 00.

.2 Review methods and procedures related to solid phenolic composite panel installation, including manufacturer's written instructions.

.3 Examine support conditions for compliance with requirements of Contract Documents, including alignment between and attachment to structural members.

.4 Review flashings, special siding details, wall penetrations, openings, and condition of other construction that affect solid phenolic composite panels.

.5 Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.

.6 Review temporary protection requirements for solid phenolic composite panel assembly during and after installation.

.7 Review procedures for repair of panels damaged after installation.

.8 Document proceedings, including corrective measures and actions required, and Supply copy of record to each participant.

.2 Coordination:

.1 Coordinate solid phenolic composite panel assemblies with air barrier/vapour retarder, rain drainage work, flashing, trim, and construction of girts, soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

.2 Coordinate with related trades to maintain continuity of building air barrier/vapour retarder system at locations including but not limited to roofing, cladding and building openings.

1.6 SUBMITTALS

.1 Product Data: Submit manufacturer's literature and data sheets for each type of material provided under this Section for Project in accordance with requirements of Section 01 30 00.

.1 Ensure data sheets provide required information including detailed instructions for installing as well as maintaining, preserving, and keeping materials in clean and safe conditions. Provide adequate warning of maintenance practices or cleaning agents detrimental to specified materials.

.2 Safety Data Sheets (SDS): Submit SDS for inclusion in Operation and Maintenance Manual specified in Section 01 70 00, for adhesives, sealants and any other material designated by Consultant.

.3 Shop Drawings: Submit Shop Drawings for work of this Section in accordance with Section 01 30 00.

.1 Ensure Shop Drawings show fabrication and installation layouts of solid phenolic composite panels; details of edge conditions, joints, panel profiles, corners, supports and anchorages, attachment system, insulation type and thickness, trim, flashings, air seals, closures, and accessories; and special details including paths of pressure equalization and cavity drainage.

.2 Distinguish between factory, shop, and field-assembled work.

.3 Show provisions for structural and thermal movement between metal cladding and adjacent materials.

.4 Samples: Submit samples in accordance with Section 01 30 00. Submit following samples:

.1 Manufacturer’s colour charts or chips illustrating full range of colours, finishes and textures.

.2 300 mm x 300 mm (12 inch x 12 inch) solid phenolic composite panel in thickness specified, including clips, anchors, supports, fasteners, closures and other panel accessories necessary for assembly.

.3 Include panel assembly sample not less than 300 mm x 300 mm (12 inch x 12 inch) showing 4-way joint system.

.4 300 mm (12 inch) each of extruded and formed trims.

.5 Engineering Data:

.1 Submit engineering data substantiating that specified structural requirements of the metal cladding assembly meet minimum requirements of CSA S136.

.2 Submit design calculations signed and sealed by professional engineer registered in the province of Ontario, attesting to ability of preformed metal cladding system to withstand specified design loads including inward and outward pressures under fastenings to structure.

.6 Sample Warranties: Submit samples of extend warranties specified in this Section.

.7 Certificates:

.1 Submit written certification from manufacturer that the Products, systems, and assemblies have been installed in accordance with manufacturer's requirements.

.8 Maintenance Data:

.1 Provide maintenance data for cleaning and maintenance of aluminum finishes for incorporation into manual specified in Section.

.2 Submit instructions for touch-up, repair and removal of panels.

1.7 QUALITY ASSURANCE

.1 Qualifications:

.1 Manufacturers: Provide Products for Work of this Section by manufacturer with minimum 10 years' experience in the manufacture of such materials.

.2 Installers: Provide work of this Section executed by competent installers with minimum 5 years' experience in the application of Products, systems and assemblies specified and with approval and training of the Product manufacturers.

.1 Use only manufacturer's trained and approved erectors who have experience in the installation of the metal cladding system specified.

.2 Welding: Companies engaged in welding must be certified by Canadian Welding Bureau to CSA W47.1. Companies are to have welding procedures approved and welders qualified for base material types and thicknesses that are to be welded.

.3 Mock-ups: Provide Mock-ups in locations designated by Consultant and as required to demonstrate quality of workmanship. Maintain Mock-ups during construction in an undisturbed condition as a standard for judging the completed work.

.1 Provide Mock-ups in locations designated by Consultant and as required to demonstrate quality of workmanship and displaying typical connections of the Project. Modify site mock-up detailing if necessary in accordance with Consultant's review.

.2 Maintain Mock-ups during construction in an undisturbed condition as a standard for judging the completed work.

.3 Reviewed Mock-ups may form part of finished Work if left undisturbed at time of Substantial Performance of the Work

.4 Single Source Responsibility: Ensure primary materials provided in this Section are obtained from 1 source by a single manufacturer and secondary materials are obtained from sources recommended by primary materials manufacturers.

.5 Licensed Professionals: Employ a professional structural engineer registered in the province of Ontario, carrying minimum of $2,000,000.00 professional liability insurance to:

.1 design the components of the work of this Section requiring structural performance and their attachments to building's structure,

.2 be responsible for full assemblies and connections,

.3 be responsible for determining sizes, yield strengths, gauge thicknesses and joint spacing to allow thermal movement and loading of components in accordance with applicable codes and regulations,

.4 be responsible for production and review of Shop Drawings,

.5 inspect the work of this Section during fabrication and erection,

.6 stamp and sign each shop drawing,

.7 Provide site administration and inspection of this part of the Work.

.8 Submit certificate validating seismic assessment and field review of this part of the Work.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.

.2 Protect finish and edges using a plastic film adhered to panel in accordance with panel manufacturer's recommendations. Retain strippable protective covering on solid phenolic composite panels during installation.

.3 Deliver components, solid phenolic composite panels, and other manufactured items so as not to be damaged or deformed. Package solid phenolic composite panels for protection during transportation and handling.

.4 Unload, store, and erect solid phenolic composite panels in a manner to prevent bending, warping, twisting, and surface damage.

.5 Stack solid phenolic composite panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store solid phenolic composite panels to ensure dryness, with positive slope for drainage of water. Do not store solid phenolic composite panels in contact with other materials that might cause staining, denting, or other surface damage.

1.9 FIELD CONDITIONS

.1 Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of solid phenolic composite panels to be performed according to manufacturers' written instructions and warranty requirements.

1.10 WARRANTY

.1 Warrant work of this Section against defects and/or deficiencies in accordance with General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of Consultant and at no expense to Owner.

.1 Materials and Installation:

.1 Structural failures including rupturing, cracking, or puncturing.

.2 Deterioration of materials beyond normal weathering.

.2 Warranty Period: Ten years from date of Substantial Performance of the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Products of following manufacturers may be acceptable subject to conformance to requirements of Drawings, Schedules and Specifications:

.1 Panel Manufacturers:

.1 Abet Laminati;

.2 Fundermax c/o Façade Systems Inc;

.3 Trespa c/o Allied Technical Sales;

.4 Vivix by Formica Group c/o Engineered Assemblies;

.2 System Fabricators:

.1 Engineered Assemblies;

.2 Sobotec Ltd.;

.3 Thermal Systems KWC Ltd.;

.2 Substitution Limitations: This Specification is based on Trespa's Products.

.3 Comparable Products from manufacturers listed herein offering functionally and aesthetically equivalent products in Consultant's opinion, and subject to Consultant's review, will be considered provided they meet the requirements of this Specification.

2.2 REGULATORY REQUIREMENTS

.1 System Fire Propagation Characteristics: Provide solid phenolic composite panel system tested in accordance with CAN/ULC-S134 by an independent testing organization, and approved for use in non-combustible construction.

.2 Panel Fire Performance: Flame spread less than 25 and smoke developed less than 450, in accordance with CAN/ULC S102/S102.2 (subject to approval by Authorities Having Jurisdiction).

2.3 DESIGN AND PERFORMANCE REQUIREMENTS

.1 Architectural Drawings and details are diagrammatic and are only intended to show design concept, aesthetics, interfacing requirements, configuration, components and arrangements. They are not intended to identify or solve completely problems of thermal and structural movements, assembly framing, engineering design, fixings and anchorages.

.2 Design, fabricate and install cladding system to prevent excessive condensation interior of wall when mechanical systems are functioning under designed operating conditions.

.3 Ensure systems provided include attachment, insulation, air barrier/vapour retarder systems, necessary framing and suspension systems to support and anchor panel systems from concrete and/or metal structural framework.

.4 Moisture Management:

.1 Design system as a "Drained / back-ventilated rainscreen cladding" system in accordance with AAMA 509. Provide minimum 25 mm (1 inch) air space behind panels unless indicated otherwise on Drawings.

.2 Provide gaskets, baffles, overlaps, seals and compartmentalization where required to achieve appropriate pressure equalization in exterior envelope cavity wall design. Maintain

integrity of continuous air barrier/vapour retarder system with adjacent surrounding air barrier/vapour retarder.

.3 Incorporate means of draining moisture to exterior. Design drainage system to provide clear, internal paths of drainage of any trapped moisture within construction to exterior. Ensure weep water discharges in a manner that avoids staining of architectural finishes, collecting in puddles or formation of icicles.

.4 Provide moisture barrier as specified in this Section to protect insulation, whether specifically noted on Drawings or not.

.5 Incorporate means of draining moisture to exterior. Design drainage system to provide clear, internal paths of drainage of any trapped moisture within construction to exterior. Ensure weep water discharges in a manner that avoids staining of architectural finishes, collecting in puddles or formation of icicles.

.5 Water Leakage:

.1 Static Water Penetration: No water penetration when tested in accordance with ASTM E331 at inward static pressure differential of not less than 300 Pa (6.24 psf) positive static air pressure difference for a 15 minute duration, with a water application rate of 5 gal/ft2/hr.

.2 Dynamic Water Penetration: No uncontrolled water penetration when tested in accordance with AAMA 501 at dynamic pressure differential of not less than 300 Pa (6.24 psf) for a 15-minute duration, with water application rate of 5 gal/ft2/hr.

.3 Water leakage does not include water controlled by flashing and gutters that is drained to exterior without damage to adjacent materials or finishes.

.6 Structural Performance: Provide solid phenolic composite panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E330:

.1 Wind Loads: As indicated on Structural Drawings, based on OBC requirements for minimum probability factor for Project location.

.2 Maximum Panel Deflection between supports: ≤ L/180

.3 Structural support deflection: ≤ L/360.

.4 Design cladding to accommodate thermal movement caused by ambient temperature range in accordance with OBC requirements and to suit Project location, without causing noise, buckling, failure of joint sealants, undue stress on metal members and fasteners, of operating units, reduction of performance, and other detrimental effects.

.5 Design building envelope assemblies, members and their connections to withstand, within acceptable deflection limitations, their own weight, loads imposed by motion of operable elements, and maximum design loads and combination of loads due to snow, rain, ice, the pressure and suction of wind and internal pressure.

.6 Design cladding support system in accordance with CAN/CSA S136 for Design of Cold Formed Steel Structural Members.

.7 Design structural supports and anchorage system to maintain profiles and cladding layout.

.8 Thermal Movements: Provide assemblies that allow for thermal movements resulting from following maximum changes (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components and other detrimental effects:

.1 Temperature Change (range): 67 deg C (120 deg F), ambient; 100 deg C (180 deg F), material surfaces.

.7 Seismic Performance: Design work of this Section to withstand seismic motions determined in accordance with requirements of OBC and CAN/CSA S832.

2.4 SOLID PHENOLIC COMPOSITE PANELS (MP-3)

.1 Provide BS EN 438-6, solid phenolic wall panels fabricated from composite of solid phenolic resins molded with a homogeneous core of organic fber reinforced phenolic and one or more integrally cured surfaces of compatible thermoset nonabsorbent resins. Include attachment assembly components, panel stiffeners, and accessories required for weathertight system.

.1 Panel Nominal Thickness:

.1 Wall Applications:

.1 Exposed Fastener: 8 mm (5/16 inch)

.2 Soffit Applications: 10 mm (3/8 inch)

.2 Nominal Joint Thickness: 10 mm (3/8 inch)

.3 Panel Dimensions: As indicated on Drawings.

.4 Exterior Finish: Manufacturer’s standard UV-resistant clear topcoat.

.5 Colours: to be selected by Consultant from manufacturer's full range.

.2 Attachment Assembly Components: Formed from material compatible with panel facing.

.3 Panel Fasteners: Manufacturer’s standard exposed fasteners assembly designed to withstand design loads and pull-out strengths required for Project. In conditions where exposed fasteners are acceptable to Consultant, ensure fasteners are colour-matched to panel face.

.4 Acceptable Products:

.1 “Meteon” by Trespa;

.2 “Vivix Formica” by Engineered Assemblies;

.3 “Fundermax Exterior” by Fundermax

2.5 AUXILIARY MATERIALS

.1 Air barrier/vapour retarder Membrane: Refer to Section 07 27 14.

.1 Transition and Through-wall flashing membrane: Minimum 1.0 mm (40-mil) thick, self-adhering sheet as recommended by primary membrane manufacturer and compatible with other components of the air barrier/vapour retarder assembly.

.2 Provide air barrier/vapour retarder membrane and transition at openings in cladding or at locations where continuity is required.

.2 Water Resistant Barrier (WRB): Conforming to ASTM E2556/E2556M, UV-Resistant, 3 layer tear-resistant spun-bonded polypropylene (PP) fabric thermally bonded to polymeric middle layer with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested according to CAN/ULC S102/S102.2; and acceptable to authorities having jurisdiction. Product must be designed for mechanical attachment and for application with open-joint cladding systems.

.1 Physical and Performance Properties:

.1 Vapor Permeance: Not less than 572 ng/Pa x s x sq. m (10 perms); ASTM E96/E 96M, Desiccant Method (Procedure A).

.2 Tensile Strength: Minimum 3.5 N/mm (20 lbs/inch); ASTM D882.

.3 Water Resistance: No water penetration after 120minutes; AATC 127 or CCMC 07102.

.4 Pliability: No crack; ASTM E2556/E2556M

.5 UV-Resistance: Pass (> 90 % tensile retention after UV exposure); CCMC 07251003 (UV exposure according to ASTM G154) or DIN EN 13859.

.2 Acceptable Products:

.1 “SRP-AirOutShield UV” by SRP Canada.

.2 “DELTA®FASSADE S or DELTA®FASSADE S PLUS” by Dörken Systems, Inc.;

.3 Insulation: Refer to Section 07 21 00 for type. Thickness to suit design requirements to achieve thermal and sound attenuation requirements.

.4 Miscellaneous Metal Subframing and Furring: Sub-Girts, Z-bars etc., ASTM C645, Manufacturer's standard C- or Z-shaped sections, conforming to ASTM A653M, Grade A Zinc coating to Z275 (G90) designation. Transfer grid may be hat bars, Z-bars, adjustable Z-bars or combination of clip and Z-bar.

.1 Minimum thickness: 1.219 mm (18 ga.).

.2 Material visible after assembly of panel shall be finished to match panels.

.5 Miscellaneous Steel Shapes including Plate and Hollow Sections: CSA G40.21, Grade 300W, or ASTM A36M complete with shop applied primer of either CPMA/CISC 1-73 or CGSB 1-GP-140M.

.6 Extrusions and extrusion clips for attaching panels to substructure: purpose made aluminum. Install a separator between extrusions and sub-girts.

.7 Thermally-Broken Sub-framing: Low-conductivity thermally-broken, intermittent structural attachment insulation clips designed maintain insulation effectiveness, with adjustable depth and suitable for vertical and horizontal sub-girts.

.1 Acceptable Products:

.1 “ISO Clip” by Northern Facades Ltd.

.2 “Cascadia Clip” by Cascadia Windows

.3 “TClip Thermally Broken Façade Substructure” by Engineered Assemblies

.4 “NVelope NV1 Cladding Attachment System” by SFS Group.

.5 Approved equivalent.

.8 Panel Accessories:

.1 Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of solid phenolic composite panels unless otherwise indicated.

.2 Provide flashing and trim formed from aluminum colour-matched to solid phenolic composite panels and as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent solid phenolic composite panels.

.3 Match material and finish of solid phenolic composite panels, unless otherwise indicated.

.9 Field Touch-Up Paint: of same colour as exterior panel and as recommended by manufacturer.

.10 Isolation Coating: Bituminous paint, alkali-resistant bituminous paint or epoxy resin solution to Provide dielectric separation which will dry to be tack-free and withstand high temperatures. Cold-applied asphalt mastic complying with SSPC-Paint 12, except containing no asbestos fibers.

.11 Sealants: ASTM C920, conforming to Section 07 92 00 as recommend by manufacturer.

.12 Fasteners: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten miscellaneous metal framing members to substrates.

.1 Exposed fasteners: Series 300 stainless steel and nylon colour coated head to match substrate colour.

.2 Concealed fasteners: stainless steel Type 304 screws in accordance with manufacturer's recommendations.

2.6 FABRICATION

.1 Prior to commencement of fabrication, obtain Consultant's final approval of colours. Fabricate to manufacturer's standard assembly line production methods, incorporating unique conditions of this Project.

.2 Fabricate and finish solid phenolic composite panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

.3 Finished cladding shall be free from visible defects and accurately manufactured to dimensions of reviewed Shop Drawings.

.4 Fabricate all flashing pieces associated with and in contact with panel system from 1.57 mm (0.062”) minimum thickness aluminum sheet. Where exposed to view, finish to match adjacent panels. Use same sheet stock as exposed face sheets, pre-finished to match.

.5 Include cold rolled framing, furring, brackets, clips, hangers and incidental components as required for secure fastening and Provide weathertight installation including non-corrosive fasteners.

.6 Provide for condensation and inner wall drainage at sill members and other shapes which would otherwise tend to trap water.

2.7 FINISHES

.1 Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of Samples reviewed by Consultant. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of Samples reviewed by Consultant and are assembled or installed to minimize contrast.

.2 Painting: Concealed surfaces of aluminum and galvanized steel which would otherwise come in direct contact with structural steel, concrete, masonry shall be given a heavy coating of bituminous paint.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Site Verification of Conditions:

.1 Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation. Commencement of work implies acceptance of previously completed work.

.2 Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by solid phenolic composite panel manufacturer.

.3 Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by aluminum panel manufacturer.

.4 Notify Consultant in writing of any conditions which would be detrimental to the installation.

.5 Coordinate and verify job site dimensions affecting this Work. Submit in writing dimensions or conditions which vary from those on reviewed Shop Drawings or detrimental to installation. Obtain corrective measures from Consultant prior to installation.

.6 Verify that air-barriers/vapour-retarders have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

.7 Examine roughing-in for components and assemblies penetrating solid phenolic composite panels to verify actual locations of penetrations relative to seam locations of solid phenolic composite panels before installation.

.8 Commencement of Work implies acceptance of previously completed Work.

3.2 PREPARATION

.1 Framing: Install subgirts, base angles, sills, furring, and other miscellaneous panel support members and anchorages according to reviewed Shop Drawings, erection drawings, and manufacturer's installation instructions.

.1 Secure sub-girt units to structural supports with stainless steel or galvanized self-tapping screws. Install Work rigidly and securely.

.2 Fasten thermally broken structural clips through air barrier/vapour retarder to supporting structure in accordance with manufacturer's installation details and instructions.

.3 Weld all connections, unless otherwise permitted. For hot dipped galvanized items and where not possible, bolt or secure connections in a manner acceptable to Consultant.

.4 Erect Work true to dimensions, square, plumb, level and free from distortion or defects detrimental to appearance and performance.

.2 Insulation

.1 Install insulation to maintain continuity of thermal protection to building elements and spaces. Extend insulation in thickness indicated to cover entire wall. Comply with installation requirements in Section 07 21 00.

.2 Install insulation with adhesive and/or stick clips as specified in Section 07 21 00 to prevent movement of insulation in finished wall.

.3 Butt each insulation board against adjacent boards with joints staggered. Fit neatly with tight joints around obstructions, openings and corners. Fill voids behind flashings and trim with loose mineral wool insulation.

.3 Water Resistive Barrier (WRB):

.1 Cover exposed insulation with water-resistive barrier securely fastened to framing.

.2 Cut back barrier 13 mm (1/2 inch) on each side of the break in supporting members at expansion- or control-joint locations.

.3 Seal seams, edges, fasteners, and penetrations with manufacturer's recommended tape.

.4 Tape horizontal and vertical seams with manufacturer approved construction tape.

.5 Seal tears and cuts with manufacturer approved construction tape.

.6 Install primary cladding system as soon as possible after installation of WRB in accordance with system manufacturer's written instructions.

3.3 INSTALLATION

.1 Install solid phenolic composite panel system according to manufacturer's written instructions in orientation, sizes, and locations indicated on reviewed Shop Drawings. Conform to AAMA 509. Do not apply sealants to panel joints unless otherwise indicated.

.2 Install panels perpendicular to supports unless otherwise indicated. Anchor solid phenolic composite panels and other components of the Work securely in place, with provisions for thermal and structural movement.

.3 Following installation of insulation between "Z" girts, set panels in position and secure with stainless steel fasteners in accordance with Shop Drawing layout.

.4 Erect panels plumb, true, level and in alignment to established lines and elevations.

.5 Prepare openings for louvers, doors, windows where applicable, and as detailed. Install necessary formed closures and trim as applicable at openings and penetrations. Make cut-outs neatly by saw cutting.

.6 Flash and seal solid phenolic composite panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air barrier/vapour retarder and flashings that will be concealed by solid phenolic composite panels are installed.

.7 Where indicated on Drawings or as required to complete work of this Section, Supply and Install closures, caps, fascias, covers and trims with colour matching panel finish, where exposed.

.8 Install flashing to divert moisture to exterior.

.9 Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by solid phenolic composite panel manufacturer.

3.4 FIELD QUALITY CONTROL

.1 Manufacturer's Field Service: Engage a factory-authorized service representative to provide training and supervision of Contractor's personnel in installation of panel system at commencement of installation. Factory-authorized service representative must also:

.1 meet and discuss installation procedures and unique conditions at the Place of the Work.

.2 inspect substrate surfaces and recommend solutions to accommodate adverse conditions.

.3 periodically visit and inspect the installation and report unsatisfactory conditions to Consultant.

.4 attend final inspection and submit written certification that Products, systems and assemblies have been installed in accordance with manufacturer's requirements.

3.5 ERECTION TOLERANCES

.1 Installation Tolerances: Install solid phenolic composite panel units within installed tolerance of 6 mm in 6 m (1/4 inch in 20 feet), non-accumulative, on level, plumb, and location lines as indicated, and within 5% offset of adjoining faces and of alignment of matching profiles.

3.6 CLEANING AND PROTECTION

.1 Remove temporary protective coverings and strippable films as solid phenolic composite panels are installed, unless otherwise indicated in manufacturer's written installation instructions.

.2 On completion of solid phenolic composite panel installation, clean finished surfaces as recommended by solid phenolic composite panel manufacturer. Maintain in a clean condition during construction.

.3 After solid phenolic composite panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

.4 Replace solid phenolic composite panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

PART 1 - GENERAL

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL INSTRUCTIONS

.1 Read and conform to:

.1 the General Conditions and the Supplementary Conditions of the Contract;

.2 Division 1 requirements and documents referred to therein.

1.3 SUMMARY

.1 Work Included: Provide labour, materials, products, equipment and services to complete the aluminum composite panel system work specified herein. This includes, but is not necessarily limited, to:

.1 aluminum composite material panel system for walls and soffits,

.2 miscellaneous framing components,

.3 related trims and extrusions, including but not limited to flashings, splicers, end caps, trims and closures,

.4 transitions and connections between air barrier/vapour retarder membranes.

.2 Related Requirements: Specifications throughout the entirety of Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.4 REFERENCES

.1 Definitions:

.1 ACM: aluminum composite material cladding formed by joining two thin metal skins to polyethylene or fire-retardant core and bonded under precise temperature, pressure, and tension.

.2 PER: Pressure equalized rainscreen system; rainscreen system designed for no water intrusion with equal pressure between interior system cavity and outside cladding barrier.

.2 Reference Standards: Latest published editions of reference standards listed in this Section in effect as of the closing date and time of the Request for Tenders for the Contract, including any amendments adopted, are applicable unless otherwise indicated.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meetings:

.1 Prior to starting work of this Section, convene a pre-installation meeting at Project site to review Project requirements and site conditions with pertinent parties. Conform to requirements of Section 01 30 00.

.2 Review methods and procedures related to aluminum composite material panel installation, including manufacturer's written instructions.

.3 Examine support conditions for compliance with requirements of Contract Documents, including alignment between and attachment to structural members.

.4 Review flashings, special siding details, wall penetrations, openings, and condition of other construction that affect aluminum composite material panels.

.5 Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.

.6 Review temporary protection requirements for aluminum composite material panel assembly during and after installation.

.7 Review procedures for repair of panels damaged after installation.

.8 Document proceedings, including corrective measures and actions required, and Supply copy of record to each participant.

.2 Coordination:

.1 Coordinate metal panel assemblies with air barrier/vapour retarder, rain drainage work, flashing, trim, and construction of girts, soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

.2 Coordinate with related trades to maintain continuity of building air barrier/vapour retarder system at locations including but not limited to roofing, cladding and building openings.

1.6 SUBMITTALS

.1 Product Data: Submit manufacturer's literature and data sheets for each type of material provided under this Section for Project in accordance with requirements of Section 01 30 00.

.1 Ensure data sheets provide required information including detailed instructions for installing as well as maintaining, preserving, and keeping materials in clean and safe conditions. Provide adequate warning of maintenance practices or cleaning agents detrimental to specified materials.

.2 Safety Data Sheets (SDS): Submit SDS for inclusion in Operation and Maintenance Manual specified in Section 01 70 00, for adhesives, sealants and any other material designated by Consultant.

.3 Shop Drawings: Submit Shop Drawings for work of this Section in accordance with Section 01 30 00.

.1 Ensure Shop Drawings show fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, supports and anchorages, attachment system, insulation type and thickness, trim, flashings, air seals, closures, and accessories; and special details including paths of pressure equalization and cavity drainage.

.2 Distinguish between factory, shop, and field-assembled work.

.3 Show provisions for structural and thermal movement between metal cladding and adjacent materials.

.4 Samples: Submit samples in accordance with Section 01 30 00. Submit following samples:

.1 Manufacturer’s colour charts or chips illustrating full range of colours, finishes and textures.

.2 300 mm x 300 mm (12 inch x 12 inch) aluminum composite panel in thickness specified, including clips, anchors, supports, fasteners, closures and other panel accessories necessary for assembly.

.3 300 mm (12 inch) each of extruded and formed trims.

.5 Engineering Data:

.1 Submit engineering data substantiating that specified structural requirements of the metal cladding assembly meet minimum requirements of CSA S136.

.2 Submit design calculations signed and sealed by professional engineer registered in the province of Ontario, attesting to ability of preformed metal cladding system to withstand specified design loads including inward and outward pressures under fastenings to structure.

.6 Sample Warranties: Submit samples of extend warranties specified in this Section.

.7 Certificates:

.1 Submit written certification from manufacturer that the Products, systems, and assemblies have been installed in accordance with manufacturer's requirements.

.8 Maintenance Data:

.1 Provide maintenance data for cleaning and maintenance of aluminum finishes for incorporation into manual specified in Section.

.2 Submit instructions for touch-up, repair and removal of panels.

.9 Extra Materials: Submit sealed can of touch-up paint (minimum 1 l), properly identified for each panel colour provided.

1.7 QUALITY ASSURANCE

.1 Qualifications:

.1 Manufacturers: Provide Products for Work of this Section by manufacturer with minimum 10 years' experience in the manufacture of such materials.

.2 Installers: Provide work of this Section executed by competent installers with minimum 5 years' experience in the application of Products, systems and assemblies specified and with approval and training of the Product manufacturers.

.1 Use only manufacturer's trained and approved erectors who have experience in the installation of the metal cladding system specified.

.2 Welding: Companies engaged in welding must be certified by Canadian Welding Bureau to CSA W47.1. Companies are to have welding procedures approved and welders qualified for base material types and thicknesses that are to be welded.

.3 Mock-ups: Provide Mock-ups in locations designated by Consultant and as required to demonstrate quality of workmanship. Maintain Mock-ups during construction in an undisturbed condition as a standard for judging the completed work.

.1 Provide Mock-ups in locations designated by Consultant and as required to demonstrate quality of workmanship and displaying typical connections of the Project. Modify site mock-up detailing if necessary in accordance with Consultant's review.

.2 Maintain Mock-ups during construction in an undisturbed condition as a standard for judging the completed work.

.3 Reviewed Mock-ups may form part of finished Work if left undisturbed at time of Substantial Performance of the Work

.4 Single Source Responsibility: Ensure primary materials provided in this Section are obtained from 1 source by a single manufacturer and secondary materials are obtained from sources recommended by primary materials manufacturers.

.5 Licensed Professionals: Employ a professional structural engineer registered in the province of Ontario, carrying minimum of $2,000,000.00 professional liability insurance to:

.1 design the components of the work of this Section requiring structural performance and their attachments to building's structure,

.2 be responsible for full assemblies and connections,

.3 be responsible for determining sizes, yield strengths, gauge thicknesses and joint spacing to allow thermal movement and loading of components in accordance with applicable codes and regulations,

.4 be responsible for production and review of Shop Drawings,

.5 inspect the work of this Section during fabrication and erection,

.6 stamp and sign each shop drawing,

.7 Provide site administration and inspection of this part of the Work.

.8 Submit certificate validating seismic assessment and field review of this part of the Work.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.

.2 Protect finish and edges using a plastic film adhered to panel in accordance with panel manufacturer's recommendations. Retain strippable protective covering on aluminum composite material panels during installation.

.3 Deliver components, aluminum composite material panels, and other manufactured items so as not to be damaged or deformed. Package aluminum composite material panels for protection during transportation and handling.

.4 Unload, store, and erect aluminum composite material panels in a manner to prevent bending, warping, twisting, and surface damage.

.5 Stack aluminum composite material panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store aluminum composite material panels to ensure dryness, with positive slope for drainage of water. Do not store aluminum composite material panels in contact with other materials that might cause staining, denting, or other surface damage.

1.9 FIELD CONDITIONS

.1 Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of aluminum composite material panels to be performed according to manufacturers' written instructions and warranty requirements.

1.10 WARRANTY

.1 Warrant work of this Section against defects and/or deficiencies in accordance with General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of Consultant and at no expense to Owner.

.1 Materials and Installation: for period of 5 years from date of Substantial Performance of the Work. Defects include but are not limited to; buckling, opening of seams, and structural failure.

.2 Panel Finish: for period of 30 years from date of Substantial Performance of the Work. Defects include but are not limited to: discoloration, finish peeling, bond failure and extensive colour fading.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Products of following manufacturers may be acceptable subject to conformance to requirements of Drawings, Schedules and Specifications:

.1 Aluminum Sheet Manufacturer:

.1 3A Composites USA Inc/Alucobond;

.2 Alcoa Inc./Reynobond;

.3 Alcotex, Inc.;

.4 ALPOLIC, Division of Mitsubishi Chemical America, Inc.;

.5 Alucoil/Larson;

.2 Panel Fabricators:

.1 Architectural Metals North America;

.2 Kanalco Ltd.;

.3 Northern Facades/Flynn Canada Ltd.;

.4 Ontario Panelization;

.5 Sobotec Ltd.;

.6 Vicwest;

.2 Substitution Limitations: This Specification is based on Northern Facades/Flynn Canada Ltd.'s Products.

.3 Comparable Products from manufacturers listed herein offering functionally and aesthetically equivalent products in Consultant's opinion, and subject to Consultant's review, will be considered provided they meet the requirements of this Specification.

2.2 REGULATORY REQUIREMENTS

.1 System Fire Propagation Characteristics: Provide aluminum composite material panel system tested in accordance with CAN/ULC-S134 by an independent testing organization, and approved for use in non-combustible construction.

.2 Panel Fire Performance: Flame spread less than 25 and smoke developed less than 450, in accordance with CAN/ULC S102/S102.2 (subject to approval by Authorities Having Jurisdiction).

2.3 DESIGN AND PERFORMANCE REQUIREMENTS

.1 Architectural Drawings and details are diagrammatic and are only intended to show design concept, aesthetics, interfacing requirements, configuration, components and arrangements. They are not intended to identify or solve completely problems of thermal and structural movements, assembly framing, engineering design, fixings and anchorages.

.2 Design, fabricate and install cladding system to prevent excessive condensation interior of wall when mechanical systems are functioning under designed operating conditions.

.3 Ensure systems provided include attachment, insulation, air barrier/vapour retarder systems, necessary framing and suspension systems to support and anchor panel systems from concrete and/or metal structural framework.

.4 Rain Screen Principle:

.1 Ensure system is designated as a “pressure-equalized rainscreen” system based on testing according to AAMA 508.

.2 Design exterior envelope cladding systems based on Rain Screen Principle advocated by NRCC and Provide for drainage of water entering building envelope wall systems.

.3 Design for compartments at corners to achieve appropriate pressure equalization in exterior cladding system.

.4 Provide gaskets, baffles, overlaps, seals and compartmentalization where required to achieve appropriate pressure equalization in exterior envelope cavity wall design. Maintain integrity of continuous air barrier/vapour retarder system with adjacent surrounding air barrier/vapour retarder.

.5 Incorporate means of draining moisture to exterior. Design drainage system to provide clear, internal paths of drainage of any trapped moisture within construction to exterior. Ensure weep water discharges in a manner that avoids staining of architectural finishes, collecting in puddles or formation of icicles.

.5 Water Leakage:

.1 Static Water Penetration: No water penetration when tested in accordance with ASTM E331 at inward static pressure differential of not less than 300 Pa (6.24 psf) positive static air pressure difference for a 15 minute duration, with a water application rate of 5 gal/ft2/hr.

.2 Dynamic Water Penetration: No uncontrolled water penetration when tested in accordance with AAMA 501 at dynamic pressure differential of not less than 300 Pa (6.24 psf) for a 15-minute duration, with water application rate of 5 gal/ft2/hr.

.3 Water leakage does not include water controlled by flashing and gutters that is drained to exterior without damage to adjacent materials or finishes.

.6 Structural Performance: Provide aluminum composite material panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E330:

.1 Wind Loads: As indicated on Structural Drawings, based on OBC requirements for minimum probability factor for Project location.

.2 Maximum Panel Deflection between supports: ≤ L/180

.3 Maximum Deflection of Individual Panels: ≤ L/60.

.4 At connection points of framing members to anchors, anchor deflection in any direction shall not exceed 1.6 mm (1/16 inch).

.5 Ensure stress on panel skin does not exceed manufacturer’s recommended maximum value to avoid permanent deformation.

.6 Design cladding to accommodate thermal movement caused by ambient temperature range in accordance with OBC requirements and to suit Project location, without causing noise, buckling, failure of joint sealants, undue stress on metal members and fasteners, of operating units, reduction of performance, and other detrimental effects.

.7 Design building envelope assemblies, members and their connections to withstand, within acceptable deflection limitations, their own weight, loads imposed by motion of operable elements, and maximum design loads and combination of loads due to snow, rain, ice, the pressure and suction of wind and internal pressure.

.8 Design cladding support system in accordance with CAN/CSA S136 for Design of Cold Formed Steel Structural Members.

.9 Design structural supports and anchorage system to maintain profiles and cladding layout.

.10 Thermal Movements: Provide assemblies that allow for thermal movements resulting from following maximum changes (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components and other detrimental effects:

.1 Temperature Change (range): 67 deg C (120 deg F), ambient; 100 deg C (180 deg F), material surfaces.

.7 Seismic Performance: Design work of this Section to withstand seismic motions determined in accordance with requirements of OBC and CAN/CSA S832.

2.4 ALUMINUM COMPOSITE METAL PANELS (MP-2)

.1 Provide factory-formed and -assembled, aluminum composite material wall panels fabricated from two metal facings that are bonded to a solid, extruded thermoplastic core; formed into profile for installation method indicated. Include attachment assembly components, panel stiffeners, and accessories required for weathertight system.

.1 Panel Thickness: Not less than 4 mm (0.157 inch).

.2 Core: Fire retardant (FR).

.3 Exterior Finish: Three-coat fluoropolymer.

.4 Colours (MP-2A and MP-2B): Allow for 2 colours to be selected by Consultant from manufacturer's full range.

.2 Attachment Assembly Components: Formed from material compatible with panel facing.

.3 Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide concealed fasteners unless indicated otherwise. In conditions where exposed fasteners are acceptable to Consultant, ensure fasteners are obscured in panel joinery.

.4 Basis-of-Design: “Accumet” by Northern Facades/Flynn Canada Ltd. or approved equivalent as follows:

.1 “Alumitex™ AFS” by Ontario Panelization;

.2 “AM 2000” by Architectural Metals North America

.3 “Architectural Panel System #3” by Vicwest;

.4 “SL-2000” by Sobotec Ltd.;

.5 Approved equivalent by Kanalco Ltd.

2.5 AUXILIARY MATERIALS

.1 Air barrier/vapour retarder Membrane: Refer to Section 07 27 14.

.1 Transition and Through-wall flashing membrane: Minimum 1.0 mm (40-mil) thick, self-adhering sheet as recommended by primary membrane manufacturer and compatible with other components of the air barrier/vapour retarder assembly.

.2 Provide air barrier/vapour retarder membrane and transition at openings in cladding or at locations where continuity is required.

.2 Insulation: Refer to Section 07 21 00 for type. Thickness to suit design requirements to achieve thermal and sound attenuation requirements.

.3 Miscellaneous Metal Subframing and Furring: Sub-Girts, Z-bars etc., ASTM C645, Manufacturer's standard C- or Z-shaped sections, conforming to ASTM A653M, Grade A Zinc coating to Z275 (G90) designation. Transfer grid may be hat bars, Z-bars, adjustable Z-bars or combination of clip and Z-bar.

.1 Minimum thickness: 1.219 mm (18 ga.).

.2 Material visible after assembly of panel shall be finished to match panels.

.4 Miscellaneous Steel Shapes including Plate and Hollow Sections: CSA G40.21, Grade 300W, or ASTM A36M complete with shop applied primer of either CPMA/CISC 1-73 or CGSB 1-GP-140M.

.5 Extrusions and extrusion clips for attaching panels to substructure: purpose made aluminum. Install a separator between extrusions and sub-girts.

.6 Thermally-Broken Sub-framing: Low-conductivity thermally-broken, intermittent structural attachment insulation clips designed maintain insulation effectiveness, with adjustable depth and suitable for vertical and horizontal sub-girts.

.1 Acceptable Products:

.1 “ISO Clip” by Northern Facades Ltd.

.2 “Cascadia Clip” by Cascadia Windows

.3 “TClip Thermally Broken Façade Substructure” by Engineered Assemblies

.4 “NVelope NV1 Cladding Attachment System” by SFS Group.

.5 Approved equivalent.

.7 Panel Accessories:

.1 Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of aluminum composite material panels unless otherwise indicated.

.2 Provide flashing and trim formed from same material as aluminum composite material panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent aluminum composite material panels.

.3 Match material, gauge thickness and finish of metal panels, unless otherwise indicated.

.8 Field Touch-Up Paint: of same colour as exterior panel and as recommended by manufacturer.

.9 Isolation Coating: Bituminous paint, alkali-resistant bituminous paint or epoxy resin solution to Provide dielectric separation which will dry to be tack-free and withstand high temperatures. Cold-applied asphalt mastic complying with SSPC-Paint 12, except containing no asbestos fibers.

.10 Sealants: ASTM C920, conforming to Section 07 92 00 as recommend by manufacturer.

.11 Fasteners: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten miscellaneous metal framing members to substrates.

.1 Exposed fasteners: Series 300 stainless steel and nylon colour coated head to match substrate colour.

.2 Concealed fasteners: stainless steel Type 304 screws in accordance with manufacturer's recommendations.

2.6 FABRICATION

.1 Prior to commencement of fabrication, obtain Consultant's final approval of colours. Fabricate to manufacturer's standard assembly line production methods, incorporating unique conditions of this Project.

.2 Fabricate metal panels for designated façade and trim sections to profiles and patterns indicated. Manufacture panels from sufficiently thick material in combination with backing and/or reinforcing to produce metal cladding required to suit design requirements indicated on Drawings. Fabricate all components of system in factory and ready for field installation.

.3 Fabricate with straight lines, square corners and/or smooth bends, free from twists or warps, kinks, dents and other similar imperfections which may affect appearance and/or serviceability. Exposed edges and ends of metal shall be dressed smooth, free from sharp ends. Connections and joints exposed to element shall be constructed to exclude water.

.4 Finished cladding shall be free from visible defects and accurately manufactured to dimensions of reviewed Shop Drawings.

.5 Make connections rigid and fail-safe wherever practicable, and make completely concealed.

.6 Coordinate openings required by other trades and Provide openings in panels prior to finishing whenever possible. Reinforce perimeter of openings to meet design requirements and as recommended by manufacturer.

.7 Fabricate all flashing pieces associated with and in contact with panel system from 1.57 mm (0.062 inch) minimum thickness aluminum sheet. Where exposed to view, finish to match adjacent panels. Use same sheet stock as exposed face sheets, pre-finished to match.

.1 Panel Tolerances:

.1 Panel Bow: Not to exceed 0.8% of panel overall dimension in width or length.

.2 Length & Width: +0 mm, -3.2 mm (1/8 inch).

.3 Squareness: 1.3 mm per linear m (0.02 inch per ft).

.4 Panel fabrication tolerances for length or width: maximum of ± 1 mm (3/64 inch) and variation from theoretical diagonal dimensions of finished panel cannot exceed 3 mm (1/8 inch).

.5 Joints: to not vary more than 5% of their dimensioned width at any location along full joint length and to not be wavy, out of line, or of different width from panel to panel.

.6 Maximum deviation from vertical and horizontal alignment of erected panels: 6 mm (1/4 inch) in (20') non-accumulative

.8 Include cold rolled framing, furring, brackets, clips, hangers and incidental components as required for secure fastening and Provide weathertight installation including non-corrosive fasteners.

.9 Provide for condensation and inner wall drainage at sill members and other shapes which would otherwise tend to trap water.

.10 Prior to commencement of fabrication, obtain Consultant's final approval of colours. Fabricate to manufacturer's standard assembly line production methods, incorporating unique conditions of this Project.

2.7 FINISHES

.1 Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

.2 Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of Samples reviewed by Consultant. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of Samples reviewed by Consultant and are assembled or installed to minimize contrast.

.1 Colour variation: no more than 2E (CMC) when measured in accordance with AATCC 173, "CMC: Calculation of Small Colour Differences for Acceptability."

.2 Ensure entire project is manufactured from single color coil paint run to ensure color uniformity.

.3 Where metallic colours are used, ensure panel grain is maintained.

.3 Exposed Panel Finish: Three-Coat Fluoropolymer conforming to AAMA 2605 containing not less than 70 percent PVDF resin by weight in both colour coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

.1 Basis-of-Design: “Duranar XL” by PPG or approved equivalent by Sherwin Williams (formerly Valspar).

.4 Painting: Concealed surfaces of aluminum and galvanized steel which would otherwise come in direct contact with structural steel, concrete, masonry shall be given a heavy coating of bituminous paint.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Site Verification of Conditions:

.1 Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation. Commencement of work implies acceptance of previously completed work.

.2 Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by aluminum composite material wall panel manufacturer.

.3 Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by aluminum composite material wall panel manufacturer.

.4 Notify Consultant in writing of any conditions which would be detrimental to the installation.

.5 Coordinate and verify job site dimensions affecting this Work. Submit in writing dimensions or conditions which vary from those on reviewed Shop Drawings or detrimental to installation. Obtain corrective measures from Consultant prior to installation.

.6 Verify that air-barriers/vapour-retarders have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

.7 Examine roughing-in for components and assemblies penetrating aluminum composite material panels to verify actual locations of penetrations relative to seam locations of aluminum composite material panels before installation.

.8 Examine and verify structural components to ensure walls and openings are within specified tolerance and structure is plumb within 1:1000 of overall height.

.9 Commencement of Work implies acceptance of previously completed Work.

3.2 PREPARATION

.1 Framing: Install subgirts, base angles, sills, furring, and other miscellaneous panel support members and anchorages according to reviewed Shop Drawings, erection drawings, and manufacturer's installation instructions.

.1 Secure sub-girt units to structural supports with stainless steel or galvanized self-tapping screws. Install Work rigidly and securely.

.2 Fasten thermally broken structural clips through air barrier/vapour retarder to supporting structure in accordance with manufacturer's installation details and instructions.

.3 Weld all connections, unless otherwise permitted. For hot dipped galvanized items and where not possible, bolt or secure connections in a manner acceptable to Consultant.

.4 Erect Work true to dimensions, square, plumb, level and free from distortion or defects detrimental to appearance and performance.

.2 Insulation

.1 Install insulation to maintain continuity of thermal protection to building elements and spaces. Extend insulation in thickness indicated to cover entire wall. Comply with installation requirements in Section 07 21 00.

.2 Install insulation with adhesive and/or stick clips as specified in Section 07 21 00 to prevent movement of insulation in finished wall.

.3 Butt each insulation board against adjacent boards with joints staggered. Fit neatly with tight joints around obstructions, openings and corners. Fill voids behind flashings and trim with loose mineral wool insulation.

3.3 INSTALLATION

.1 Install aluminum composite material panels according to manufacturer's written instructions and AAMA 508 in orientation, sizes, and locations indicated on reviewed Shop Drawings.

.2 Install panels perpendicular to supports unless otherwise indicated. Anchor aluminum composite material panels and other components of the Work securely in place, with provisions for thermal and structural movement.

.3 Following installation of insulation between "Z" girts, set panels in position and secure with stainless steel fasteners in accordance with Shop Drawing layout.

.4 Erect panels plumb, true, level and in alignment to established lines and elevations.

.5 Use concealed fastenings only, except where exposed fastenings are specifically permitted by Consultant in writing.

.6 Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

.7 Locate and space fastenings in uniform vertical and horizontal alignment in accordance with manufacturer’s instructions.

.8 Shim or otherwise plumb substrates receiving metal panels.

.9 Prepare openings for louvers, doors, windows where applicable, and as detailed. Install necessary formed closures and trim as applicable at openings and penetrations. Make cut-outs neatly by saw cutting.

.10 Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air barrier/vapour retarder and flashings that will be concealed by metal panels are installed.

.11 Where indicated on Drawings or as required to complete work of this Section, Supply and Install closures, caps, fascias, covers and trims with colour matching panel finish, where exposed.

.12 Install flashing to divert moisture to exterior.

.13 Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by aluminum composite material panel manufacturer.

3.4 FIELD QUALITY CONTROL

.1 Manufacturer's Field Service: Engage a factory-authorized service representative to provide training and supervision of Contractor's personnel in installation of panel system at commencement of installation. Factory-authorized service representative must also:

.1 meet and discuss installation procedures and unique conditions at the Place of the Work.

.2 inspect substrate surfaces and recommend solutions to accommodate adverse conditions.

.3 periodically visit and inspect the installation and report unsatisfactory conditions to Consultant.

.4 attend final inspection and submit written certification that Products, systems and assemblies have been installed in accordance with manufacturer's requirements.

3.5 ERECTION TOLERANCES

.1 Installation Tolerances: Shim and align aluminum composite material wall panel units within installed tolerance of 1:1000 (1 inch in 80 feet), non-accumulative, on level, plumb, and location lines as indicated, and within 5% offset of adjoining faces and of alignment of matching profiles.

3.6 CLEANING AND PROTECTION

.1 Remove temporary protective coverings and strippable films as aluminum composite material panels are installed, unless otherwise indicated in manufacturer's written installation instructions.

.2 On completion of aluminum composite material panel installation, clean finished surfaces as recommended by aluminum composite material panel manufacturer. Maintain in a clean condition during construction.

.3 After aluminum composite material panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

.4 Replace aluminum composite material panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

PART 1 - GENERAL

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL INSTRUCTIONS

.1 Read and conform to:

.1 the General Conditions and the Supplementary Conditions of the Contract .

.2 Division 01 requirements and documents referred to therein.

1.3 SUMMARY

.1 Work Included: Provide labour, materials, products, equipment and services to complete the Insulated-Core Metal Wall Panels work specified herein. This includes, but is not necessarily limited, to:

.1 Preformed pre-insulated composite soffit cladding system complete with prefinished steel faced factory insulated core.

.2 Structural steel framing members required for support of preformed pre-insulated composite cladding system not shown on Drawings.

.3 Sealants as required between metal panel components and between panels and adjoining construction.

.4 Metal flashing and trims are required for insulated composite cladding system.

.5 Miscellaneous ancillary items such as feature strips, sills, drips and similar components.

.6 Auxiliary materials required for complete construction.

.2 Related Requirements: Specifications throughout the entirety of Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.4 REFERENCES

.1 Reference Standards: Latest published editions of reference standards listed in this Section in effect as of the closing date and time of the Request for Tenders for the Contract, including any amendments adopted, are applicable unless otherwise indicated.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meetings:

.1 Prior to starting work of this Section, convene a pre-installation meeting at Project site to review Project requirements and site conditions with pertinent parties. Conform to requirements of Section 01 30 00.

.2 Review methods and procedures related to insulated-core metal wall panels installation, including manufacturer's written instructions.

.3 Examine support conditions for compliance with requirements of Contract Documents, including alignment between and attachment to structural members.

.4 Review flashings, special siding details, wall penetrations, openings, and condition of other construction that affect insulated-core metal wall panels.

.5 Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.

.6 Review temporary protection requirements for insulated-core metal wall panel assembly during and after installation.

.7 Review procedures for repair of panels damaged after installation.

.8 Document proceedings, including corrective measures and actions required, and Supply copy of record to each participant.

.2 Coordination:

.1 Coordinate metal panel assemblies with air barrier/vapour retarder, rain drainage work, flashing, trim, and construction of girts, soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

.2 Coordinate with related trades to maintain continuity of building air barrier/vapour retarder system at locations including but not limited to roofing, cladding and building openings.

1.6 SUBMITTALS

.1 Product Data: Submit manufacturer's literature and data sheets for each type of material provided under this Section for Project in accordance with requirements of Section 01 30 00.

.1 Ensure data sheets provide required information including detailed instructions for installing as well as maintaining, preserving, and keeping materials in clean and safe conditions. Provide adequate warning of maintenance practices or cleaning agents detrimental to specified materials.

.2 Safety Data Sheets (SDS): Submit SDS for inclusion in Operation and Maintenance Manual specified in Section 01 70 00, for adhesives, sealants and any other material designated by Consultant.

.3 Shop Drawings: Submit Shop Drawings for work of this Section in accordance with Section 01 30 00.

.1 Ensure Shop Drawings show fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, supports and anchorages, attachment system, insulation type and thickness, trim, flashings, air seals, closures, and accessories; and special details including paths of pressure equalization and cavity drainage.

.2 Distinguish between factory, shop, and field-assembled work.

.3 Show provisions for structural and thermal movement between metal cladding and adjacent materials.

.4 Samples: Submit samples in accordance with Section 01 30 00. Submit following samples:

.1 Manufacturer’s colour charts or chips illustrating full range of colours, finishes and textures.

.2 300 mm x 300 mm (12 inch x 12 inch) aluminum plate in thickness specified, including clips, anchors, supports, fasteners, closures and other panel accessories necessary for assembly.

.3 Include panel assembly sample not less than 300 mm x 300 mm (12 inch x 12 inch) showing 4-way joint system.

.4 300 mm (12 inch) each of extruded and formed trims.

.5 Sample Warranties: Submit samples of extend warranties specified in this Section.

.6 Maintenance Data:

.1 Provide maintenance data for cleaning and maintenance of aluminum finishes for incorporation into manual specified in Section.

.2 Submit instructions for touch-up, repair and removal of panels.

.7 Evaluation and Testing Reports:

.1 Submit manufacturer's certified and approved performance requirements conforming to Code requirements and authorities having jurisdiction.

.2 Submit comprehensive test reports performed by qualified testing agency for following criteria:

.1 Fire test response characteristics;

.2 Structural Design Compliance;

.3 Air Leakage;

.4 Vapour permeance;

.5 Water Penetration

.6 Acoustics.

1.7 QUALITY ASSURANCE

.1 Qualifications:

.1 Manufacturers: Provide Products for Work of this Section by manufacturer with minimum 10 years' experience in the manufacture of such materials.

.2 Installers: Provide work of this Section executed by competent installers with minimum 5 years' experience in the application of Products, systems and assemblies specified and with approval and training of the Product manufacturers.

.1 Use only manufacturer's trained and approved erectors who have experience in the installation of the metal cladding system specified.

.2 Single Source Responsibility: Ensure primary materials provided in this Section are obtained from 1 source by a single manufacturer and secondary materials are obtained from sources recommended by primary materials manufacturers.

.3 Welding of structural components: performed by fabricator having minimum certification of Division 1 of W47.1 and CSA W59.

.4 Mock-ups: Provide Mock-ups in locations designated by Consultant and as required to demonstrate quality of workmanship. Maintain Mock-ups during construction in an undisturbed condition as a standard for judging the completed work.

.1 Provide Mock-ups in locations designated by Consultant and as required to demonstrate quality of workmanship and displaying typical connections of the Project. Modify site mock-up detailing if necessary in accordance with Consultant's review.

.2 Maintain Mock-ups during construction in an undisturbed condition as a standard for judging the completed work.

.3 Reviewed Mock-ups may form part of finished Work if left undisturbed at time of Substantial Performance of the Work

.5 Licensed Professionals: Employ a professional structural engineer registered in the province of Ontario, carrying minimum of $2,000,000.00 professional liability insurance to:

.1 design the components of the work of this Section requiring structural performance and their attachments to building's structure,

.2 be responsible for full assemblies and connections,

.3 be responsible for determining sizes, yield strengths, gauge thicknesses and joint spacing to allow thermal movement and loading of components in accordance with applicable codes and regulations,

.4 be responsible for production and review of *Shop Drawings*,

.5 inspect the work of this Section during fabrication and erection,

.6 stamp and sign each shop drawing,

.7 *Provide* site administration and inspection of this part of the *Work*.

.8 Submit certificate validating seismic assessment and field review of this part of the *Work*.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.

.2 Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact. Package composite wall panels for protection against transportation damage. Provide markings to identify components consistently with Drawings.

.3 Protect finish and edges using a plastic film adhered to panel in accordance with panel manufacturer's recommendations.

.4 Exercise care in unloading, storing and installing panels to prevent bending, warping, twisting and surface damage.

.5 Store components and materials in accordance with panel manufacturer's recommendations. Store components off ground to prevent twisting, bending and defacement. Slope to shed moisture.

1.9 WARRANTY

.1 Warrant work of this Section against defects and/or deficiencies in accordance with General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of Consultant and at no expense to Owner.

.1 Materials and Installation: for period of 5 years from Substantial Performance of the Work. Defects include but are not limited to; buckling, opening of seams, and structural failure.

.2 Panel Finish: for period of 30 years from Substantial Performance of the Work. Defects include but are not limited to: discoloration, finish peeling, bond failure and extensive colour fading.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Products of following manufacturers may be acceptable subject to conformance to requirements of Drawings, Schedules and Specifications:

.1 Kingspan Insulated Panels Ltd.

.2 Metl-Span

.3 Norbec Panels

.4 Vicwest

.5 Zero-Lock Enterprises Ltd.

.2 Substitution Limitations: This Specification is based on Kingspan's Products.

.3 Comparable Products from manufacturers listed herein offering functionally and aesthetically equivalent products in Consultant's opinion, and subject to Consultant's review, will be considered provided they meet the requirements of this Specification.

2.2 REGULATORY REQUIREMENTS

.1 System Fire Propagation Characteristics: Provide insulated-core metal wall panel system tested in accordance with CAN/ULC-S134 by an independent testing organization, and approved for use in non-combustible construction.

.2 Panel Fire Performance: Flame spread less than 25 and smoke developed less than 450, in accordance with CAN/ULC S102/S102.2 (subject to approval by Authorities Having Jurisdiction).

2.3 DESIGN AND PERFORMANCE REQUIREMENTS

.1 Architectural Drawings and details are diagrammatic and are only intended to show design concept, aesthetics, interfacing requirements, configuration, components and arrangements. They are not intended to identify or solve completely problems of thermal and structural movements, assembly framing, engineering design, fixings and anchorages.

.2 Design, fabricate and install cladding system to prevent excessive condensation interior of wall when mechanical systems are functioning under designed operating conditions.

.3 Ensure systems provided include attachment, insulation, air barrier/vapour retarder systems, necessary framing and suspension systems to support and anchor panel systems from concrete and/or metal structural framework.

.4 Rain Screen Principle:

.1 Design exterior envelope cladding systems based on Rain Screen Principle advocated by NRCC and Provide for drainage of water entering building envelope wall systems.

.2 Incorporate means of draining moisture to exterior. Design drainage system to provide clear, internal paths of drainage of any trapped moisture within construction to exterior. Ensure weep water discharges in a manner that avoids staining of architectural finishes, collecting in puddles or formation of icicles.

.5 Structural Requirements: Design structural supports and anchorage system to maintain profiles, panel layouts, live loads and dead load requirements.

.1 Design to accommodate thermal movement of materials.

.2 Design to allow for sufficient tolerances to accommodate building tolerances and deflections.

.3 Design load/deflection criteria and fastening pattern shall be verified by tests in accordance with ASTM E72 requirements.

.1 Panel Deflection: L/180 max.

.2 Structural Framing Wind Load Deflection: L/240 max and not greater than 19 mm (3/4 inch)

.3 Structural Framing Vertical Deflection: L/720 max and not greater than 13 mm (½ inch)

.4 Loads: In accordance with requirements of OBC including wind, snow and build up snow loads

.5 Fatigue Test: Ensure there is no evidence of metal/insulation interface delamination when the panel is tested by simulated wind loads (positive and negative loads), when applied for 2,000,000 alternate cycles of L/180 deflection.

.4 Anchors: Designed for supporting 1.5 times design loads, minimum

.6 Design corner pieces, trim, flashing and caps symmetrical with cladding panel lines and overall design.

.7 Thermal and Moisture Performance:

.1 Thermal Resistance: Minimum R value to meet or exceed design requirements; but not less than RSI 1.32 per 25 mm (R7.5 per inch) when tested in accordance with requirements of ASTM C1363 and ASTM C518.

.2 Maximum Air Leakage Rate (ASTM E283): 0.001 cfm/ft2 at air pressure differential of 0.96 kPA (20.0 psf)

.8 Water Penetration: Static Water Penetration: no uncontrolled water penetration through the panel joints at a static pressure of 0.96 kPA (20.0 psf) when tested per ASTM E331.

.9 Acoustic Requirements Test: Minimum STC 25 when tested in accordance ASTM E90.

.10 Humidity Test: Panels shall exhibit no delamination or metal interface corrosion when subjected to +140°F (+60°C) temperature and 100% relative humidity for a total of 1200 hours (50 days).

2.4 MATERIALS

.1 Pre-insulated composite cladding - Non-rated applications (MP-1): Panels composed of exterior and interior steel faces with insulating core meeting following requirements:

.1 Insulating Core: foamed in place multi-component 95% closed cell polyisocyanurate insulation conforming to ASTM C1289, having following physical properties:

.1 Minimum density: 35 to 45 kg/m3 (2.2 to 2.8 pcf) per ASTM D1622

.2 Compressive strength: 0.16 MPa (23 psi) per ASTM D1621

.3 Minimum RSI (R) Value: 1.32 per 25 mm (7.5 per 1 inch) in accordance with ASTM C518

.4 Surface Burning Characteristics: Flame Spread ≤ 25, Smoke Developed ≤ 250 per CAN/ULC S102/S102.2.

.2 Exterior and Interior Panel Faces:

.1 Steel coil material: ASTM A755, Grade 33, G90 galvanized steel in accordance with ASTM A653 and ASTM A924 or AZ50 Galvalume/ Zincalume (55% aluminum, 45% zinc) in accordance with ASTM A792.

.2 Steel Thickness: Minimum 0.759 mm (22 ga) with orange peel texture.

.3 Panel Thickness: 100 mm (4 inch) – R30.

.4 Colours: to be selected by Consultant from manufacturer's full range.

.5 Basis-of-design: “KS Series Micro Rib – with Quadcore Technology Insulated Panel” by Kingspan or approved equal.

2.5 ACCESSORIES

.1 Fasteners:

.1 Cadmium plated steel self-drilling fasteners with neoprene washer, as recommended by manufacturer.

.2 Size: As recommended by manufacturer.

.2 Perimeter Trims: Required trim and metal flashing to be steel with same coating, color, and gauge as exterior face of insulated metal wall panel.

.1 Extruded perimeter trim: Shall be extruded aluminum 6063-T5 alloy with spray applied PVF coating in same color as exterior face of insulated metal wall panel.

.3 Sealants: Factory applied butyl, non-skinning/curing type as recommended by manufacturer.

.1 Preformed Sealant (where required): Expanding foam sealant; size expanding sealant at 25% uncompressed dimension to suit joint openings and to create an effective air and moisture barrier. Provide factory applied adhesive on preformed sealant faces.

.4 Panel Edges: Tongue and groove.

.5 Butyl Tape: As recommended by manufacturer.

.6 Flexible Membrane and Fastening Bars:

.1 Provide minimum 1.0 mm (0.004 inch) thick, reinforced, continuous self-adhesive compatible SBS Modified bitumen flexible membrane air seal closures recommended by manufacturer.

.2 Fastening Bars: Provide minimum 6 mm x 25 mm (1/4 inch x 1 inch) hot dip galvanized steel, continuous fastening bars.

2.6 FABRICATION

.1 Fabricate components of system in factory and ready for field installation. Radius-formed components shall be bent to true circular curve. Fabricate metal panels for designated facade complete with trims to profiles and finish required to meet design requirements. Form panel lines, breaks and angles sharp, true with adjacent surfaces and free from warp and buckle. Fabricate sharply cut edges with no displacement of sheet or protrusion of core.

.2 Fabricate with straight lines, square corners and/or smooth bends, free from twists or warps, kinks, dents and other similar imperfections which may affect appearance and/or serviceability. Exposed edges and ends of metal shall be dressed smooth, free from sharp ends. Connections and joints exposed to element shall be constructed to exclude water.

.3 Carry out complete fabrication including welding, grinding, punching and like to finish work. Make welds clean, sound and solid, free from defects. Grind smooth, free from marks.

.4 Finished cladding shall be free from visible defects and accurately manufactured.

.5 Make connections rigid and fail-safe wherever practicable, and make completely concealed.

.6 Coordinate openings required by other trades and Provide openings in panels prior to finishing whenever possible. Reinforce perimeter of openings to meet design requirements and as recommended by manufacturer.

.7 Fabricate all flashing pieces associated with and in contact with wall panel system. Use same sheet stock as exposed face sheets, pre-finished to match.

.8 Include cold rolled framing, furring, brackets, clips, hangers and incidental components as required for secure fastening and Provide weathertight installation including non-corrosive fasteners.

.9 Provide for condensation and inner wall drainage at sill members and other shapes which would otherwise tend to trap water.

2.7 FINISHES

.1 Exterior and Interior Finish System:

.1 Exterior Facing Finish: Fluropolymer (PVDF) Two Coat system, 0.8 mil primer with 0.8 mil Kynar 500 (70%) or Hylar 5000 colour top coat ; Minimum Coating thickness: 1.6 mil.

.2 Interior Facing Finish: Manufacturer's standard white polyester.

.3 Strippable Coating: applied prior to roll forming and embossing as recommended by manufacturer.

.4 Colour: to be selected by Consultant at later date from the manufacturer’s standard range.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Site Verification of Conditions:

.1 Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation. Commencement of work implies acceptance of previously completed work.

.2 Examine all structural steel before beginning installation to ensure that all supporting members are straight, level, plumb, properly braced and satisfactory for panel installation.

.3 Do not begin installation until unsatisfactory conditions are corrected.

.4 Start of installation shall signify structure and adjacent conditions as being proper and acceptable.

.2 Wall framing alignment:

.1 Ensure proper alignment of wall framing members to assure proper fit up of overall construction.

.2 Wall panels installed over misaligned intermediate wall framing members will cause deflection (bending) of panels. Deflected panels will have bending stress which may cause panel face rippling or buckling when combined with conditions of thermal stress and wind stress.

.3 Prior to starting panel installation, check wall framing for straightness and alignment, and also check to verify that wall panels can be installed without interference.

.4 Conform to specified wall framing alignment tolerance. Intermediate framing members may require more critical alignment tolerances then specified tolerances.

.5 Notify Consultant in writing of any conditions which would be detrimental to the installation. Commencement of work implies acceptance of previously completed work.

3.2 INSTALLATION

.1 Provide framing, supports and cast-in anchorage plates, as necessary, to support prefinished preformed composite wall panel.

.2 Provide the work of this Section in accordance with panel manufacturer's instructions

.3 Provide the work of this Section set in alignment, plumb, straight to true planes.

.4 Remove strippable coatings.

.5 Provide a 10 mm (3/8 inch) wide x 25 mm (1 inch) deep perimeter joint at the interface of adjacent, dissimilar materials / construction for caulking. Coordinate with Section 07 92 00.

.6 **[Metal Soffits:**

.1 Provide metal soffits constructed from metal panels as indicated.

.2 **Provide a complete suspension system as required to support and anchor the metal soffits.]**

.7 Butyl Weather Barrier Sealant:

.1 Apply non-skinning butyl sealant as shown on shop drawings and manufacturer's installation instructions as necessary to establish the vapor barrier for the panels.

.2 Use non-skinning butyl tube sealant only for tight metal-to-metal contact.

.3 Do not use non-skinning butyl tube sealant to bridge gaps.

.8 Sealant For Exposed Joints:

.1 Clean and prime surfaces to receive exterior exposed sealants in accordance with sealant manufacturer's recommendations.

.2 sealant manufacturer's recommendations for joint width-to-depth ratio, application temperature range, size and type of backer rod, and compatibility of materials for adhesion.

.3 Direct contact between butyl and silicone sealants is not permitted.

.9 Flexible Membrane and Fastening Bars:

.1 Provide flexible membrane air seal closures to complete the air seal system from the work of this Section to adjacent parts of the Work.

.2 Provide flexible membrane laps with adhesive overlap seal minimum 150 mm (6 inch) in width.

.3 Provide fastening bars to securely clamp the flexible membrane and to seal it against the air seal sheet and panel lap sealants of the insulated metal panels.

.10 Panel Trim and Panel Flashings:

.1 Place trim and trim fasteners only as indicated per details on reviewed shop drawings.

.2 Include panel trim in continuous air seal system of insulated metal panel system.

.3 Field drill weep holes where appropriate in horizontal trim where indicated on shop drawings.

.4 Place continuous strip of butyl tape or butyl sealant on closure trims for the length of the panel to be covered as indicated on shop drawings.

.11 Place panel fasteners through pre-punched holes in attachment clips, concealed within the joint of the panel. Secure units to the structural supports. Space clips as recommended by manufacturer or otherwise indicated on the approved shop drawings.

3.3 CLEANING AND CARE

.1 After completing panel installation, strip protective film as designated, Panel surfaces shall be free of deleterious material including dirt;

.2 Wipe finishes surfaces of filling caused by drilling or cutting to prevent any discolouration or rust stains resulting from installation process.

3.4 FIELD QUALITY CONTROL

.1 Manufacturer's Field Service: Engage a factory-authorized service representative to provide training and supervision of Contractor's personnel in installation of panel system at commencement of installation. Factory-authorized service representative must also:

.1 meet and discuss installation procedures and unique conditions at the Place of the Work.

.2 inspect substrate surfaces and recommend solutions to accommodate adverse conditions.

.3 periodically visit and inspect the installation and report unsatisfactory conditions to Consultant.

.4 attend final inspection and submit written certification that Products, systems and assemblies have been installed in accordance with manufacturer's requirements.

.2 **[Testing Requirements:**

.1 Testing Agency: Engage independent testing and inspection agency acceptable to the Consultant to perform field tests and inspections and to prepare reports of findings.

.1 **Field Water Test: After completing portion of metal wall panel assembly including accessories and trim, test a 2-bay area selected by the Consultant for water penetration in accordance with AAMA 501.2.]**

.3 Manufacturer’s Field Services:

.1 Ensure manufacturer’s representative carries out regular inspections of system during installation.

.2 Ensure walls and openings are within +3 mm (+ 1/8 inch) and structure is plumb within 1:1000 of overall height.

.3 Have manufacturer’s representative and Contractor carry out final inspection and approval of completed work.

3.5 CLEANING AND PROTECTION

.1 Remove temporary protective coverings and strippable films as insulated-core metal wall panels are installed, unless otherwise indicated in manufacturer's written installation instructions.

.2 On completion of insulated-core metal wall panel installation, clean finished surfaces as recommended by insulated-core metal wall panel manufacturer. Maintain in a clean condition during construction.

.3 Replace insulated-core metal wall panel that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SEE ADD#4 Q#99

PART 1 - GENERAL

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL INSTRUCTIONS

.1 Read and conform to:

.1 The General Conditions and Supplementary Conditions of the Contract as amended in the Contract Documents.

.2 Division 01 requirements and any additional documents referred to therein.

1.3 SUMMARY

.1 Work Included: Provide labour, materials, products, equipment and services to complete the modified bituminous membrane roofing work specified herein. This includes, but is not necessarily limited, to:

.1 Styrene-butadiene-styrene (SBS) modified bituminous membrane roofing.

.2 Cap-sheet materials

.3 Base-sheet materials

.4 Flashing sheet materials

.5 Roof Sheathing Boards and insulation overlay boards.

.6 Vapour retarders

.7 Roof insulation.

.8 Auxiliary roofing membrane materials required for complete installation.

.2 Related Requirements: Specifications throughout the entirety of Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.4 REFERENCES

.1 Reference Standards: Unless otherwise stipulated by a specific publication date in this Section or the Ontario Building Code, the latest published editions of reference standards in force as of the Bid Closing Deadline for the Project, including adopted amendments, are applicable.

.2 Definitions:

.1 Roofing Terminology: Refer to CRCA and NRCA Roofing Specifications Manuals and ASTM D1079 for definition of terms related to roofing work in this Section.

.2 Roof System: the organization and securement of various interacting materials (apart from the supporting deck structure), designed and installed to prevent the transmission of water through the system into the conditioned space of a building (adapted from ASTM D6630)

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meetings:

.1 Prior to starting work of this Section, convene a pre-installation meeting at Project site to review Project requirements and site conditions with pertinent parties. Conform to requirements of Section 01 30 00.

.2 Meet with Owner, Consultant, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.

.3 Review methods and procedures related to roofing installation, including manufacturer's written instructions.

.4 Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

.5 Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.

.6 Review structural loading limitations of roof deck during and after roofing.

.7 Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.

.8 Review governing regulations and requirements for insurance and certificates if applicable.

.9 Review temporary protection requirements for roofing system during and after installation.

.10 Review roof observation and repair procedures after roofing installation.

1.6 SUBMITTALS

.1 Product Data: Submit manufacturer's literature and data sheets for each type of material provided under this Section for Project in accordance with requirements of Section 01 30 00.

.1 Ensure data sheets provide required information including detailed instructions for installing as well as maintaining, preserving, and keeping materials in clean and safe conditions. Provide adequate warning of maintenance practices or cleaning agents detrimental to specified materials.

.2 Safety Data Sheets (SDS): Submit SDS for inclusion in Operation and Maintenance Manual specified in Section 01 70 00, for adhesives, sealants and any other material designated by Consultant.

.3 Shop Drawings: Submit Shop Drawings for work of this Section in accordance with Section 01 30 00 for roofing system. Include plans, elevations, sections, details, and attachments to other work.

.1 Base flashings and membrane terminations.

.2 Tapered insulation, including slopes.

.3 Crickets, saddles, and tapered edge strips, including slopes.

.4 Insulation fastening patterns for corner, perimeter, and field-of-roof locations.

.4 Samples: Submit samples in accordance with Section 01 30 00 for the following:

.1 Coloured cap sheet (other than black).

.2 Flashing sheet, colour required.

.3 Walkway pads or rolls, of colour required.

.5 Manufacturer's Certificate:

.1 Submit letter signed by manufacturer certifying that products meet or exceed specified requirements. Submit evidence of meeting performance requirements by submitting additional test and evaluation reports as well as conformance to applicable listings.

.2 Compatibility: Compatibility between components of roofing system is essential. Provide written declaration to Consultant stating that materials and components, as assembled in system, meet this requirement.

.6 Warranties: Submit copies of warranties specified in this Section for Consultant's review.

.7 System Test Reports: Submit reports substantiating conformance with requirements of CSA A123.21 based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of membrane roofing system.

.8 Wind Uplift Resistance Calculations: Provide calculations or reports sealed by a Professional Engineer, licensed to practice in Province of Ontario, demonstrating that roof assembly design meets wind uplift requirements specified in this Section. Alternatively, wind uplift calculations prepared by roofer or roof manufacturer determined using NRC's Wind-RCI calculators or equivalent tools demonstrating compliance will be deemed acceptable.

1.7 CLOSEOUT SUBMITTALS

.1 Maintenance Data: Submit in accordance with Section 01 70 00 for roofing system to include in maintenance manuals.

.1 As a minimum include following: Project name, project location, dated and executed copy of manufacturer's warranty, name, address and phone number of nearest manufacturer's representative.

.2 Include recommendations for periodic inspections, care and maintenance. Identify common causes of damage with instructions for temporary patching until permanent repair can be made.

1.8 QUALITY ASSURANCE

.1 Qualifications:

.1 Manufacturers: Provide Products for Work of this Section by manufacturer with minimum 10 years' experience in the manufacture of such materials.

.1 Manufacturer shall employ trained technical service representatives, independent of sales.

.2 Manufacturer shall be an ISO 9001 registered company (or equivalent quality assurance system) and provide a 'Quality Compliance Certificate (QCC)' for reporting/confirming tested values of modified bitumen membrane materials upon request.

.2 Installers: Provide work of this Section executed by competent installers with minimum 5 years' experience in the application of Products, systems and assemblies specified and with approval and training of the Product manufacturers.

.1 Ensure roofer is qualified and approved by membrane manufacturer and is a member in good standing in OIRCA or CRCA or local provincial roofing contractor's association.

.2 Single Source Responsibility: Ensure primary materials provided in this Section are obtained from 1 source by a single manufacturer and secondary materials are obtained from sources recommended by primary materials manufacturers.

.1 Mixing Products across from various manufacturers without manufacturer's or Consultant's written permission is not permitted.

.3 Mock-ups:

.1 Construct mock-up 10 m² (100 sq ft.) minimum size showing typical lap joint, one inside corner and one outside corner.

.2 Reviewed mock-up may form part of complete work if undisturbed at time of Substantial Performance of the Work.

.3 Allow 24 hours for inspection of mock-up by Consultant before proceeding with roofing work.

1.9 DELIVERY, STORAGE, AND HANDLING

.1 Comply with manufacturer's written instructions for handling, storing, and protecting during installation as well as any specific Consultant's instructions.

.2 Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

.3 Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.

.1 Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

.4 Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

.5 Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

.6 Fire Protection:

.1 Respect safety measures described in manufacturer's literature as well as requirements of authorities having jurisdiction.

.2 Store combustible materials away from heat and open flames. Protect and store materials in dry, ventilated area away from welding flame, spark or other combustible materials.

.3 Keep two dry chemical or foam-type fire extinguishers acceptable to authorities having jurisdiction, fully charged and in operable condition within easy access of torching applications and at every location where open flames are used.

.4 Verify no vent pipes venting flammable fumes (e.g. fuel storage tanks) are located in area of work.

.5 Protect against self-starting fires at end of daily roofing operations. Use a heat detector gun to spot smoldering or concealed fires. Examine roof for hot spots one hour after completion of roofing operations, especially at flashings and around roof penetrations. Maintain fire watch for one hour after each day's roofing operations cease.

1.10 PROJECT CONDITIONS

.1 Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

.1 Do not apply any part of roofing system over damp materials, or during a period of damp weather.

.2 Install roofing on dry deck, free of snow and ice. Use only dry materials and apply only during weather conditions that will not promote the intrusion of moisture into roofing system.

1.11 WARRANTY

.1 Extended Warranty: Manufacturer's standard or modified form, total system, non-pro-rated, "No-Dollar-Limit", transferrable warranty in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period. Failure includes roof leaks resulting from manufacturing and/or workmanship defects or deficiencies.

.1 Warranty Period: 20 years from date of Substantial Performance of the Work.

.2 Installer Warranty: Submit roofing Installer's warranty, on OIRCA or CRCA standard warranty form, signed by Installer, covering the Work of this Section, including all components of membrane roofing system such as membrane roofing, base flashing, roof insulation, fasteners, insulation overlay boards, Roof Sheathing Boards, vapour retarders, and walkway products, for the following:

.3 .1 Warranty Period: Two years from date of Substantial Performance of the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Products of following manufacturers may be acceptable subject to conformance to requirements of Drawings, Schedules and Specifications:

.1 Henry Company

.2 IKO.

.3 Johns Manville.

.4 Siplast, Inc.

.5 Soprema Inc.

.2 Comparable Products from manufacturers listed herein offering functionally and aesthetically equivalent products in Consultant’s opinion, and subject to Consultant’s review, will be considered provided they meet the requirements of this Specification.

2.2 REGULATORY REQUIREMENTS

.1 Exterior Fire-Test Exposure: CAN/ULC-S107, Class A, unless otherwise required by authorities having jurisdiction; for application and roof slopes indicated on Drawings and Schedules, as determined by testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

2.3 DESIGN AND PERFORMANCE REQUIREMENTS

.1 Roof arrangements and configurations provided in Contract Documents are indicative and are intended to convey design intent only. Final roof assemblies must be determined in consultation with manufacturer based on wind uplift criteria specified herein and manufacturer's standard tested assemblies. Indicate all variations and deviations from specified assemblies to Consultant clearly during Shop Drawing review and seek acceptance prior to commencing construction activities.

.2 Installed membrane roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Membrane roofing and base flashings shall remain watertight.

.3 Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.

.4 Roofing System Design: Provide membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to requirements of Ontario Building Code:

.1 Corner Uplift Pressure: Refer to Structural Drawings.

.2 Perimeter Uplift Pressure: Refer to Structural Drawings.

.3 Field-of-Roof Uplift Pressure: Refer to Structural Drawings.

.5 CSA Listings: Provide roofing membrane, base flashings, and component materials that comply with requirements of CSA A123.21.

2.4 BASE SHEET ROOFING MEMBRANE (TORCHED APPLICATION)

.1 Composite-Reinforced Base Sheet Roofing Membrane: SBS-modified asphalt sheet (reinforced with composite glass/polyester); smooth surfaced; suitable for application method specified.

.1 CGSB 37-GP-56M; Classification: Type 2 – Covered Roofing, Class P - plain surfaced, Grade 2 - heavy duty service or equivalent to CSA A123.23; Type C.

.2 Reinforcement: combination of polyester and glass fibres to ASTM D6162, having nominal weight of 160 g/m²

.3 Top/bottom surfaces: Manufacturer’s standard suitable for application indicated.

.4 Application: Torched

.5 Acceptable Products:

.1 “Sopraply Base 520” by Soprema Inc

.2 "Torchflex TP-HD-FF-BASE" by IKO

.3 “DynaPly® HW” T1 by Johns Manville.

.4 “Paradiene 20 TG” by Siplast

2.5 CAP SHEET ROOFING MEMBRANE (TORCHED APPLICATION)

.1 High SRI Composite-Reinforced Field Cap Sheet Roofing Membrane: SBS-modified asphalt sheet (reinforced with composite glass/polyester); granule surfaced; suitable for application method specified.

.1 CGSB 37-GP-56M; Classification: Type 2 – Exposed roofing, Class G – Granule surface, Grade 2 – Heavy-duty or equivalent to CSA A123.23; Type B.

.2 Reinforcement: combination of polyester and glass fibres to ASTM D6162, having nominal weight of 160 g/m²

.3 Top/bottom surfaces: Manufacturer’s standard suitable for application indicated.

.4 Solar Reflectance Index (SRI): As specified in this Section.

.5 Granule colour: Bright white.

.6 Application: Torched.

.7 Acceptable Products:

.1 "SOPRASTAR FLAM HD GR" by Soprema Inc

.2 "DynaWeld FR CR (coated)" by Johns Manville

.3 "Armourcool Granular TP-HD " by IKO

.4 "Parafor 30 TG BW" by Siplast

.5 "modifiedPLUS® NP250gT4 with Solarflex Coating" by Henry Company

2.6 BASE SHEET FLASHING MEMBRANE

.1 Flashing Base Sheet Roofing Membrane: SBS-modified asphalt sheet (reinforced with polyester fabric or composite glass fibre/polyester); smooth surfaced; suitable for application method specified.

.1 CGSB 37-GP-56M; Classification: Type 2 – Covered Roofing, Class P - plain surfaced, Grade 2 - heavy duty service or equivalent to CSA A123.23; Type B or C.

.2 Reinforcement: nonwoven polyester fibres to ASTM D6164, having nominal weight of 180 g/m² or combination of polyester and glass fibres to ASTM D6162, having nominal weight of 160 g/m²

.3 Top/bottom surfaces: Manufacturer's standard suitable for application indicated.

.4 Application: Cold-applied/Self-Adhesive

.5 Acceptable Products: as recommended by manufacturer.

2.7 CAP SHEET FLASHING MEMBRANE

.1 Identical to field roofing cap sheet membrane.

2.8 ROOF SHEATHING BOARDS

.1 Provide roof sheathing board as specified in this Section and conforming to the following characteristics:

.1 Combustibility: non-combustible in accordance with ULC CAN4-S114-M.

.2 Fire-test response characteristics (CAN/ULC-S102/S102.2-M):

.1 Flame spread: 0,

.2 smoke developed: 0

.3 Mould Resistance: Rating of 10, no mould growth after four weeks exposure when tested in accordance with ASTM D3273.

.4 Material to act as thermal barrier in accordance with UL 1256/ CAN/ULC-S126-M.

.5 Maximum size: 1220 mm x 1220 mm (84' x 84').

.2 Following types are acceptable:

.1 Glass-Mat Roof Sheathing Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, Type X, 16 mm (5/8 inch) thick, factory primed.

.1 Application: as recommended by manufacturer.

.2 Acceptable Products:

.1 "DensDeck Prime with EONIC Technology" by Georgia-Pacific LLC.

.2 Approved equivalent by CGC Inc.

.2 Fibre-Reinforced Roof Sheathing Board: ASTM C 1278/C 1278M, cellulosic-fibre-reinforced, water-resistant gypsum substrate, Type X, 16 mm (5/8 inch) thick.

.1 Application: as recommended by manufacturer.

.2 Acceptable Products:

.1 "Securock® - Brand Gypsum-Fiber Roof Board" by CGC Inc.

.2 Approved equivalent.

.3 Fasteners: Factory-coated steel fasteners and metal plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening roof sheathing board to roof deck.

2.9 VAPOUR RETARDER (AVB-3)

.1 Self-Adhering-Sheet Vapour Retarder: Tri-laminate woven polyethylene film laminated to layer of SBS-modified bitumen, minimum 0.80- mm (31.5-mil) total thickness; maximum permeance rating of 6 ng/Pa x s x sq. m (0.1 perm); self-adhered, with slip-resisting surface and release film backing. Provide primer when recommended by vapour retarder manufacturer.

.1 Acceptable Products:

.1 "Sopravap'r" by Soprema Inc.

.2 "JM Vapor Barrier SA" by Johns Manville.

.3 "IKO M.V.P" by IKO Industries.

.4 "Vapor Block SA" by Henry Company

.5 Approved equivalent by Siplast

2.10 ROOF INSULATION (INS-8)

.1 Provide preformed roof insulation boards manufactured or approved by roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated.

.2 Polyisocyanurate Board Insulation: CAN/ULC-S704, Type 3, Class 3 and ASTM C 1289, Type II, Class 2, Grade 2 inorganic glass-fibre mat facer on both major surfaces.

.1 Compressive strength: minimum 138 kPA (20 psi).

.2 Minimum RSI (R) Value: 1.0 per 25 mm (5.7 per 1 inch) in accordance with CAN/ULC-S770 based on Long Term Thermal Resistance (LTTR) R-value.

.3 Thickness: As indicated on Drawings

.4 Application: Cold-Adhered.

.5 Acceptable Products:

.1 "Sopra-ISO Plus" by Soprema Inc.

.2 "ENRGY 3® CGF" Johns Manville.

.3 "IKOTherm III" by IKO Industries Inc.

.4 "Paratherm Poly ISO" by Siplast

.5 Approved equivalent by Atlas Roofing Corporation.

.3 Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of not less than 1:48 (1/4 inch per 12 inches) unless otherwise indicated. Refer to Drawings for specific slopes. Tapered insulation to be of identical composition as roof insulation board.

.4 Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.11 INSULATION OVERLAY BOARD

.1 Provide insulation overlay board as specified in this Section and conforming to the following characteristics:

.1 Combustibility: non-combustible in accordance with ULC CAN4-S114-M.

.2 Fire-test response characteristics (CAN/ULC-S102/S102.2-M):

.1 Flame spread: 0,

.2 smoke developed: 0

.3 Mould Resistance: Rating of 10, no mould growth after four weeks exposure when tested in accordance with ASTM D3273.

.4 Maximum size: 1220 mm x 1220 mm (4’ x 4’).

.2 Following types are acceptable:

.1 Mineral fortified, asphaltic roof insulation overlay board with glass fibre facers.

.1 Application: Cold-Adhered.

.2 Thickness: 6 mm (1/4 inch

.3 Acceptable Products:

.1 “Sopraboard” by Soprema Inc.

.2 “Protectoboard” by IKO Industries.

.3 “Protecto Board” or “HAL Board” by Siplast

.2 Laminated Overlay Board: System consisting of non-woven reinforced SBS modified bitumen membrane base ply factory laminated to 13 mm (1/2 inch) thick high density (HD) polyisocyanurate board as acceptable in lieu of separate insulation overlay boards.

.1 Application: Fully-adhered.

.2 Basis-of-Design: “2-1Soprasmart ISO HD” by Soprema Inc. or Equivalent.

2.12 WALKWAYS

.1 Walkway Pads: Polyester reinforced SBS modified bitumen pads with slip-resisting mineral-granule surface, manufactured as a traffic pad for foot traffic and acceptable to roofing system manufacturer, 5 mm (3/16 inch) thick, minimum.

.1 Acceptable Products:

.1 “Soprawalk” by Soprema Inc. or approved equivalent.

.2 “DynaTred” by Johns Manville.

.3 “Paratread” by Siplast

.4 “Torchflex TP-250-Cap” by IKO

.5 Approved Equivalent.

.2 Pad Size: Manufacturer's standard type.

.3 Granule Colour: Contrasting colour as selected by Consultant at a later date.

.2 Roof Pavers: CSA A23.1/A23.2 Heavyweight, hydraulically pressed, concrete units, square edged manufactured for use as plaza deck pavers; minimum average cube compressive strength 50 MPa (7250 psi), with no individual unit less than 45 MPa (6525 psi).

.1 Size: 610 mm x 610 mm x 45 mm (24 inch x 24 inch x 1-3/4 inch)

.2 Finish: non-slip finish – shot blast.

.3 Colour: As selected by Consultant from manufacturer's full range.

.1 Colour Pigment Material Standard: Comply with ASTM C 979.

.4 Freeze/Thaw Deicing Salt Resistance: Required.

.5 Water Absorption: not greater than 5 percent.

.6 SRI: Provide Products having minimum Solar Reflective Index (SRI) values as follows:

.1 Initial: Not less than 80

.2 3-year test results: Not less than 78.

.7 Acceptable Products: "Solar Reflective Slabs" by Brooklin Concrete Products or approved equivalent.

.8 Provide pavers at traffic concentration points (i.e. roof hatches, access doors, rooftop ladders, etc.), regardless of traffic frequency or whether or not these are explicitly indicated on Drawings.

.3 Paver Supports:

.1 Paver manufacturer's standard SBR rubber, high-density polyethylene, or polyurethane paver support assembly, including fixed-height, adjustable or stackable pedestals, shims, and spacer tabs for flush joint spacing sufficient to allow for expansion and contraction while avoiding tripping hazards.

.1 Acceptable Manufacturers:

.1 "Paver Pedestals" by Soprema Inc.

.2 Approved equivalent by Bison Innovative Products

.3 Approved Equivalent.

.2 Polystyrene: Extruded polystyrene insulation as fabricated with both sides having a matrix of drainage, size as required to support pavers.

.1 Grooves: 13 mm x 13 mm (½ inch x ½ inch); staggered

2.13 ASSOCIATED ROOFING WORKS

.1 Provide required associated roofing accessories and supports as necessary to provide complete roofing work and support roof equipment shown on Drawings. This includes but is not limited to supports for:

.1 Mechanical equipment, electrical equipment, pipes, guy wire, stack vents, relief vents, fall restraint anchors and similar components.

.2 Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

.3 Provide seismically reinforced supports where required by Authorities Having Jurisdiction.

.4 Acceptable Manufacturers: Thaler Metal Industries Ltd. Or approved equivalent.

2.14 ACCESSORIES

.1 Provide roof accessories recommended by insulation manufacturer for intended use and compatibility with roofing.

.2 Insultation Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.

.3 Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:

.1 Bead-applied, low-rise, multicomponent urethane adhesive.

.2 Full-spread spray-applied, low-rise, two-component urethane adhesive.

.3 Acceptable Product:

.1 “Duotack” by Soprema Inc.;

.2 “Millenium Adhesive” by IKO Industries;

.3 “MJM Green 2-Part UIA Canister” by Johns Manville.

.4 Approved equivalent

.4 Insulation Cant Strips: ASTM C 208, Type II, Grade 1, cellulosic-fibre insulation board.

.1 Acceptable Products:

.1 “FesCant Plus” by Johns Manville.

.2 Approved Equivalent by SOPREMA.

.3 Approved Equivalent by IKO Industries.

.5 Wood Nailer Strips: Comply with requirements in Section 06 10 00.

.6 Tapered Edge Strips: ASTM C 208, Type II, Grade 1, cellulosic-fibre insulation board.

.7 Low-VOC Primer: water-based polymer emulsion primer

.1 Acceptable Products:

.1 “Elastocol Stick Zero” or “Elastocol H2O” by Soprema Inc.;

.2 “SAM LVC” by IKO Industries

.3 “TA 119” by Siplast

.4 “Blueskin LVC Primer” by Henry Company

.5 Approved equivalent

.8 Adhesive for membranes: one-part, asbestos-free, low-VOC, low-odour, cold-applied, elastomeric adhesive compatible with roofing membrane and base flashings.

.1 Acceptable Products:

.1 “Colply EF Adhesive” and “Colply EF Flashing Adhesive” by Soprema Inc.

.2 "Cold Gold Field Adhesive" and “Cold Gold Flashing Adhesive” by IKO Industries.

.3 “MBR Cold Adhesive” by Johns Manville.

.4 “SFT Flashing Cement” by Siplast

.5 "MB 80-11 Flashing Adhesive" by Henry Company.

.6 Approved Equivalent.

.9 Liquid-Applied Flashing: Low-VOC resin-based, seamless, reinforced waterproofing system flashing that is compatible with adjacent materials.

.1 Provide at all flashing details including, but not limited to, mechanical equipment, roof/wall penetrations and similar locations.

.2 Acceptable Products:

.1 "Alsan Flashing" by Soprema Inc.

.2 "MS Detail" by IKO Industries.

.3 "PermaFlash" by Johns Manville.

.10 Mastic Sealant: CAN/CGSB-37.29, Polyisobutylene, plain or modified bitumen; nonhardening, nonmigrating, non-skinning, and nondrying.

.11 Board Fasteners: Factory-coated steel fasteners and metal plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening roofing components to substrate; tested by manufacturer for required pullout strength, and acceptable to roofing system manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Site Verification of Conditions:

.1 Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation. Commencement of work implies acceptance of previously completed work.

.2 Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:

.1 Verify that roof openings and penetrations are in place and curbs are set and braced and that roof drain bodies are securely clamped in place.

.2 Verify that wood cants, blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.

.3 Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Section 05 31 00, Steel Decking.

.4 Verify that deck is securely fastened with no projecting fasteners.

.3 Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

.1 Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

.2 Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

.3 Prime surface of concrete deck with approved primer and allow primer to dry. Refer to product data sheet for coverage and application information.

3.3 INSTALLATION, GENERAL

.1 Install roofing membrane system according to roofing system manufacturer's written instructions and applicable recommendations in CRCA's roofing specifications.

.2 Start installation of roofing membrane in presence of roofing system manufacturer's technical personnel.

.3 Coordinate installing roofing system so components of the roofing membrane system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is forecast.

.1 Provide tie-offs at end of each day's work to cover exposed roofing membrane sheets with a course of coated felt set in roofing cement or hot roofing asphalt with joints and edges sealed.

.2 Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system.

.3 Remove and discard temporary seals before beginning work on adjoining roofing.

.4 Substrate-Joint Penetrations: Prevent roofing asphalt and adhesives from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction.

3.4 ROOF SHEATHING BOARD INSTALLATION

.1 Install Roof Sheathing Board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt Roof Sheathing Boards together.

.1 Fasten Roof Sheathing Board to top flanges of steel deck according to recommendations in FM Approvals' "RoofNav" and FM Global Loss Prevention Data Sheet 1-29 for specified Windstorm Resistance Classification.

.2 Fasten Roof Sheathing Board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to membrane roofing system manufacturers' written instructions.

3.5 VAPOUR RETARDER INSTALLATION

.1 Self-Adhering Sheet Vapour Retarder: Prime substrate if required by manufacturer. Install self-adhering sheet vapour retarder, side and end lapping each sheet a minimum of 100 mm (4 inches) and 150 mm (6 inches), respectively. Seal laps by rolling.

.2 Completely seal vapour retarder at terminations, obstructions, and penetrations to prevent air movement into membrane roofing system.

3.6 INSULATION INSTALLATION

.1 Comply with roofing system manufacturer's written instructions for installing roof insulation.

.2 Mechanically fasten base layer to substrate according to roofing system manufacturer's written instructions.

.3 Nailer Strips: Mechanically fasten 89-mm actual- (4-inch nominal-) width wood nailer strips of same thickness as insulation perpendicular to sloped roof deck at the following spacing:

.1 4.88 m (16 feet) apart for roof slopes steeper than 1:12 (1 inch per 12 inches) but less than 3:12 (3 inches per 12 inches).

.2 1220 mm (48 inches)] apart for roof slopes steeper than 3:12 (3 inches per 12 inches).

.4 Insulation Cant Strips: Install and secure preformed 45-degree insulation cant strips at junctures of roofing membrane system with vertical surfaces or angle changes more than 45 degrees.

.5 Install tapered insulation under area of roofing to conform to slopes indicated on Drawings and Schedules.

.6 Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 6 mm (1/4 inch) with insulation.

.1 Cut and fit insulation within 6 mm (1/4 inch) of nailers, projections, and penetrations.

.7 Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 75 mm (3 inches) or more, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 150 mm (6 inches) in each direction.

.8 Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

.9 Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.

.10 Adhered Insulation: Install each layer of insulation and adhere to substrate as follows:

.1 Set each layer of insulation in a solid mopping of hot roofing asphalt.

.2 Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.

[Mechanically Fastened Insulation: Install each layer of insulation and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.

.3 Fasten insulation according to requirements in FM Approvals' "RoofNav" for specified Windstorm Resistance Classification.

.11 Mechanically Fastened and Adhered Insulation: Install first layer of insulation to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.

.1 Fasten first layer of insulation according to requirements in FM Approvals' "RoofNav" for specified Windstorm Resistance Classification.

.2 Fasten first layer of insulation to resist uplift pressure at corners, perimeter, and field of roof.

.3 Set each subsequent layer of insulation in a solid mopping of hot roofing asphalt.

.4 Set each subsequent layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.

.12 Install insulation overlay boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints a minimum of 150 mm (6 inches) in each direction from joints of insulation below. Loosely butt insulation overlay boards together. Tape joints if required by roofing system manufacturer.

.1 Fasten insulation overlay boards according to requirements in FM Approvals' "RoofNav" for specified Windstorm Resistance Classification.

.2 Apply hot roofing asphalt to underside, and immediately bond insulation overlay board to substrate.

.13 Install laminated insulation overlay boards in a shingle fashion (to prevent back water laps) over insulation/substrate with long joints in continuous straight lines with end joints butted and aligned

with the 1-inch membrane overlapped onto the adjacent board. Fasten insulation overlay board in accordance to test approval, the letter of intent to warrant and project specification. Seal side laps and install manufacturer's recommended lapping tape, centered over the aligned end joints.

3.7 ROOFING MEMBRANE INSTALLATION, GENERAL

.1 Install roofing membrane system according to roofing system manufacturer's written instructions and applicable recommendations in CRCA's Roofing Specification Manual.

.2 Start installation of roofing membrane in presence of roofing system manufacturer's technical personnel.

.3 Where roof slope exceeds 1:12 (1 inch per 12 inches), install roofing membrane sheets parallel with slope. Refer to manufacturers steep slope installation requirements.

.1 Backnail roofing membrane sheets to substrate according to roofing system manufacturer's written instructions.

.4 Cooperate with testing agencies engaged or required to perform services for installing roofing system.

.5 Coordinate installation of roofing system so insulation and other components of the roofing system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is forecast.

.1 Provide tie-offs at end of each day's work to cover exposed roofing sheets and insulation.

.2 Complete terminations and base flashings, and provide temporary seals to prevent water from entering completed sections of roofing system.

.3 Remove and discard temporary seals before beginning work on adjoining roofing.

3.8 SBS-MODIFIED BITUMINOUS BASE-PLY MEMBRANE INSTALLATION

.1 Install modified bituminous roofing base ply sheet according to roofing manufacturer's written instructions, starting at low point of roofing system. Extend roofing membrane sheets over and terminate beyond cants, when applicable, installing as follows:

.1 Heat Welded (Torched): Torch apply to substrate.

.2 Unroll roofing sheets and allow them to relax.

.2 Laps: Accurately align roofing sheets, without stretching, and maintain uniform side and end laps. Stagger end laps. Completely bond and seal laps, leaving no voids.

.1 Repair tears and voids in laps and lapped seams not completely sealed.

3.9 SBS-MODIFIED BITUMINOUS CAP SHEET MEMBRANE INSTALLATION

.1 Install modified bituminous roofing cap sheet according to roofing manufacturer's written instructions, starting at low point of roofing system. Extend roofing membrane sheets over and terminate beyond cants, when applicable.

.1 Heat Welded (Torched): Torch apply to substrate.

.2 Unroll cap sheet and allow them to relax.

.3 Laps: Accurately align roofing sheets, without stretching, and maintain uniform side and end laps. Stagger end laps. Completely bond and seal laps, leaving no voids.

.1 Repair tears and voids in laps and lapped seams not completely sealed.

.2 Apply roofing granules to cover exuded bead at laps while bead is hot.

.4 Install roofing sheets so side and end laps shed water.

3.10 MEMBRANE FLASHING INSTALLATION

.1 Install base flashing over cant strips and other sloped and vertical surfaces, at roof edges, and at penetrations through roof; secure to substrates according to roofing system manufacturer's written instructions, and as follows:

.1 Prime substrates with asphalt primer.

.2 Backer-Sheet Application: Mechanically fasten backer sheet to walls or parapets.

.3 Flashing-Sheet Application: As specified by manufacturer for membrane application method.

.2 Extend base flashing up walls or parapets a minimum of 200 mm (8 inches) above roofing membrane and 100 mm (4 inches) onto field of roofing membrane.

.3 Mechanically fasten top of base flashing securely at terminations and perimeter of roofing.

.1 Seal top termination of base flashing.

.4 Install roofing membrane cap-sheet flashing where metal flanges and edgings are set on membrane roofing according to roofing system manufacturer's written instructions.

.5 Roof Drains: Coordinate with Division 22, Plumbing. Cover metal flashing with roofing membrane cap-sheet stripping and extend a minimum of 150 mm (6 inches) beyond edge of metal flashing onto field of roofing membrane. Clamp roofing membrane, metal flashing, and stripping into roof-drain clamping ring. Install stripping according to roofing system manufacturer's written instructions.

3.11 WALKWAY INSTALLATION

.1 Walkway Pads: Install walkway pads using units of size indicated on Drawings and Schedules or, if not indicated, of manufacturer's standard size according to walkway pad manufacturer's written instructions.

.1 Set walkway pads in cold-applied adhesive.

.2 Set walkway pads in flashing cement.

.3 Torch apply walkway pads.

3.12 FIELD QUALITY CONTROL

.1 Testing Agency: Owner may engage a qualified testing agency to inspect substrate conditions, surface preparation, membrane application, flashings, protection, and drainage components, and to supply reports to Consultant.

.2 Manufacturer's Field Services:

.1 Arrange for roofing system manufacturer's technical personnel to visit Project site on day roofing is commenced and at regular agreed-upon intervals until completion.

.2 Upon completion of work of this Section, arrange for roofing system manufacturer's technical personnel to inspect roof and verify quality of work.

.3 Submit detailed field report prepared by manufacturer's representative to inform Consultant, Contractor and Subcontractor after inspection and issue manufacturer's warranty if roofing installation is satisfactory.

.4 Notify Consultant and Owner 48 hours in advance of date and time of inspection.

.3 Roofing system will be considered defective if it does not pass tests and inspections.

.1 Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.13 PROTECTING AND CLEANING

.1 Protect roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Consultant and Owner.

.2 Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Performance of the Work and according to warranty requirements.

.3 Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

PART 1 - GENERAL

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL INSTRUCTIONS

.1 Read and conform to:

.1 the General Conditions and the Supplementary Conditions of the Contract.

.2 Division 01 requirements and documents referred to therein.

1.3 SUMMARY

.1 Work Included: Provide labour, materials, Products, equipment and services to complete the TPO membrane roofing work specified herein. This includes, but is not necessarily limited, to:

.1 Conventional roof assembly system consisting of fully adhered single ply TPO sheet materials, flashing membrane materials, and support boards.

.2 Auxiliary materials required for complete installation.

.2 Related Requirements: Specifications throughout the entirety of Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.4 REFERENCES

.1 Definitions:

.1 Roofing Terminology: Refer to CRCA Specifications Manuals and ASTM D1079 for the definition of terms related to roofing work in this Section.

.2 Reference Standards: Unless otherwise stipulated by a specific publication date in this Section or the Ontario Building Code, the latest published editions of reference standards in force as of the Bid Closing Deadline for the Project, including adopted amendments, are applicable.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meetings:

.1 Prior to starting work of this Section, convene a pre-installation meeting at Project site to review Project requirements and site conditions with pertinent parties. Conform to requirements of Section 01 30 00.

.2 Schedule and hold a pre-installation meeting at the Project site at least one week before beginning work on this Section to coordinate activities with related Subcontractors.

.1 Required Attendance: Subcontractor performing work of this Section, representatives from manufacturers and fabricators involved in or affected by installation.

.2 Notification: Notify Consultant and Owner of scheduled meeting dates in advance; minimum 72 hour notice required.

.3 Agenda:

.1 Review progress of related construction activities and preparations for particular activity under consideration.

.2 Make note of required sequencing and coordination with materials and activities that have preceded or will follow.

.3 Review and finalize construction schedule and verify availability of materials, personnel, equipment, and facilities needed to make progress and avoid delays.

.4 Review methods and procedures for roofing installation, including manufacturer's instructions.

.5 Review structural loading limitations of roof deck during and after roofing.

.6 Examine supports, deck, and alignment and attachment to structural members.

.7 Review flashing, details, penetrations, openings, and conditions of other elements that may affect roofing system installation.

.8 Discuss governing regulations, insurance, certificates, tests, and inspections as applicable.

.9 Review temporary protection requirements for roofing system before, during and after installation.

.10 Discuss roof observation and repair procedures after roofing installation.

.3 Reporting: Record significant discussions, agreements, and disagreements, including required corrective measures and actions.

.4 Distribution: Distribute minutes of the meeting to each party present and to other parties requiring information not more than 72 hours after meeting.

1.6 SUBMITTALS

.1 Product Data: Submit manufacturer's literature and data sheets for each type of material provided under this Section for Project in accordance with requirements of Section 01 33 00.

.2 Product Data: Submit manufacturer's product characteristics, catalogue cuts, installation instructions and other relevant information for each material and product used for TPO membrane roofing work specified in this Section.

.3 Safety Data Sheets (SDS): Submit SDS for inclusion in Operation and Maintenance Manual specified in Section 01 70 00, for adhesives, sealants and any other material designated by Consultant.

.4 Shop Drawings: Submit Shop Drawings indicating material layouts, details of construction, connections, and relationship with adjacent construction. As a minimum indicate following:

.1 Include plans, elevations, sections and details as applicable.

.2 Illustrate tapered insulation, roof cricket infill, setting plan layout, and details.

.3 Provide membrane layout on detailed roof plan, complete with full assembly section, vertical parapet details, joint or termination detail conditions, and conditions of interface with other materials.

.5 Wind Uplift Resistance Calculations: Provide calculations or reports sealed by a Professional Engineer, licensed to practice in Province of Ontario, demonstrating that roof assembly design meets wind uplift requirements specified in this Section. Alternatively, wind uplift calculations prepared by roofer or roof manufacturer determined using NRC's Wind-RCI calculators or equivalent tools that demonstrate compliance with requirements of Contract Documents will be deemed acceptable.

.6 Manufacturer's Certificate:

.1 Submit letter signed by manufacturer certifying that products meet or exceed specified wind uplift requirements. Submit evidence of meeting performance requirements by submitting additional test and evaluation reports as well as conformance to applicable listings.

.2 Compatibility: Compatibility between components of roofing system is essential. Provide written declaration to Consultant stating that materials and components, as assembled in system, meet this requirement.

.7 Samples: Submit selection and verification samples for Products requiring colour, texture, or design selection. Submit manufacturer's list of finishes or colour swatches for Consultant's selection.

.1 As a minimum submit samples of the following:

.1 Roof membrane selection: minimum 300 mm square.

.2 Typical flashing: minimum 300 mm.

.8 Warranties: Submit copies of warranties specified in this Section for Consultant's review.

1.7 CLOSEOUT SUBMITTALS

.1 Closeout Submittals, generally: in accordance with Section 01 78 00, Closeout Submittals.

.2 Operating and Maintenance Data: Submit care and maintenance instructions for TPO membrane roofing to be included in building operation and maintenance manual.

.3 Warranty Documentation: Submit a copy of extended warranties specified in this Section.

1.8 QUALITY ASSURANCE

.1 Manufacturer Qualifications: Provide Products for work of this Section by manufacturer with at least 10 years' experience manufacturing such materials.

.1 The manufacturer shall employ trained technical service representatives, independent of sales.

.2 The manufacturer shall be an ISO 9001 registered company and provide a 'Quality Compliance Certificate (QCC)' for reporting/confirming tested values of TPO membrane materials upon request.

.2 Installer Qualifications: A qualified firm that is approved, authorized, or licensed by membrane roofing system manufacturer to install manufacturer's product and that is eligible to obtain manufacturer's extended warranty specified in this Section.

.1 The installer must be approved by manufacturer for installing roof system and to authenticate warranties.

.3 Single Source Responsibility: Ensure primary materials provided in this Section are obtained from 1 source by a single manufacturer and secondary materials are obtained from sources recommended by primary materials manufacturers.

.1 Mixing Products across from various manufacturers without manufacturer's or Consultant's written permission is not permitted.

.4 Mock-Ups / First Installation Review: Construct mock-ups to verify selections made under submittals, demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

.1 Location: In-situ (i.e. first installation), as directed on site by Consultant.

.2 Construct mock-up 10 m² (100 sq ft.) minimum size showing typical lap joint, one inside corner and one outside corner.

.3 Purpose: To set benchmarks for installation and to judge subsequent work. Maintain Mock-ups during construction in undisturbed condition.

.4 Reviewed mock-ups: May become part of the completed work if undisturbed at the time of Substantial Performance of The work, provided they are undisturbed, and comply with requirements outlined in Contract Documents.

1.9 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle TPO membrane roofing materials in accordance with manufacturer's written instructions.

.2 Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

.3 Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.

.1 Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

.4 Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

.5 Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.10 SITE CONDITIONS

.1 Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements. Do not install roofing system during inclement weather that may affect adhesion, curing or sealing of membranes or components.

1.11 WARRANTY

.1 Extended warranty: Submit for Owner's review and acceptance, manufacturer's extended warranty in which manufacturer commits to repair or replace components of TPO membrane roofing that fail within specified warranty period. Manufacturer's extended warranty is in addition to, and does not supersede, any other rights that Owner may have under Contract Documents.

.1 Warranty Period: Not less than 20 years from date of Substantial Performance of The work.

.2 Installer Warranty: Submit roofing Installer's warranty, on OIRCA or CRCA standard warranty form, signed by Installer, covering the Work of this Section, including all components of membrane roofing system such as membrane roofing, base flashing, roof insulation, fasteners, insulation overlay boards, Roof Sheathing Boards, vapour retarders, and walkway products, for the following warranty period:

.1 Warranty Period: Two years from date of Substantial Performance of the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Products of following manufacturers may be acceptable subject to conformance to requirements of Drawings, Schedules and Specifications:

.1 Carlisle Syntec

.2 GAF

.3 Holcim Elevate (previously Firestone)

.4 Johns Manville

.2 Comparable Products from manufacturers listed herein offering functionally and aesthetically equivalent products in Consultant's opinion, and subject to Consultant's review, will be considered provided they meet the requirements of this Specification.

2.2 DESIGN AND PERFORMANCE REQUIREMENTS

.1 General Performance: installed membrane roofing and flashing system must remain watertight and withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defects in manufacture, fabrication, installation, or construction.

.2 Wind Uplift Design Criteria: Roofing system must have undergone testing by a qualified testing and inspection agency to resist uplift pressure based on Ontario Building Code and CAN/CSA A123.21 requirements as follows:

.1 Corner Uplift Pressure: Refer to Structural

.2 Perimeter Uplift Pressure: Refer to Structural

.3 Field-of-Roof Uplift Pressure: Refer to Structural

.3 Roof Fire Covering Classification: Conforming to CAN/ULC S107 with Class A, Class B or Class C classification and conforming to Ontario Building Code 3.1.15.2.

.1 Provide Class A roof coverings per CAN/ULC S107 in all wood-framed and other buildings consisting of combustible construction as defined by Ontario Building Code.

.4 Material Compatibility: Ensure compatibility between roofing system components and interfacing materials. Roof system must not adversely affect adjacent materials.

2.3 TPO SHEET MEMBRANE

.1 TPO Sheet: uniform, flexible TPO sheet.

.1 Compliance: ASTM D6578/ASTM D6878, internally fabric or scrim reinforced.

.2 Accelerated Weathering: Must withstand 2000 hours in accordance with ASTM G152, ASTM G154, or ASTM G155.

.3 Impact Resistance: Must resist impact in accordance with ASTM D3746, ASTM D4272, or FM Approvals 4470 Foot Traffic Test.

.4 Application: fully adhered

.5 Thickness: Not less than 1.5 mm (60 mils), nominal.

.6 Exposed Face Color: White.

.7 Basis-of-Design: "Sure-Weld® TPO" by Carlisle Syntec or approved equivalent.

2.4 ROOF INSULATION (INS-8)

.1 Polyisocyanurate foam insulation board:

.1 Classification: CAN/ULC S704, Type 2 and ASTM C1289, Type II, Class 2, Grade 2 inorganic glass-fibre mat facer on both major surfaces. Organic facers are not permitted.

.2 Compressive strength: minimum 138 kPA (20 psi).

.3 Minimum RSI (R) Value: 1.0 per 25 mm (5.7 per 1") based on LTTR testing per CAN/ULC S770.

.4 Thickness: As indicated on Drawings and required to provide specified R-values.

.2 Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

.3 Insultation Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer for wind uplift criteria specified.

2.5 ROOF VAPOUR RETARDER (AVB-3)

.1 Self-Adhering Vapor Retarder

.1 Compliance: to ASTM D1970 or CAN/CGSB-51.33

.2 Material: Slip-resistant, cold-applied polyethylene film with rubberized asphalt or butyl rubber adhesive, and release paper backing as standard with manufacturer.

.3 Thickness: Not less than 1.0 mm (40 mils) for rubberized asphalt; minimum 0.76 mm (30 mils) for butyl rubber type.

.4 Permeance: Maximum 6 ng/Pa·s·m² (0.1 perm)

.2 Primer: Low-VOC, water-based polymer emulsion primer as recommended by roofing membrane manufacturer.

2.6 SUBSTRATE BOARDS

.1 Fire Response:

.1 Combustibility: non-combustible in accordance with CAN/ULC S114.

.2 Surface Burning Characteristics: Flame spread: 0 / Smoke developed: 0 in accordance with CAN/ULC S102.

.2 Mould Resistance (ASTM D3273): Minimum 10 rating (no mould growth after four week).

.3 Maximum Board Size: 1220 mm x 1220 mm (4 ft x 4 ft).

.4 Thickness:

.1 Sheathing board (over deck): Not less than 16 mm (5/8 in) thick.

.2 Cover board (over insulation): Not less than 13 mm (1/2 in) thick.

.5 Following types are acceptable:

.1 Glass-Mat Roof Sheathing Board: to ASTM C1177/ASTM C1177M, glass-mat, water-resistant gypsum substrate, factory primed.

.1 Moisture Absorption Rate: 5% or less by weight.

.2 Surface Moisture Absorption: 1 gram or less.

.2 Fibre-Reinforced Roof Sheathing Board: ASTM C1278/ASTM C1278M, cellulosic-fibre-reinforced, water-resistant gypsum substrate.

.6 Board Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening roof board to substrate, and acceptable to roofing system manufacturer for wind uplift criteria.

2.7 AUXILIARY COMPONENTS

.1 Provide auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing. Provide pourable sealers, preformed cone/vent sheet flashings, moulded pipe boot flashings, preformed corner sheet flashings, reinforced TPO securement strips, T-joint covers, in-seam sealants, termination reglets, cover strips, and other elements required for a complete installation.

.2 Sheet Flashing: Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and colour as TPO sheet membrane; minimum 1.5 mm (60 mils) thick.

.3 Bonding Adhesive: manufacturer's standard water-based type.

.4 Seaming Material: butyl splicing adhesive with splice cleaner, or synthetic-rubber polymer primer with butyl splice tape (minimum width of 75 mm) with release film; as recommended by manufacturer to authenticate warranties.

.5 Lap Sealant: Standard manufacturer's single-component, color matched to roofing membrane.

.6 Water Cutoff Mastic: Manufacturer’s standard butyl mastic sealant.

.7 Metal Termination Bars: manufacturer's standard, predrilled, stainless steel or aluminum, types; approx. 25 x 3 mm (1 x 1/8 inch), with anchors.

.8 Fasteners: Corrosion-resistant, factory-coated steel with metal or plastic plates, complying with FM Global 4470, for securing membrane to substrate; and approved by roofing system manufacturer.

2.8 PAVERS, BALLAST AND WALKWAYS

.1 Pavers: Pre-formed concrete roof pavers. Minimum size: 610 x 610 mm (24 x 24 inches). Maximum weight: 50 kg/m2. Must be square, free from chips, spalls, or cracks.

.2 Paver Pedestals: Manufacturer’s standard paver pedestals complete with levelling plates for smooth, level walkways.

.1 Basis-of-Design: Pave-El Pedestals.

.3 Wood Nailers: New, #2 grade or better, rot-resistant treated wood. Creosote or asphalt treatments are not acceptable. Install at roof edges or gravel stops; install flush with membrane underlayment top, ± 6 mm (1/4 inch).

.4 Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resistant, textured walkway pads or rolls. Thickness approximately 5 mm (3/16 inch) and approved by roofing system manufacturer.

.1 Size: Approximately 914 x 1524 mm (36 x 60 inches).

.2 Color: Contrast with roof membrane

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Site Verification of Conditions:

.1 Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation. Commencement of work implies acceptance of previously completed work.

.2 Inspect materials for defects before installation.

.3 Comply with safety regulations of authority having jurisdiction.

.4 Roof Openings and Penetrations:

.1 Ensure roof openings, penetrations are in place, curbs are set and braced.

.2 Ensure roof drain bodies are securely clamped in place.

.5 Wood Cants, Blocking, Curbs, and Nailers:

.1 Ensure wood cants, blocking, curbs, nailers and similar components are securely anchored to roof deck at penetrations and terminations.

3.2 PREPARATION

.1 Design and selection of materials for temporary roofing are responsibilities of Contractor.

.2 Clean substrate of dust, debris, moisture, and substances detrimental to roofing installation in accordance with manufacturer's written instructions. Remove sharp projections.

.3 Prevent materials from entering and clogging roof drains and conductors.

.4 Avoid spillage or migration of materials onto surfaces of other construction.

.5 Remove roof-drain plugs when work is not in progress or when rain is forecast.

3.3 INSTALLATION, GENERALLY

.1 Installation Compliance: Install roofing membrane system in accordance with roofing system manufacturer's written instructions, reviewed Shop Drawings and applicable recommendations in CRCA’s Roofing Specification Manual.

.2 Supplement manufacturer's installation instructions with additional installation requirements specified in this Section to produce specified work results.

3.4 ROOF SHEATHING INSTALLATION

.1 Mechanically Fastened Roof Sheathing:

.1 Fasten panels to steel deck with fasteners and plates as recommended by membrane manufacturer.

.2 For steel decks, ensure fasteners engage top rib and penetrate through deck by at least 19 mm (3/4 inch). Align long edge of board parallel to and on top rib for continuous support.

.3 Adhere to membrane manufacturer’s guidelines for fasteners' number and spacing.

.4 Stagger end joints of adjacent boards; ensure butt joints are moderately contacting.

.5 Cut boards cleanly where slopes change, do not break boards to fit deck.

.6 Concrete fasteners and anchors must penetrate a minimum of 32 mm (1 1/4 inch), as approved by membrane manufacturer.

3.5 VAPOUR RETARDER INSTALLATION

.1 Panel Selection: Only use roof sheathing panels approved by the vapor retarder manufacturer.

.2 Primer Application: On glass-faced gypsum board panels, apply primer in accordance with gypsum board and vapor retarder manufacturers' instructions.

.3 Surface Preparation: Ensure primed surfaces are clean and free of dust to facilitate effective adhesion. Cover substrates with vapor retarder as soon as they are ready.

.4 Steel Deck Alignment: When applying directly to steel deck, align roll parallel to deck flutes. Vapor retarder overlaps must sit on top ribs of deck, ensuring full-length support.

.5 Initial Placement: Roll out vapor retarder on substrate for alignment; do not remove release sheet immediately.

.6 Overlap and Staggering: Overlap sheets by 75 mm (3 inches) at sides and 150 mm (6 inches) at ends. Stagger end laps by minimum of 300 mm (12 inches).

.7 Adhesion Technique: Start by peeling back and adhering one end of release sheet to substrate. Gradually remove remaining sheet at a 45-degree angle to minimize wrinkles.

.8 Realignment: If misalignment occurs, do not readjust. Instead, cut roll, start new section to ensure correct alignment, and overlap over misaligned piece by 150 mm (6 inches).

.9 Final Rolling: Use a 34 kg (75 lb) roller for application. Align roller edge with side laps' lower end and roll up membrane. Avoid cutting membrane for air bubble removal; push out bubbles by rolling them towards the lap edges.

.10 Completely seal vapour retarder at terminations, obstructions, and penetrations to prevent air infiltration into roofing system.

3.6 INSULATION INSTALLATION

.1 Follow manufacturer's instructions for insulation installation. Do not install insulation boards displaying signs of moisture damage.

.2 Install insulation using staggered layers to minimize thermal bridging.

.3 Install insulation with long joints in a continuous straight line. Stagger end joints between rows.

.4 Ensure that edges and ends between boards abut each other. Fill gaps exceeding 6 mm (1/4 inch) with insulation. Cut and fit insulation within 6 mm (1/4 inch) of nailers, projections, and penetrations.

.5 Secure preformed 45-degree insulation cant strips at junctures of roofing membrane systems with vertical surfaces or angle changes exceeding 45 degrees.

.6 Install tapered insulation under roofing to match slopes indicated on Drawings. Install insulation under roofing membrane to reach required thickness.

.7 Provide two or more layers when overall insulation thickness is 75 mm (3 inches) or more.

.8 Stagger joints of each succeeding layer at least 150 mm (6 inches) in each direction from joints of previous layer.

.9 Trim surface of insulation as needed at roof drains. Ensure completed surface is flush and does not impede flow of water.

.10 Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.

3.7 COVER BOARD INSTALLATION

.1 Install cover board over insulation to protect insulation from roof traffic. Ensure tight, staggered joints. Use adhesive specified in roof assembly's CSA A123.21 wind uplift test report.

3.8 ROOFING MEMBRANE INSTALLATION

.1 Presence of Technical Personnel: Begin installation of roofing membrane only in the presence of roofing system manufacturer's technical personnel. Cooperate with Owner's inspection and testing agencies as needed.

.2 Temporary Protection:

.1 Coordinate roofing system installation to ensure insulation and other non-permanent components are protected against precipitation and are not left uncovered at end of workday or when rain is anticipated.

.2 Provide tie-offs at the end of each day of work to cover exposed roofing sheets and insulation.

.3 Complete terminations and base flashings; provide temporary seals to prevent water ingress into completed sections of roofing system.

.4 Remove and discard temporary seals before starting work on adjoining roofing areas.

3.9 INSTALLATION OF ROOFING MEMBRANE

.1 Unroll membrane roofing and allow to relax before installation.

.2 Accurately align roofing and maintain uniform side and end laps in accordance with manufacturer's requirements. Stagger end laps.

Adhesive Application: Apply bonding adhesive to substrate and underside of roofing at the manufacturer-specified rate. Allow to partially dry before installation. Avoid application to splice area.

.3 Terminations, Penetrations, and Perimeters: Securely fasten or adhere roofing at such areas.

.4 Shingling: Install roofing with side laps shingled with slope of roof deck.

.5 Welding Process: Use manufacturer's recommended hot air welding machine for welding seams. Immediately after welding, roll all splice intersections with roller to ensure continuous hot air welded seams. For membranes 60-mil thick or thicker, overlay all splice intersections with manufacturer's standard non-reinforced flashing or TPO T-Joint covers.

.6 Seam Inspection: Probe all seams after hot air welds cool down. Repair seam deficiencies on same day they are identified. Verify field strength of seams a minimum of twice daily, and repair seam areas.

.7 Edge Sealing: After seam inspection, seam probing, apply edge sealant on all cut edges of reinforced membrane where scrim reinforcement is visible.

.8 Repairs: Address and repair tears, voids, and lapped seams that do not meet requirements.

3.10 MEMBRANE FLASHING INSTALLATION

.1 Install membrane flashing at roof penetrations, walls, and intersections.

.2 Install base flashing over cant strips and other sloped and vertical surfaces, at roof edges, and at penetrations through roof. Secure to substrates according to roofing system manufacturer's written instructions.

.3 Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply to seam area of flashing.

.4 Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

.5 Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.

.6 Terminate and seal top of sheet flashings.

3.11 INSTALLATION OF WALKWAYS

.1 Flexible Walkways: Install walkway products in locations indicated. Adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions. Flexible Walkways: Install flexible walkways at the following locations:

.1 Perimeter of each rooftop unit.

.2 Between each rooftop unit location, creating a continuous path connecting rooftop unit locations.

.3 Between each roof hatch and each rooftop unit location or path connecting rooftop unit locations.

.4 Top and bottom of each roof access ladder.

.5 Between each roof access ladder and each rooftop unit location or path connecting rooftop unit locations.

.6 Locations indicated on Drawings.

.7 As required by roof membrane manufacturer's warranty requirements.

.8 Provide 6-inch (76-mm) clearance between adjoining pads.

.9 Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

.2 Roof-Paver Walkways: Install walkway roof pavers according to manufacturer's written instructions in locations indicated, to form walkways. Leave 75 mm (3 inches) of space between adjacent roof pavers.

3.12 FIELD QUALITY CONTROL

.1 Roof Inspection: Contractor must have roof system manufacturer's technical personnel to inspect roofing during installation and on completion to confirm substrate conditions, surface preparation, membrane application, flashings, protection, and drainage components; and to supply reports to Consultant.

.2 Roofing system will be considered defective if it does not pass tests and inspections.

.3 Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.13 PROTECTION

.1 Protect TPO membrane roofing from damage, soiling and contaminating substances resulting from construction activities or caused by work of other trades.

.2 Promptly replace TPO membrane roofing work damaged during construction that cannot be satisfactorily repaired.

3.14 CLEANING AND WASTE MANAGEMENT

.1 Cleaning: Maintain clean construction area at the end of each day. When the activities of this Section are complete, remove materials, tools, equipment and rubbish.

.2 Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

.3 Waste Management and Disposal: sort waste for reuse, recycling, or disposal, as specified. Remove recycling bins and containers from site and dispose of contents at the appropriate waste disposal facilities.

END OF SECTION

GENERAL

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL INSTRUCTIONS

.1 Read and conform to:

.1 the General Conditions and the Supplementary Conditions of the Contract.

.2 Division 01 requirements and documents referred to therein.

1.3 SUMMARY

.1 Work Included: Provide sheet metal flashing and trim including but not limited to following:

.1 site-fabricated flashings concealed from view

.2 site-fabricated flashings exposed to view

.3 related flashing accessories.

.4 Auxiliary materials required for complete installation.

.2 Related Requirements: Specifications throughout the entirety of Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.4 REFERENCES

.1 Reference Standards: Latest published editions of reference standards listed in this Section in effect as of the closing date and time of the Request for Tenders for the Contract, including any amendments adopted, are applicable unless otherwise indicated.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meetings:

.1 Prior to starting work of this Section, convene a pre-installation meeting at Project site to review Project requirements and site conditions with pertinent parties. Conform to requirements of Section 01 30 00.

.1 review installation procedures and coordination required with related work including roofing requirements for interfacing with roof accessories and roof mounted equipment.

.2 review fire hazard assessment of work prior to commencement of torch application.

.3 review and finalize construction schedule and verify availability of materials, installer's personnel, equipment and facilities needed to make progress and avoid delays.

.4 review structural loading limitations of roof deck during roofing.

.5 review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs and condition of other construction that will affect roofing system.

.6 review temporary protection requirements for roofing system during and after installation.

.7 review flashing repair procedures after installation.

.2 Coordination:

.1 Coordinate installation of sheet metal flashing and trim with interfacing and adjoining construction to provide a leakproof, secure, and noncorrosive installation.

.2 Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.

1.6 SUBMITTALS

.1 Product Data: Submit manufacturer's literature and data sheets for each type of material provided under this Section for Project in accordance with requirements of Section 01 30 00.

.1 Ensure data sheets provide required information including detailed instructions for installing as well as maintaining, preserving, and keeping materials in clean and safe conditions. Provide adequate warning of maintenance practices or cleaning agents detrimental to specified materials.

.2 Safety Data Sheets (SDS): Submit SDS for inclusion in Operation and Maintenance Manual specified in Section 01 70 00, for adhesives, sealants and any other material designated by Consultant.

.3 Shop Drawings: Submit Shop Drawings for work of this Section in accordance with Section 01 30 00.

.1 Submit fully detailed Shop Drawings showing proposed method of shaping, forming, jointing, fastening and application of sheet metal work, in accordance with the Contract Documents. Submit lists of materials to be used to Consultant.

.4 Samples: Submit samples in accordance with Section 01 30 00. Submit samples for each type of sheet metal flashing, trim, and accessory exposed to view indicated with factory-applied colour finishes. Submit in sizes indicated below.

.1 Sheet Metal Flashing: 300 mm (12 inches) long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.

.2 Trim, Metal Closures, Expansion Joints, Joint Intersections, and Miscellaneous Fabrications: 300 mm (12 inches) long and in required profile. Include fasteners and other exposed accessories.

.3 Accessories and Miscellaneous Materials: Full-size Sample.

.4 Submit a representative sample section of prepainted metal flashing illustrating "S" lock jointing, minimum 600 mm (24 inch) long, method to accommodate thermal movement, cleats and fasteners. Submit sample well in advance of material fabrication.

.5 Wind Uplift Resistance Calculations: Provide calculations or reports sealed by a Professional Engineer, licensed to practice in Province of Ontario, demonstrating that roof assembly design meets wind uplift requirements specified in this Section. Alternatively, wind uplift calculations prepared by roofer or roof manufacturer determined using NRC's Wind-RCI calculators or equivalent tools demonstrating compliance will be deemed acceptable.

1.7 QUALITY ASSURANCE

.1 Qualifications:

.1 Manufacturers: Provide Products for Work of this Section by manufacturer with minimum 10 years' experience in the manufacture of such materials.

.2 Installers: Provide work of this Section executed by competent installers with minimum 5 years' experience in the application of Products, systems and assemblies specified and with approval and training of the Product manufacturers.

.3 Sealant Compatibility and Adhesion Testing: Use sealant manufacturer's standard test methods to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.

.4 Single Source Responsibility: Ensure primary materials provided in this Section are obtained from 1 source by a single manufacturer and secondary materials are obtained from sources recommended by primary materials manufacturers.

.5 Mock-ups: Provide Mock-ups in locations designated by Consultant and as required to demonstrate quality of workmanship. Maintain Mock-ups during construction in an undisturbed condition as a standard for judging the completed work. Coordinate with adjacent building envelope material mock-ups including roofing, cladding, insulation and air barrier work

1.8 DELIVERY, STORAGE AND HANDLING

.1 Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.

.2 Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to the extent necessary for the period of sheet metal flashing and trim installation.

.3 Replace damaged work which cannot be satisfactorily repaired, restored or cleaned at no cost to Owner.

1.9 WARRANTY

.1 Warrant work of this Section including finish for period of 5 years from Substantial Performance of the Work against defects and/or deficiencies in accordance with General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of Consultant and at no expense to Owner.

PART 2 - PRODUCTS

2.1 DESIGN AND PERFORMANCE REQUIREMENTS

.1 Design sheet metal flashing and trim assemblies to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction in accordance with requirements of authorities having jurisdiction.

.2 As minimum ensure flashing system comply with requirements CRCA's "Roofing Specifications FL Series" details and SMACNA's "Architectural Sheet Metal Manual".

.3 Ensure completed sheet metal flashing and trim do not rattle, leak, or loosen, and remain watertight.

.4 Select appropriate type of flashings on basis of compatibility when incorporated into roofing system and in a rigid manner in finished roofing system.

.5 Design exterior envelope system to minimize thermal bridging using proven installation methods and details consisting of a combination of low conductivity materials, thermal breaks, and insulation to minimize heat loss and enhance assemblies' effective R-values.

.6 Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

.1 Temperature Change: 67 deg C (120 deg F), for ambient temperature; 100 deg C (180 deg F), for material surfaces.

2.2 PREFINISHED SHEET METALS

.1 Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

.2 Galvanized Steel Sheet: Provide zinc-coated (galvanized) steel sheet in accordance with ASTM A653/A653M, Z275 (G90) coating designation; prepainted by coil-coating process to comply with ASTM A755/A755M.

.1 Surface: Smooth, flat.

.2 Minimum thickness: 0.61 mm (24 ga) thickness.

.3 Exposed Finish:

.1 Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with dry film thickness of not less than 0.005 mm (0.2 mil) for primer and 0.02 mm (0.8 mil) for topcoat.

.2 Colour: As selected by Consultant from manufacturer's full range.

.3 Basis-of-Design: “WeatherXL” by Sherwin Wiliams (previously Valspar) or approved equivalent by PPG.

.3 Aluminum Sheet: ASTM B209M (ASTM B209), alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required.

.1 Surface: Smooth, flat.

.2 Minimum thickness: 2 mm (0.08 inch) thickness.

.3 Exposed Finish:

.1 Clear Anodic Finish, Coil Coated: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

.2 Three-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in both colour coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

.1 Basis-of-Design: “Duranar XL” by PPG or approved equivalent by Sherwin Williams (previously Valspar).

.3 Colour: As selected by Consultant from manufacturer's full range.

.4 Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.013 mm (0.5 mil).

2.3 UNDERLAYMENT MATERIALS (AVB-4)

.1 Self-Adhering, High-Temperature Sheet Underlayment: Minimum 0.76 mm (30 mils) thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to

withstand high metal temperatures beneath metal roofing. Provide primer in accordance with underlayment manufacturer's written instructions.

.1 Thermal Stability: ASTM D1970 or equivalent to CAN/CGSB-51.33; stable after testing at 116 deg C (240 deg F) or higher.

.2 Low-Temperature Flexibility: ASTM D1970 or equivalent to CAN/CGSB-51.33; passes after testing at minus 29 deg C (20 deg F) or lower.

.3 Basis-of-Design: “Blueskin PE200 HT” by Henry Company or approved equivalent as follows:

.1 “Grace Ultra” by GCP Applied Technologies.

.2 “Lastobond Shield HT” by Soprema

2.4 FLEXIBLE FLASHING

.1 Composite flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 1.0 mm (0.039 inch)

.1 Acceptable Products:

.1 “CCW-705-TWF Thru-Wall Flashing” by Carlisle Coatings & Waterproofing

.2 “Perm-A-Barrier Wall Flashing” by GCP Applied Technologies.

.3 “Blok Lok Airtight 40 Self Adhered Air and Vapour Barrier” by Hohmann & Barnard, Inc.

.4 “Air-Shield Thru-Wall Flashing” by W.R. Meadows Inc., Canada

.5 “Blueskin TWF” by Henry Company

.6 “AquaBarrier™ TWF” by IKO Industries Ltd.

.7 “ExoAir TWF” by Tremco Incorporated, an RPM company

.8 “Sopraseal WFM” by Soprema Inc.

.2 Primer: as per manufacturer’s recommendation.

.3 Mechanical fasteners: recommended by flashing manufacturer to suit project requirements.

2.5 LIQUID FLASHING MATERIALS

.1 Liquid-Applied Flashing: Low-VOC resin-based, seamless, reinforced waterproofing system flashing that is compatible with adjacent materials.

.1 Provide waterproofing of atypical flashing details including, but not limited to, mechanical equipment, roof/wall penetrations and similar locations.

.2 Acceptable Products:

.1 “Alsan Flashing” by Soprema Inc.

.2 “MS Detail” by IKO Industries.

.3 “PermaFlash” by Johns Manville.

2.6 ACCESSORIES

.1 Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and recommended by manufacturer of primary sheet metal unless otherwise indicated.

.2 Isolation coating: conforming to ASTM D1187, alkali resistant bituminous paint or epoxy resin solution to provide dielectric separation which will dry to be tack-free and withstand high temperatures.

.3 Roof Drainage Sheet Metal Fabrications: Fabricate hanging gutters, downspouts, parapet scuppers, splash pans and similar fabrications in conformity to CRCA, Roofing Practices Manual, designed and sized to withstand design loads in accordance with applicable building code and referenced standards.

.4 Sealants: conforming to ASTM C920 or CAN/CGSB-19.13-M, in accordance with requirements of Section 07 92 00. Confirm compatibility with adjacent materials.

.5 Bedding Compound: Rubber-asphalt type.

.6 Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.

.7 Starter Strips: Of same material as flashing used, 1.2 mm (18 ga), minimum 50 mm (2 inch) wide, interlocked with metal flashing.

.8 Flashing Cleats, Starter Strips, Skirts, Clips and Backup Plates: Same as specified sheet metal, unless indicated otherwise, make cleats 50 mm (2 inch) wide and interlocked with metal flashing.

.9 Fasteners: Use fasteners designed and sized to withstand design loads in accordance with applicable building code and referenced standards.

.1 Exposed Fasteners: Heads matching colour of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.

.2 Blind Fasteners: High-strength stainless-steel rivets suitable for metal being fastened.

.3 Use fasteners manufactured from Series 300 stainless steel with and finish as flashing metal or material compatible with material being fastened with respect to galvanic reaction. Size and type to suit applicable conditions. Use stainless steel where connecting directly to concrete.

.4 Nails, screws, bolts and other fastening devices: CSA B111, Table 12, finished to match metal being fastened where exposed to view by means of plastic caps or factory-applied coating.

.5 Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.

2.7 FABRICATION

.1 Fabricate copings, parapet vertical flashings, flashings, curb counter flashing starter clips, strips, downspouts, parapet scuppers, and miscellaneous flashings in accordance with CRCA recommendations and to detail indicated.

.2 Form sections true to shape, accurate in size, square, and free from distortion or defects. Equally space joints in any one run of flashing to suit building module or window spacing and locate in consultation with Consultant before installation commences.

.3 Fabricate flashings meeting the Project requirements for roof mounted equipment. Provide seismic bracing as required.

.4 Fabricate cleats and starter strips of same material as sheet, minimum 50 mm (2 inch) wide, interlockable with sheet.

.5 Form pieces in longest practical lengths. Make joints to permit thermal movement. Make flashing surfaces free from building, warp, wave, dents, oil canning or other defects.

.6 Hem exposed edges on underside 13 mm (1/2 inch); mitre and seam corners.

.7 Form material with standing seam where applicable.

.8 Fabricate corners from one piece with minimum 450 mm (18 inch) long legs; seam for rigidity, seal with sealant. Make corners square and surfaces straight and in true planes.

.9 Fabricate vertical faces with bottom edge formed outward 6 mm (1/4 inch) and hemmed to form drip.

.10 Fabricate flashings to allow toe to extend 50 mm (2 inch) over roofing as applicable. Return and brake edges.

.11 Form sheet metal pans 150 mm (6 inch) nominal size, with 75 mm (3 inch) upstand, and 100 mm (4 inch) flanges. Fill pans watertight with liquid flashing as specified in this Section.

2.8 FINISHES

.1 Shop prepare and prime exposed ferrous metal surfaces.

.2 Concealed metal surfaces to receive one coat of bituminous paint, minimum 0.4 mm (1/64 inch) thickness.

.3 Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Site Verification of Conditions:

.1 Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation. Commencement of work implies acceptance of previously completed work.

.2 Verify roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set, cant strips and reglets in place and nailing strips located.

.3 Verify membrane termination and base flashings are in place, sealed and secure.

.4 Notify Consultant of any unsatisfactory conditions. Do not proceed with this work until conditions have been corrected.

.5 Commencement of work shall imply acceptance of conditions and substrates.

3.2 PREPARATION

.1 Field measure site conditions prior to fabricating work.

.2 Install starter, edge strips and cleats before starting installation.

.3 Install surface mounted reglets true to lines and levels. Seal top of reglets with sealant.

.4 Insert flashings into reglets to form tight fit. Secure in place with plastic wedges. Seal flashings into reglets with sealant.

.5 Secure flashings in place using concealed fasteners. Use exposed fasteners only in locations accepted by Consultant.

.6 Apply plastic cement compound between metal flashings and felt flashings.

.7 Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.

.8 Provide and maintain continuity of air/vapour barrier to adjacent dissimilar materials. Seal to form weathertight seal between flashing and adjoining surfaces and between flashing and other work.

3.3 INSTALLATION

.1 Conform to drawing details included in CRCA manuals (FL series details) as applicable. Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

.2 Install copings, curb coverings, starter strips, (back-up plates), pipe collars and other flashings to details shown on Drawings.

.3 Exposed fastenings will not be permitted in the Work.

.4 Install starter strips where indicated or required to present a true, non-waving, leading edge. Anchor to back-up to provide rigid, secure installation.

.5 Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.

.6 Expansion Provisions: Provide for thermal expansion of exposed flashing and trim.

3.4 UNDERLAYMENT INSTALLATION

.1 Install self-adhering sheet underlayment, wrinkle free. Prime substrate if recommended by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 150 mm (6 inches) staggered 600 mm (24 inches) between courses. Overlap side edges not less than 90 mm (3-1/2 inches). Roll laps and edges with roller. Cover underlayment within 14 days.

3.5 SHEET STEEL FLASHINGS

.1 End joints where adjacent lengths of metal flashing meet shall be made using an "S-lock" joint as detailed on Drawings. Execute by inserting the end of 1 coping length in a 25 mm (1 inch) deep "S" lock formed in the end of the adjacent length. Extend concealed portion of the "S" lock 25 mm (1 inch) outwards and nail to substrate. Face nailing of joints will not be permitted.

3.6 ALUMINUM FLASHINGS

.1 Make end joints where adjacent lengths of metal flashing meet, using a 300 mm (12 inch) long back-up flashing secured in place before installing flashing. Apply beads of caulking compound on face of back-up plate to seal ends of metal flashing. Leave 13 mm (1/2 inch) wide space between ends of adjacent lengths of metal flashing. Fabricate back-up plates of same material and finish as metal flashing with which it is being used. Make back-up plate profile of flashing allowing for metal thickness.

.2 Separate dissimilar metals with a bituminous coating or polymer-modified, bituminous sheet underlayment.

3.7 SEALING

.1 Use sealant-filled joints unless otherwise indicated. Seal as required to form weathertight seal between flashing and adjoining surfaces and between flashing and other work of this Section.

.2 Provide bedding between members where possible and with neatly formed caulking bead where exposed.

.3 Provide non expansion, but movable, joints in metal to accommodate elastomeric sealant. Form joints to completely conceal sealant.

3.8 CLEANING AND PROTECTION

.1 Clean off excess sealants.

.2 Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended by sheet metal flashing and trim manufacturer. Maintain sheet metal flashing and trim in clean condition during construction.

.3 Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

PART 1 - GENERAL

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL INSTRUCTIONS

.1 Read and conform to:

.1 the General Conditions and the Supplementary Conditions of the Contract;

.2 Division 1 requirements and documents referred to therein.

1.3 SUMMARY

.1 Work Included: Provide firestopping and smoke seals systems in accordance with the OBC requirements, including but not limited to the following:

.1 Penetrations through fire-resistance-rated floor requiring protected openings including empty openings and openings that contain penetrations.

.2 Penetrations through fire-resistance-rated wall assemblies including empty openings and openings that contain penetrations.

.3 Membrane penetrations in fire-resistance-rated wall assemblies where items penetrate one side of the barrier.

.4 Joints in fire-resistance-rated assemblies to allow independent movement.

.5 Perimeter of the horizontal fire resistance rated assembly and exterior wall between a rated floor/roof and an exterior wall assembly.

.6 Joints, through penetrations and membrane penetrations in assemblies such as smoke barriers, smoke partitions and those assemblies required to limit, restrict or retard the passage of smoke.

.7 Openings and penetrations in fire-rated partitions or walls containing fire doors.

.8 Openings around structural members which penetrate floors or walls.

.9 Auxiliary tested accessories such as sealants, insulation, damming materials, boards, primers, collars required to complete firestopping work, excluding those inside sealed mechanical and electrical assemblies.

.2 Related Requirements: Specifications throughout the entirety of the Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them

1.4 REFERENCES

.1 Reference Standards: Latest published editions of reference standards listed in this Section in effect as of the closing date and time of the Request for Tenders for the Contract, including any amendments adopted, are applicable unless otherwise indicated.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meetings:

.1 Prior to starting work of this Section, convene a pre-installation meeting at the Project site to review the Project requirements and site conditions with pertinent parties. Conform to requirements of Section 01 30 00.

.2 Coordination:

.1 Coordinate construction of openings and penetrating items to ensure that through-firestopping and smoke seals are installed according to requirements specified in this Section.

.2 Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.

1.6 SUBMITTALS

.1 Product Data: Submit manufacturer's literature and data sheets for each type of material provided under this Section for the Project in accordance with requirements of Section 01 30 00. Ensure data sheets provide required information including detailed instructions for installing as well as maintaining, preserving and keeping materials in clean and safe conditions. Provide adequate warning of maintenance practices or cleaning agents detrimental to specified materials.

.2 Material Safety Data Sheets: Submit MSDS for inclusion in operation and maintenance manual without limitations for adhesives, sealants and any other material later designated by the Consultant.

.3 Firestopping Manual: Submit to the Consultant a firestopping manual complete with applicable product data sheets prepared by the Product manufacturer that indicates Products proposed for use for each assembly and installation required in the Work.

.4 Shop Drawings:

.1 Submit Shop Drawings in accordance with the submittal requirements of Section 01 30 00.

.2 Ensure Shop Drawings indicate material characteristics, details of construction, connections and relationship with adjacent construction. Submit complete and detailed Shop Drawings indicating ULC and/or cUL assembly number certification and material safety data sheets. In addition to the minimum requirements, indicate the following:

.1 Required temperature, hose stream and flame ratings,
.2 Material thicknesses,
.3 Installation methods,
.4 Primers, and
.5 Damming materials as applicable.

.3 Coordinate and ensure Shop Drawings for fire stopping and smoke seals inside sealed mechanical and electrical assemblies are reviewed by Divisions 21, 22, 23 and 26 respectively.

.5 Samples: Submit samples of various types of firestopping and smoke seal materials as requested and in accordance with the submittal requirements of Section 01 30 00.

.6 Field Reports: Submit manufacturer’s field report upon completion of firestopping work certifying that firestopping and smoke seals have been properly installed and adjusted in accordance with the manufacturer’s recommendations.

1.7 QUALITY ASSURANCE

.1 Manufacturer Qualifications: Company specializing in manufacturing Products of this Section with a minimum of 5 years documented experience.

.2 Installer Qualifications: Provide work of this Section executed by competent installers experienced trained, licensed and approved by material or system manufacturer for the application of the materials and systems being used; having a minimum of 5 years' experience in application of the Products, systems and assemblies specified herein and shown to have successfully completed not less than 5 projects of a comparable scale to this Project. Acceptable installer firms shall be:

.1 Firestop Contractors International Association Contractor Member in good standing,

.2 FM Approved in accordance with FM Standard 4991 – Approval of Firestop Contractors, ULC Qualified Firestop Contractor,

.3 Specialty applicator licensed and approved by the manufacturer.

.4 Licensed by the local authority where applicable.

.3 Mock-ups: Provide mock-ups in locations designated by the Consultant and as required to demonstrate the quality of workmanship. Maintain mock-ups during construction in an undisturbed condition as a standard for judging the completed work. Provide a mock-up of typical firestopping system as shown on reviewed Shop Drawings.

.4 Single Source Responsibility: Ensure primary materials provided in this Section are obtained from 1 source by a single manufacturer and secondary materials are obtained from sources recommended by primary materials manufacturers to the greatest extent possible.

.1 Materials from different manufacturers than those allowed by the tested and listed system shall not be intermixed in the same firestop system or opening.

.2 Tested and listed, classified firestop systems are to be used. If another manufacturer has a tested and listed system, then that system shall be used prior to an Engineering Judgment (EJ) or Equivalent Fire Resistance Rated Assembly (EFRRA).

1.8 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials to the Site in the manufacturer's sealed and labeled containers intact and legible at the time of use.

.2 Deliver materials to the Site with legible date of manufacture; lot number; shelf life (if applicable); qualified testing and inspection agency's classification marking; and mixing instructions for multi-component materials.

.3 Handle and store materials in accordance with the manufacturer's instructions with proper precautions to ensure fitness of material when installed.

.4 Do not use damaged or adulterated materials and materials exceeding their expiry dates.

1.9 PROJECTCONDITIONS

.1 Ambient Conditions: Comply with the manufacturer's recommended requirements for temperature, relative humidity, ventilation and substrate conditions during application and curing of materials.

.2 Do not Install firestopping Products when substrates are wet due to rain, frost, condensation, or other causes.

.3 Do not use materials that contain flammable solvents.

1.10 WARRANTY

.1 The Contractor warrants the work of this Section for a period of 5 years from Substantial Performance of the Work against defects and/or deficiencies in accordance with General

Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within this warranty period, to the satisfaction of the Consultant and at no expense to the Owner. Defects include but are not limited to cracking, breakdown of bond, failure to stay in place of bleeding and any other defect which affect firestopping.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Products of following manufacturers are acceptable subject to conformance to requirements of Drawings, Schedules and Specifications:

.1 3M Fire Protection;

.2 A/D Fire Protection Systems Inc.

.3 Hilti (Canada) Limitedw

.4 Specified Technologies Inc.

.5 Tremco (Canada) Limited.

.2 Substitution Limitations: This Specification is based on Hilti's Products and Systems.

.3 Comparable Products from manufacturers listed herein will be considered provided they meet the requirements of this Specification, offering functionally, aesthetically equivalent Products in Consultant's opinion and subject to Consultant's review.

2.2 DESCRIPTION

.1 Regulatory Requirements:

.1 Conform to the OBC, ULC, cUL UL, WH, FM listings, CAN/ULC-S115, ASTM E2307, ASTM E814 and ASTM E1966 fire test standards to achieve required fire protection rating in accordance with requirements of Authorities Having Jurisdiction.

.2 All materials shall be asbestos free and compatible with substrate. Materials shall allow for movement caused by thermal cycles, prevent transmission of vibrations from pipe, conduit or duct to structure and structure to pipe, conduits or duct. Materials shall comply with local VOC regulations.

.3 If required, hazardous disposal of firestop materials shall be strictly observed as noted on MSDS.

.2 Design and Performance Requirements:

.1 Provide and Install complete penetration firestopping systems that have been tested and approved by a nationally recognized third party testing agency (i.e. ULC, FM, Intertek or ULI listed in ULC Guide No. 40 U19.) performing testing and follow-up inspection services for firestop materials acceptable to Authorities Having Jurisdiction.

.2 Provide and Install firestopping Products that, once installed to the tested and listed system or engineering judgment, become firestop systems that resist the spread of fire and the passage of smoke and other gases according to requirements indicated herein, including but not limited to the following:

.1 F - Rated Through-Penetration Firestop Systems: Provide through-penetration firestop systems with F and H ratings indicated, as determined in accordance with ULC S115, but not less than one hour or the fire-resistance rating of the construction being penetrated.

.2 T - Rated Through-Penetration Firestop Systems: Provide firestop systems with T ratings, in addition to F ratings, as determined in accordance with ULC S115 where indicated or required by Authorities Having Jurisdiction.

.3 L – Rated Through-Penetration Firestop Systems: Provide firestop systems with L ratings of less than 5 cfm per sq. ft, in addition to F and T ratings, as determined in accordance with ULC S115, for all penetrations in smoke barriers, and where indicated or required by Authorities Having Jurisdiction.

.4 W – Rated Through-Penetration Firestop Systems: Provide firestop systems with W Water Resistance ratings (minimum Class 1), in addition to F, T and L ratings, as determined in accordance with ULC S115, where indicated or required by Authorities Having Jurisdiction.

.5 Perimeter Fire Containment Systems: Provide interior perimeter fire containment systems with fire-resistance ratings indicated, as determined in accordance with ASTM E2307, but not less than the fire-resistance rating of the floor construction.

.6 Fire-Resistive Joints: Provide joint systems with fire-resistance ratings indicated, as determined in accordance with ULC S115, but not less than the fire-resistance rating of the construction in which the joint occurs.

.7 For firestopping exposed to view, traffic, moisture, and physical damage, Provide firestop systems for these conditions that meet conditions expected.

.8 Where there is no specific third party tested and listed, classified firestop system available for a particular firestop configuration from any manufacturer, the firestopping Contractor shall obtain from the firestop manufacturer, an Engineering Judgment (EJ) or Equivalent Fire Resistance Rated Assembly (EFRRA) for submittal in accordance with requirements set forth by the International Firestop Council.

.3 Generally, firestopping and smoke seal ratings shall be provided as follows:

Element	Rating
Vertical fire-rated separations and locations as required by Authorities Having Jurisdiction	"F" and “L" as specified herein
Firewalls, horizontal fire-rated separations and locations as required by Authorities Having Jurisdiction	"F", "T" and "L" as specified herein
Mechanical rooms, laboratories, operating rooms and locations where water leakage may occur and as required by Authorities Having Jurisdiction	"F", "T", "L" and "W" as specified herein

.4 Perimeter Fire Containment Systems: Provide interior perimeter fire containment systems with fire-resistance ratings indicated, as determined in accordance with ASTM E2307, but not less than the fire-resistance rating of the floor construction.

.5 Fire-Resistive Joints: Provide joint systems with fire-resistance ratings indicated, as determined in accordance with ULC S115, but not less than the fire-resistance rating of the construction in which the joint occurs.

.6 For firestopping exposed to view, traffic, moisture, and physical damage, Provide firestop systems for these conditions that meet conditions expected.

.7 Where there is no specific third party tested and listed, classified firestop system available for a particular firestop configuration from any manufacturer, the firestopping Contractor shall obtain from the firestop manufacturer, an Engineering Judgment (EJ) or Equivalent Fire Resistance Rated Assembly (EFRRA) for submittal in accordance with requirements set forth by the International Firestop Council.

.8 Compatibility:

.1 Provide firestop systems that are compatible with one another, with the substrates forming openings, and with the items, if any, penetrating firestop systems, under conditions of service and application, as demonstrated by the firestop system manufacturer based on testing and field experience.

.2 Ensure firestop materials coming directly in contact with plastic pipe or plastic coated wire have undergone firestop material compatibility testing by the systems manufacturer or pipe and wire manufacturer.

.3 All firestop systems coming into contact with chlorinated polyvinyl chloride (CPVC) piping (direct or indirect) shall be FBC system compatible (This includes spray applied to firestop materials as overspray onto CPVC pipe).

.4 Ensure materials and Products provided do not cause stresses, chemical or physical reactions, or other damages to penetrating items or adjacent materials.

.5 Ensure compatibility of firestop system components with abutting dissimilar membranes, architectural coatings, finishes at floors, walls and ceilings. Check with manufacturer requirements of materials being installed.

.6 Ensure firestop system exposed to ambient conditions do not deteriorate after curing during and after completion of construction.

.7 Ensure firestopping systems do not affect structural integrity of load bearing walls and assemblies. Coordinate with the Consultant prior to penetrating any load bearing assembly.

.8 Ensure firestopping systems do not affect acoustical performance of acoustical assemblies.

.9 Provide firestopping capable of achieving a Class 1 rating when tested in accordance with ASTM G21 for antibacterial and antifungal properties to inhibit growth of bacteria, mould, mildew and fungi.

2.3 MATERIALS

.1 Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer plastic sleeve lined with an intumescent strip, a radial or square extended flange attached to one end of the sleeve for fastening to concrete formwork.

.2 Latex Sealants: Single-component latex formulations that after cure do not re-emulsify during exposure to moisture.

.3 Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

.4 Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized steel sheet.

.5 Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.

.6 Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

.7 Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at the Project site to form a nonshrinking, homogeneous mortar.

.8 Firestop Block: Ready-to-use, non-curing, reusable solution intumescent flexible block designed to seal medium to large size openings

.9 Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

.10 Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of the grades indicated below:

.1 Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and other surfaces requiring a nonslumping, gunnable sealant, unless indicated firestop system limits use to nonsag grade for both opening conditions.

.2 Grade for Horizontal Surfaces: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces.

.3 Grade for Vertical Surfaces: Nonsag formulation for openings in vertical and other surfaces.

.11 Firestop Joint Spray: sprayable fire rated mastic for construction joint; maximum flexibility in accordance with ASTM E1966 and UL 2079; containing no halogens, solvents or asbestos; water based, paintable.

.12 Cementitious matrices: Capable of providing minimum 2758 kPa (400 psi) compressive strength when cured, to retard cable tray warping within firestop seal.

.13 Primers: As required by the firestopping manufacturer and compatible with the selected system and contiguous materials.

.14 Water: Potable

.15 Pipe and duct insulation and wrappings: compatible with firestopping systems.

.16 Intumescent pads: Permanently pliable type.

.17 Intumescent composite sheet: Composite sheet, strip or precut shapes.

.18 Re-penetrable Sealants: Non-curing, re-penetrable intumescent sealants, caulking or putty materials for use with flexible cable or cable bundles.

.19 Accessories: Provide miscellaneous components needed to Install fill materials and to maintain ratings required. Use only components specified by the penetration firestopping manufacturer and approved by a qualified testing and inspecting agency. Accessories include, but are not limited to, the following items:

.1 Permanent forming/damming/backing materials in accordance with manufacturer's recommendations, including the following:

.1 Slag-/rock-wool-fiber insulation.
.2 Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
.3 Fire-rated form board.
.4 Fillers for sealants.

.2 Temporary forming materials.

.3 Substrate primers.

.4 Collars.

.20 Gypsum Products: The use of gypsum Products for through-penetration firestopping is strictly prohibited.

2.4 MIXING

.1 For those Products requiring mixing before application, comply with the through-penetration firestop system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce Products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Site Verification of Conditions:

.1 Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify the Consultant in writing of any conditions which would be detrimental to the installation.

.2 Examine substrates, openings, voids, adjoining construction and conditions under which firestop is to be installed. Confirm compatibility of surfaces. Verify penetrating items are securely fixed and properly located with proper space allowance between penetrations and surfaces of openings.

.3 Confirm locations of exposed/non-exposed firestopping/smoke seal surfaces prior to application. Provide movement capability at movement joints in accordance with design requirements for movement joint.

.4 Commencement of work implies acceptance of previously completed work.

3.2 PREPARATION

.1 Ensure surfaces to receive firestopping are free of dirt, dust, grease, oil, rust, loose materials, release agents, frost, moisture or any other matter which would impair bond of firestopping material to substrate of penetrating items.

.2 Prime substrates in accordance with the manufacturer’s written instructions.

.3 Do not apply firestopping and smoke seals to surfaces previously painted or treated with sealers, curing compounds, water repellents or other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required.

.4 Ensure that anchoring devices, back-up materials, clips, sleeves, supports and other related materials used in actual fire tests are provided.

.5 Mask where necessary to prevent firestopping materials from contacting adjoining surfaces that will remain exposed upon completion of work. Remove tape as soon as it is possible to do so without damaging firestop material or substrate.

3.3 INSTALLATION

.1 Comply with UL, ULC, cUL, ITS or FM Listings and manufacturer’s instructions for the type of material and condition of opening in each case. Consult with the manufacturer to determine the proper procedure for conditions not fully covered by printed instructions. Record in writing any oral instructions received, with a copy provided to the manufacturer.

.2 Provide firestopping to all penetrations passing through fire resistance rated wall and floor assemblies and other locations as indicated on the Drawings.

.3 Remove excess firestopping material promptly as work progresses and upon completion. Provide leak-proof dams as required to seal openings and contain firestop until cured. Install damming in accordance with test design and manufacturer's instructions.

.4 Provide an easily read label to firestop seals stating following: "THIS IS A FIRESTOP INSTALLED BY **[ ]** AND INSPECTED BY **[ ]** AND DATE INSTALLED COMPLETE WITH LISTED SYSTEM, TYPE AND THICKNESS. DO NOT REMOVE OR ALTER UNLESS IT IS IMMEDIATELY REPAIRED. TO REPAIR OR RETROFIT, USE ONLY COMPATIBLE FIRESTOP PRODUCTION IN ORDER TO MAINTAIN SYSTEM CLASSIFICATION"

3.4 FIELD QUALITY CONTROL

.1 Manufacturer's Services: Provide manufacturer's field services consisting of Product use recommendations and periodic site visits for inspection of Product installation in accordance with manufacturer's instructions.

.1 Report any inconsistencies from the manufacturer's recommendations immediately to the Consultant.

.2 Schedule site visits to review work at stages listed below:

.1 During initial installation of firestop systems to train appropriate Contractor personnel in proper selection and installation procedures.

.2 Upon completion of Work, after cleaning is carried out.

.3 Obtain field reports within three Days of review and submit immediately to the Consultant.

.2 The Owner may appoint an independent inspection and testing company to carry out additional inspection and testing as directed by the Consultant. Cooperate, coordinate, and arrange for inspections by the independent inspection and testing company at the required time. Third party testing should be carried out in accordance with ASTM E2174 and ASTM E2393.

.3 Following field inspections, Provide repair as required to ensure compliance with the Contract Documents.

3.5 CLEANING AND PROTECTION

.1 Upon completion of this work, remove all materials, equipment and debris from the Site. Leave work areas and adjacent surfaces in a condition acceptable to the Consultant.

3.6 FIRESTOPPING SCHEDULE

.1 Provide UL, ULC, cUL, ITS or FM listed firestop and smoke seal systems at:

.1 Penetrations through fire-resistance rated masonry, concrete, and gypsum board partitions and walls.

.2 Edge of floor slabs at curtain wall and precast concrete panels.

.3 Top of fire-resistance rated masonry and gypsum board partitions.

.4 Intersection of fire-resistance rated masonry and gypsum board partitions.

.5 Control and sway joints in fire-resistance rated masonry and gypsum board partitions and walls.

.6 Penetrations through fire-resistance rated floor slabs, ceilings and roofs.

.7 Openings and sleeves installed for future use through fire separations.

.8 Around mechanical and electrical assemblies penetrating fire separations.

.9 At expansion joints between fire-rated walls and other assemblies.

.10 Openings around structural support members that penetrate floors/walls.

.11 Openings and penetrations in fire rated walls or partitions containing fire doors.

.12 Penetrations made through fire-resistant rated assemblies in existing buildings for, but not necessarily limited to, mechanical and electrical services.

.2 Firestopping and smoke seals at openings where reinstallation occurs: UL or FM listed, Elastomeric or re-useable cementitious matrix or putty seal; do not use permanent cementitious seal at such locations.

.3 Firestopping and smoke seals at openings around penetrations for electrical bus ducts, pipes, ductwork and other electrical and mechanical items requiring sound and vibration control or allowance for expansion, contraction and other movement: UL or FM listed, Elastomeric seal; do not use a cementitious or rigid seal at such locations.

.4 Firestopping and smoke seals at joints and spaces designed and required to allow movement (building movement joints, deflection spaces, control joints, expansion joints, and similar locations): UL or FM listed, flexible, elastomeric seal suitable to withstand required movement and capable of returning to original configuration without damage to seal and without adhesive or cohesive failure; do not use a cementitious or rigid seal at such locations.

Firestop Schedule for Through-Penetration Systems.

TYPE OF PENETRANT	F-RATING (HR)	CONCRETE FLOORS	CONCRETE OR BLOCK WALLS	GYPSUM WALLS
		BASIS OF DESIGN UL/cUL SYSTEM		BASIS OF DESIGN UL/cUL SYSTEM
CIRCULAR BLANK OPENINGS	1	F-A-0006, C-AJ-0055, C-AJ-0090	C-AJ-0055, C-AJ-0090	--
	2	F-A-0006, C-AJ-0055, C-AJ-0090	C-AJ-0055, C-AJ-0090	--
	3	F-A-0006, C-AJ-0055, C-AJ-0086, F-A-0014	C-AJ-0055, C-AJ-0086	--
METAL PIPES OR CONDUIT	1	C-AJ-1226, F-A-1028, F-A-1017	C-AJ-1226, W-J-1067, W-J-1020	W-L-1054, W-L-1058, W-L-1164, W-L-1506
	2	C-AJ-1226, F-A-1028, F-A-1017	C-AJ-1226, W-J-1067, W-J-1020, W-J-1248	W-L-1054, W-L-1058, W-L-1164, W-L-1506
	3	C-AJ-1226, F-A-1017	C-AJ-1226, W-J-1041, W-J-1068	--
	4	C-BJ -1037, C-BJ-1034	C-BJ-1034, C-BJ-1037, W-J-1041, W-J-1042, W-J-1068	W-L-1110, W-L-1111, W-L-1165
NON-METALLIC PIPE OR CONDUIT (I.E. PVC, CPVC, ABS, FRP, ENT)	1	F-A-2053, F-A-2025, C-AJ-2109, C-AJ-2098, C-AJ-2271, C-AJ-2167, C-BJ-2021, C-AJ-2342	C-AJ-2109, C-AJ-2098, C-AJ-2167, C-AJ-2371, C-AJ-2342	W-L-2078, W-L-2075, W-L-2128
	2	F-A 2053, F-A 2025, C-AJ-2109, C-AJ-2098, C-AJ-2271, C-AJ-2167, C-BJ-2021, C-AJ-2371, C-AJ-2342	C-AJ-2109, C-AJ-2098, C-AJ-2167, C-AJ-2371, C-AJ-2342	W-L-2078, W-L-2075, W-L-2128
	3	F-A-2054, C-AJ-2109, C-AJ-2098, C-AJ-2371, C-AJ-2342	C-AJ-2109, C-AJ-2098, C-AJ-2371, C-AJ-2342	--
	4	C-BJ-2016, C-AJ-2017	W-J-2057, W-J-2091	W-L-2184, W-L-2245

SINGLE OR BUNDLED CABLES	1	F-A-3007,C-AJ-3095,C-AJ-3180, C-AJ-3283	W-J-3036, C-AJ-3095, C-AJ-3180, W-J-3060, W-J-3167	W-L-3065, W-L-3111, W-L-3112, W-L-3334, W-L-3414, W-L-3396
	2	F-A-3007,C-AJ-3095,C-AJ-3334, F-A-3060	W-J-3036, C-AJ-3095, C-AJ-3180, W-J-3060, W-J-3167, W-J-3189	W-L-3065, W-L-3111, W-L-3112, W-L-3334, W-L-3414, W-L-3396
	3	F-A-3007, C-AJ 3095, C-AJ-3285	C-AJ-3095, C-AJ-3180, W-J-3167	--
	4	N/A**	W-J-3050	W-L-3139, W-L-3334
CABLE TRAY	1	C-AJ-4034, C-AJ-4035	W-J-4027, C-AJ-4034, C-AJ-4035	W-L-4011, W-L-4019, W-L-4081
	2	C-AJ-4034, C-AJ-4035	W-J-4027, C-AJ-4034, C-AJ-4035	W-L-4011, W-L-4019, W-L-4081
	3	C-AJ-4034, C-AJ-4035	C-AJ-4034, C-AJ-4035	W-L-3385, W-L-3277
	4	N/A**	W-J-8007	W-L 8014
INSULATED PIPES	1	F-A 5015, F-A 5017, C-AJ-5090, C-AJ-5091, C-AJ-5090, C-AJ-5048	C-AJ-5090, C-AJ-5091, C-AJ 5061, W-J-5042	W-L-5028, W-L-5029, W-L-5047
	2	F-A 5015, F-A 5017, C-AJ-5090, C-AJ-5091, C-AJ-5090	C-AJ-5090, C-AJ-5091, C-AJ-5061, W-J-5042	W-L-5028, W-L-5029, W-L-5047
	3	F-A 5016, C-AJ-5090, F-A-5018	C-AJ-5090, C-AJ-5061	--
	4	C-BJ-5006	C-BJ-5006, W-J-5028	W-L-5073
ELECTRICAL BUSWAY	1	C-AJ-6006, C-AJ-6017, F-A-6002, C-AJ-6036	C-AJ-6006, C-AJ-6017, C-AJ-6036	--
	2	C-AJ-6006, C-AJ-6017, F-A 6042, C-AJ-6036	C-AJ-6006, C-AJ-6017, C-AJ-6036	--
	3	C-AJ-6006, C-AJ-6017	C-AJ-6006, C-AJ-6017	--
MECHANICAL DUCTWORK WITHOUT DAMPERS (NON-INSULATED)	1	C-AJ-7046, C-AJ-7051, C-AJ-7084	C-AJ-7046, C-AJ-7051, W-J-7021, W-J-7022	W-L-7017, W-L-7040, W-L-7042, W-L-7155
	2	C-AJ-7046, C-AJ-7051, C-AJ-7085	C-AJ-7046, C-AJ-7051, W-J-7021, W-J-7022	W-L-7040, W-L-7042, W-L-7155
	3	C-AJ-7046, C-AJ-7051	C-AJ-7046, C-AJ-7051	--
MECHANICAL DUCTWORK WITHOUT DAMPERS (INSULATED)	1	N/A**	W-J-7029, W-J-7124	W-L-7059, W-L-7153, W-L-7156, W-L-7151
	2	N/A**	W-J-7091, W-J-7112, W-J-7124	W-L-7059, W-L-7153, W-L-7156, W-L-7151
MIXED PENETRANTS	1	C-AJ-8099, C-AJ-8056, C-AJ-8143	C-AJ-8099, C-AJ-8056, W-J-8007, C-AJ-8143	W-L-1095, W-L-8013
	2	C-AJ-8099, C-AJ-8056, C-AJ-8143	C-AJ 8099, C-AJ-8056, W-J-8007, C-AJ-8143	W-L-1095, W-L-8013
	3	C-AJ-8099, C-AJ-8056	C-AJ-8041, C-AJ-8056, W-J-8007, C-AJ-8099	--
	4	C-AJ-8095	C-AJ-8095, W-J-8007	W-L-8014

** CONTACT MANUFACTURER FOR CURRENT UL-CLASSIFIED SYSTEM OR ENGINEERING JUDGMENT

NOTES:

1. Jobsite conditions of each through-penetration firestop system must meet ALL details of the UL-Classified System selected.
2. If jobsite conditions do not match any UL-classified systems in the schedules above, contact Manufacturer for alternative systems or Engineering Judgment
3. Where more than one applicable UL-Classified System is listed in the schedules, choose the UL System which is most suited for each through-penetration firestop system.
4. Coordinate this work with the work being performed by other trades to ensure that penetration opening sizes are appropriate for penetrant locations, and vice versa.

Schedule of Joint Firestop Systems.

JOINT TYPE	F-RATING (HR)	BASIS OF DESIGN UL/cUL SYSTEM	
		JOINT WIDTH LESS THAN OR EQUAL TO 2"	JOINT WIDTH GREATER THAN 2", LESS THAN OR EQUAL TO 6" [4]
CONCRETE (**FLOOR-TO-FLOOR**)	1	FF-D-1012, FF-D-1013[1]	FF-D-1012, FF-D-1013
	2	FF-D-1012, FF-D-1013[1]	FF-D-1012, FF-D-1013
	3	FF-D-1011, FF-D-1026[1]	FF-D-1011, FF-D-1026
	4	FF-D-1047	FF-D-1125
CONCRETE (**EDGE OF FLOOR SLAB-TO-WALL**)	1	FW-D-1011, FW-D-1012, FW-D-1013	FW-D-1011, FW-D-1012, FW-D-1013, FW-D-1021
	2	FW-D-1011, FW-D-1012, FW-D-1013	FW-D-1011, FW-D-1012, FW-D-1013, FW-D-1021
	3	FW-D-1011	FW-D-1011, FW-D-1021
	4	FW-D-1047	FW-D-1092
CONCRETE OR BLOCK WALL TO FLAT CONCRETE FLOOR (**TOP-OF-WALL**)	1	N/A**	N/A**
	2	HW-D-0097[1]	HW-D-1009
	3	HW-D-1008[1], HW-D 0268	HW-D-1008
	4	HW-D-1042	HW-D-1103
CONCRETE OR BLOCK WALL TO CONCRETE OVER FLUTED METAL DECK **(TOP-OF-WALL**)	1	HW-D-0098	N/A**
	2	HW-D-0080, HW-D-0081, HW-D-0098	HW-D-1037
	3	N/A**	N/A**
	4	HW-D-0294	N/A**
GYPSUM WALL TO FLAT CONCRETE FLOOR (**TOP-OF-WALL**)	1	HW-D-0757, HW-D-0082, HW-D-0083, HW-D-0106, HW-D-0119	HW-D-1011, HW-D-1012, HW-1020
	2	HW-D-0757, HW-D-0082, HW-D-0083, HW-D-0106, HW-D-0119	HW-D-1011, HW-D-1012, HW-1020
	3	HW-D-0119	HW-D-1011, HW-D-1012, HW-1020
GYPSUM SHAFT WALL TO **TOP-OF-WALL**	2	HW-D-0342 (FLAT CONCRETE) HW-D-0541, HW-D-0542 (CONCRETE OVER METAL DECK)	N/A**

GYPSUM SHAFT WALL TO CONCRETE FLOOR (**BOTTOM-OF-WALL**)	1	BW-S-0023	N/A**
	2	BW-S-0023	N/A**
GYPSUM WALL TO CONCRETE FLOOR (**BOTTOM-OF-WALL**)	1	BW-S-0001, BW-S-0002, BW-S-0039	N/A**
	2	BW-S-0001, BW-S-0002, BW-S-0039	N/A**
GYPSUM WALL TO CONCRETE OVER FLUTED METAL DECK (**TOP-OF-WALL**)	1	HW-D-0042*, HW-D-0049*, HW-D-0087*, HW-D-0089*, HW-D-0045, HW-D-0046*, HW-D-0076*, HW-D-0077*, HW-D-0154, HW-D-0184*, HW-D-0292, HW-D-0295, HW-D-538*	HWD-1011, HWD-1012, HW-1020
	2	HW-D-0042*, HW-D-0049*, HW-D-0087*, HW-D-0089*, HW-D-0045, HW-D-0046*, HW-D-0076*, HW-D-0077*, HW-D-0154, HW-D-0184*, HW-D-292, HW-D-0295, HW-D0538*	HW-D-1011, HW-D-1012, HW-D-1020
	3	HW-D-0292, HW-D-0295	HWD-1011, HWD-1012, HW-1020
	4	HW-D-0292, HW-D-0295	N/A**
CONCRETE (**WALL TO WALL**)	2	WW-D-0017, WW-D-0082	WW-D-1080, WW-D-1084
	3	WW-D-1011[1], WW-D-0032	WW-D-1011
	4	WW-D-1047	WW-D-1128
GYPSUM TO CONCRETE (**WALL TO WALL**)	1	WW-D-0040	N/A**
	2	WW-D-0040	N/A**

* SEE NOTE 3
** Contact manufacturer for current UL/cUL-classified system or engineering judgment
NOTES:

1. Classified systems for 2" - 6" wide joints may be used for joints 2" wide and less.
2. Confirm that movement capabilities of the selected UL/cUL system meets or exceeds the specified movement range of the particular joint.
3. Systems marked with an asterisk (*) are suitable for top-of-wall joints where the fluted metal deck has sprayed-on fireproofing. Verify with manufacturer prior to application.
4. Verify allowable joint width on specific UL/cUL system Drawings.

END OF SECTION

Updated through ADD#10

PART 1 - GENERAL

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL INSTRUCTIONS

.1 Read and conform to:

.1 the General Conditions and the Supplementary Conditions of the Contract;

.2 Division 1 requirements and documents referred to therein.

1.3 SUMMARY

.1 Work Included: Provide joints sealants including but not limited to the following:

.1 Exterior joints in vertical surfaces and nontraffic horizontal surfaces

.2 Exterior joints horizontal traffic surfaces

.3 Interior joints vertical surfaces and horizontal nontraffic surfaces

.2 Related Requirements: Specifications throughout the entirety of the Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.4 REFERENCES

.1 Definitions:

.1 In the context of general purpose joint sealants, the following definitions apply in accordance with ASTM C920 for performance characteristics and are used accordingly in this Section:

.1 Sealant types:

.1 Type S: Single component sealant;
.2 Type M: Multi-component sealant;

.2 Rheological Properties:

.1 Grade P: Pourable or self-leveling sealant;
.2 Grade NS: Non-sag sealant

.3 Movement:

.1 Class 100/50: Sealant which can withstand an increase of at least 100% and a decrease of at least 50% of the joint width as measured at the time of applications
.2 Class 50: a sealant which can withstand an increase and a decrease of at least 50% of the joint width as measured at the time of applications
.3 Class 35: a sealant which can without an increase and a decrease of at least 35% of the joint width as measured at the time of applications
.4 Class 25: a sealant which can withstand an increase and a decrease of at least 25% of the joint width as measured at the time of applications

.5 Class 12 ½: a sealant which can withstand an increase and a decrease of at least 12.5% of the joint width as measured at the time of applications

.4 Usage:

.1 Use T: a sealant designed for use in joints in pedestrian and vehicular traffic areas such as walkways, plazas, decks and parking garages
.2 Use NT: a sealant designed for use in joints in nontraffic areas
.3 Use I: sealant designed for use in joints which are submerged continuously in a liquid
.4 Use M: a sealant that meets the requirements of ASTM C920 when tested on mortar specimens for adhesion and cohesion after cyclic movement requirements of ASTM C719 and adhesion in peel requirements of ASTM C794
.5 Use G: a sealant that meets the health, safety, emergency response hospital procedure and policy requirements of ASTM C920 and this Specification when tested on glass specimens or adhesion and cohesion after cyclic movement requirements of ASTM C719 and adhesion in peel requirements after ultraviolet exposure through glass of ASTM C794
.6 Use A: a sealant that meets the requirements of ASTM C920 when tested on aluminum specimens in accordance with for adhesion and cohesion after cyclic movement requirements of ASTM C719 and adhesion in peel requirements of ASTM C794
.7 Use O: a sealant that meets the requirements of ASTM C920 when tested on substrates other than the standard substrates in accordance with for adhesion and cohesion after cyclic movement requirements of ASTM C719 and adhesion in peel requirements of ASTM C794

.2 Reference Standards: Latest published editions of reference standards listed in this Section in effect as of the closing date and time of the Request for Tenders for the Contract, including any amendments adopted, are applicable unless otherwise indicated.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meetings:

.1 Prior to starting work of this Section, convene a pre-installation meeting at the Project site to review the Project requirements and site conditions with pertinent parties. Conform to requirements of Section 01 30 00.

1.6 SUBMITTALS

.1 Product Data: Submit manufacturer's literature and data sheets for each type of material provided under this Section for the Project in accordance with requirements of Section 01 30 00. Ensure data sheets provide required information including detailed instructions for installing as well as maintaining, preserving and keeping materials in clean and safe conditions. Provide adequate warning of maintenance practices or cleaning agents detrimental to specified materials.

.2 Material Safety Data Sheets: Submit MSDS for inclusion in operation and maintenance manual without limitations for adhesives, sealants and any other material later designated by Consultant.

.3 Compatibility Testing Report: Prior to Supply or installation, test exterior sealant materials for compatibility with joint substrates. Test for staining and adhesion of materials including substrates treated with sealers, curing compounds and water repellants and materials which

may contact sealant. Submit written report of test results to the Consultant in accordance with Section 01 30 00.

.4 Colours:

.1 Colour Hierarchy: Submit sealant colours for acceptance in accordance with the following general colour hierarchy. Between 2 dissimilar materials, colour the sealant to match the material with the higher relative position on the colour hierarchy scale (highest is at ".1"):

.1 Concrete.
.2 Masonry.
.3 Metal extrusions.
.4 Metal (formed).

.2 For fully concealed joints, Provide the manufacturer's standard color of sealant which has the best overall performance characteristics for the application shown.

.5 Samples: Submit samples in accordance with Section 01 30 00. Provide cured, colour samples of the manufacturer's standard range of colours in each type of sealant and caulking compound for colour selection by the Consultant. Submit samples of primer, bond breaker tape and joint backing material, if requested.

1.7 QUALITY ASSURANCE

.1 Installer Qualifications: Provide work of this Section executed by competent installers who have a membership in good standing in the Sealant and Waterproofing Association and with a minimum of 5 years' experience in the application of the Products, systems and assemblies specified herein and with the approval and training of the Product manufacturers. Include lists of completed projects with the projects' names, the names of the consultants on the projects and contact persons.

.2 Testing Agency Qualifications: Retain an independent testing agency qualified in accordance with ASTM C1021 to conduct the testing indicated, as documented according to the sealant manufacturer's recommendations. Ensure materials are verified for suitability in accordance with ASTM C719 and ASTM C661.

.3 Preconstruction Testing:

.1 Test elastmeric joint sealants for compliance with requirements of ASTM C920 and, where applicable, to other standard test methods.

.2 Test elastomeric joint sealants for compliance with requirements of ASTM C920 for adhesion and cohesion under cyclic movement, adhesion-in peel and indentation hardness.

.3 Test other joint sealants for compliance with the requirements indicated in this Section by referencing standard specifications and test methods.

.4 Prior to commencement of sealing, arrange for the sealant manufacturer's technical representative to visit the Place of the Work and inspect the surfaces and joints to be sealed.

.5 Test for compatibility of sealant and accessory Products with joint substrates. Test results and written recommendations for primers and substrate preparation required for proper adhesion. For materials failing tests, obtain the joint sealant manufacturer's written instructions for corrective measures, including the use of specialty formulated primers.

.4 Single Source Responsibility: Ensure primary materials provided in this Section are obtained from 1 source by a single manufacturer and secondary materials are obtained from sources recommended by primary materials manufacturers.

.5 Mock-ups:

.1 Conform to requirements of Section 01 40 00. At the Site, in area(s) designated by the Consultant, erect sample panels 1 m (39"") long for determined type(s) of sealant joint design, showing location, size, shape and depth of joint complete with backup materials, primer, caulking and sealant, bond, colour and quality of installation work.

.2 If requested, conduct a field test for joints designated. Construct additional mock-ups if required to obtain approval. Do no sealant work until mock-ups have been approved. Approved mock-ups become the standard of comparison for sealant and caulking work on site and may become part of the finished installation if left undisturbed at the time of Substantial Performance of The Work.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Deliver caulking and sealant materials to the Site in original, unopened containers with manufacturers' labels and seals intact. Labels shall identify manufacturer's name, brand name of Product, grade and type, application directions and shelf life or expiry date of Product.

.2 Handle and store materials in accordance with manufacturer's printed directions. Store flammable materials in safe, approved containers to eliminate fire hazards.

.3 Do not use caulking and sealant materials that have been stored for period of time exceeding maximum recommended shelf life of materials.

1.9 PROJECT CONDITIONS

.1 Environmental Requirements: Do not apply any sealant under adverse weather conditions, when joints to be sealed are damp, wet or frozen or when at ambient temperatures below 5 deg C (40 deg F). Maintain minimum temperature of application during application and for 8 hours after application. Consult the manufacturer for specific instructions before proceeding; obtain the Consultant's approval.

.2 Do not proceed with installation of joint sealants where joint widths are less than those allowed by the joint sealant manufacturer for applications indicated, and until contaminants capable of interfering with adhesion are removed from joint substrates.

1.10 WARRANTY

.1 The Contractor warrants the work of this Section for period of 5 years from Substantial Performance of the Work against defects and deficiencies in accordance with General Conditions of the Contract. Promptly correct defects or deficiencies which become apparent within this warranty period, to the satisfaction of the Consultant and at no expense to the Owner. Defects include but are not limited to: cracking, crumbling, melting, shrinkage, sag, adhesion or cohesion failure, reversion, air and moisture leakage, marbling or streaking due to improper mixing, discolouration due to dirt pick-up during curing and staining of adjacent materials.

1.11 MANUFACTURER'S GUARANTEE (EXTERIOR SEALANTS)

.1 Provide sealant manufacturer's non-stain guarantee naming the Owner as beneficiary and covering defects and deficiencies and weather tightness of complete membrane and flashings for 20 years from Substantial Performance of the Work.

.2 Provide a guarantee covering the materials described in this Section. The guarantee shall include the furnishing, repair and replacement of such materials at the manufacturer's expense

and to the extent required for the work of this Section which does not comply with performance and other requirements specified herein.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Products of following manufacturers are acceptable subject to conformance to requirements of Drawings, schedules and Specifications:

.1 BASF Inc.

.2 CPD Construction Products;

.3 Dow Corning

.4 Euclid Chemical Canada Ltd.

.5 Momentive Performance Materials;

.6 Hilti (Canada) Limited

.7 Pecora Corporation

.8 Sika Canada Inc.

.9 Tremco Canada

.10 W. R. Meadows

.11 or Equivalent to the above.

2.2 DESCRIPTION

.1 Regulatory Requirements:

.1 Ensure sealants comply with ~~LEED and~~ requirements of Authorities Having Jurisdiction with regards VOC emission.

.2 Performance Requirements:

.1 Provide exterior and interior elastomeric joint sealants establishing and maintaining water tight, water resistant and air tight continuous joint seals without staining or deteriorating joint substrates.

.2 Ensure elastomeric sealants provided comply with ASTM C920 and other standards specified herein for type, grade, class and uses.

.3 Provide Products with capability, when tested for adhesion and cohesion under maximum cyclic movement in accordance with ASTM C719, to withstand required percentage change in joint width existing at the time of installation and remain in compliance with other requirements of ASTM C920 for uses indicated.

.4 Provide elastomeric sealants that are non-staining and have undergone testing in accordance with ASTM C1248 for joint substrates indicated for the Project.

2.1 EXTERIOR JOINT SEALANTS

.1 Single component, nonsag, neutral curing silicone sealant, ASTM C920, Type S, Grade NS, Class 100/50 or Class 50 as required for applications and joint design, for Use NT or nonstaining silicone sealant according to ASTM C 1248.

.1 Exterior joints in vertical surfaces and horizontal non-traffic surfaces as follows:

.1 Construction joints in cast-in-place concrete.
.2 Control and expansion joints in unit masonry.
.3 Joints between different materials listed above.
.4 Perimeter joints between materials listed above and frames of doors, windows and louvers.
.5 Other joints as indicated on Drawings and Schedules.

.2 Acceptable Products:

.1 "Dowsil 790" or "Dowsil 795" or "Dowsil CCS" by Dow Chemical of Canada ULC
.2 "Spectrem 1" or "Spectrem 2" by Tremco Incorporated
.3 "Sikasil WS-290" or "Sikasil WS-295" by Sika Canada Inc.
.4 "Silpruf SCS2000" or "Silpruf LM SCS2700" by GE Silicones (Momentive Performance Materials)
.5 "890NST" or "864NST" by Pecora Corporation
.6 Approved equivalent.

.2 Single component, nonsag, low dirt pick-up, non-staining, neutral curing silicone sealant, ASTM C920, Type S, Grade NS, Class 100/50 or Class 50 as required for applications and joint design, for Use NT.

.1 Exterior joints in vertical surfaces and horizontal non-traffic surfaces as follows:

.1 Joints between plant-precast architectural concrete units.
.2 Joints in stone masonry and cladding.
.3 Joints in metal panel substrates.
.4 Joints between different materials listed above.
.5 Other joints as indicated on Drawings and Schedules.

.2 Acceptable Products:

.1 "Spectrem 3" or "Spectrem 4 TS" by Tremco Incorporated
.2 "Dowsil 756 SMS" by Dow Chemical of Canada ULC
.3 "Silpruf NB SCS9000" by GE Silicones (Momentive Performance Materials)
.4 "Sikasil WS-290" or "Sikasil WS-295" by Sika Canada Inc
.5 Approved equivalent.

.3 Single-Component, Nonsag, Traffic-Grade, Neutral-Curing Silicone Joint Sealant, ASTM C920, Type S, Grade NS, Class 100/50, for Use T.

.1 Exterior joints in horizontal traffic surfaces as follows:

.1 Control and expansion joints in brick pavers.
.2 Isolation and contraction joints in cast-in-place concrete slabs.
.3 Joints between plant-precast architectural concrete paving units.
.4 Joints in stone paving units, including steps.
.5 Tile control and expansion joints.
.6 Joints between different materials listed above.
.7 Other joints as indicated on Drawings and Schedules.

.2 Acceptable Products:

.1 "Dowsil 790" or "Dowsil NS Parking Structure Sealant" by Dow Chemical of Canada ULC
.2 "Spectrem 800/900SL" by Tremco Incorporated
.3 "Sikasil -728 SL" or "Sikasil -728 NS" by Sika Canada Inc.
.4 "301 NS" or "311 NS" by Pecora Corporation

.5 Approved equivalent.

.4 Single-Component or Multicomponent, Pourable, Traffic-Grade, Urethane Joint Sealant, ASTM C920, Type S or Type M, Grade P, Class 25 or Class 50 as required by joint design, for Use T.

.1 Exterior joints in horizontal traffic surfaces subject to water immersion as follows:

.1 Joints in pedestrian plazas.
.2 Joints in swimming pool decks.
.3 Other joints as indicated on Drawings and Schedules.

.2 Acceptable Products:

.1 “TH901” or “Vulkem 45 SSL” by Tremco Incorporated
.2 “MasterSeal SL1 or MasterSeal SL 2” by Master Builders Solutions“
.3 “Urexpan NR-201” by Pecora Corporation
.4 “Sikaflex - 1CSL”or “Sikaflex 2C SL ” by Sika Canada Inc.
.5 Approved equivalent.

2.2 INTERIOR JOINT SEALANTS

.1 Single component, nonsag, neutral curing silicone or urethane sealant, ASTM C920, Type S or Type M, Grade NS, Class 50, Class 35 or Class 25 as required for applications and joint design, for Use NT.

.1 Interior joints in vertical surfaces and horizontal nontraffic surfaces as follows:

.1 Control and expansion joints on exposed interior surfaces of exterior walls.
.2 Perimeter joints of exterior openings.
.3 Tile control and expansion joints.
.4 Vertical joints on exposed surfaces of interior unit masonry and concrete walls and partitions.
.5 Joints on underside of plant-precast structural concrete beams and planks.
.6 Perimeter joints between interior wall surfaces and frames of interior doors, windows and elevator entrances.
.7 Other joints as indicated on Drawings and Schedules.

.2 Acceptable Products:

.1 “Dowsil 791” or “Dowsil 795” or “Dowsil CWS” by Dow Chemical of Canada ULC
.2 “Spectrem 2” or “Spectrem 3” or “Dymonic” or “Dymonic FC” by Tremco Incorporated
.3 ”SilPruf LM SCS2700” by GE Silicones (Momentive Performance Materials)
.4 “890NST” or “890FTS” or “864NST” or “PCS” or “DnyaTrol I-XL” or “DynaTrol II” by Pecora Corporation
.5 “SikaSil WS-295” by Sika Canada Inc.
.6 Approved equivalent.

.2 Mildew-Resistant, Single-Component, Nonsag, Silicone Joint Sealant, ASTM C920, Type S, Grade NS, Class 25, for Use NT

.1 Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces as follows:

.1 Joints between plumbing fixtures and adjoining walls, floors, and counters.
.2 Tile control and expansion joints.
.3 Other joints as indicated on Drawings and Schedules.

.2 Acceptable Products: Mildew-Resistant, Single-Component, Acid-Curing or Neutral Curing Silicone Joint Sealant, ASTM C920, Type S, Grade NS, Class 25, for Use NT.

.1 "Dowsil 786 Mildew Resistant" or "Dowsil Tub/Ceramic/Tile" by Dow Corning Corporation
.2 "Silicones; Sanitary SCS1700" by GE Silicones (Momentive Performance Materials)
.3 "Tremsil 200 Sanitary" by Tremco Incorporated
.4 "Sikasil GP/GP HT" by Sika Canada Inc.
.5 "898 NST" by Pecora Corporation

.3 Nonsag, paintable, nonstaining latex complying with ASTM C834 or butyl rubber sealant complying with ASTM C1311.

.1 Surface Burning Characteristics: Flame spread, and smoke developed indexes not greater than 25 and 450, respectively.

.2 Interior acoustical joints in vertical surfaces and horizontal nontraffic surfaces as follows:

.1 Acoustical joints at top and bottom of gypsum board partitions; at top of masonry walls and through non fire-rated penetrations in gypsum and masonry walls.
.2 Other joints as indicated on Drawings and Schedules.

.3 Acceptable Products:

.1 "AC-20 FTR" or "AIS-919" by Pecora Corporation
.2 "SHEETROCK Acoustical Sealant" by CGC Inc.
.3 "QuietZone Acoustic Sealant" by Owens-Corning Canada Inc.
.4 "Tremco Acoustical Sealant" by Tremco Ltd.
.5 "QuietSeal" or "QuietSeal 350" by Serious Materials.
.6 "CP506 – Smoke and Acoustic Sealant" by Hilti
.7 "RCS20" by GE Silicones (Momentive Performance Materials)
.8 "MasterSeal NP520" by Master Builders Solutions

.4 Single-Component or Multicomponent, Traffic-Grade, Silicone or Urethane Joint Sealant, ASTM C920, Type S or Type M, Class 25 or Class 50 as required by joint design, for Use T

.1 Interior traffic joints as follows:

.1 Isolation joints in cast-in-place concrete slabs. Refer to Section 03 35 00 for filling of contraction joints.
.2 Acceptable Products:

.1 "Dowsil 790" by Dow Corning Corporation
.2 "301 NS" or "311 NS" "300 SL" or "310 SL" by Pecora Corporation
.3 "Spectrem 800/900SL" by Tremco Incorporated
.4 "Sikaflex - 1CSL or Sikaflex 2C SL" by Sika Canada Inc.
.5 "MasterSeal SL1" or "MasterSeal SL2" by Master Builders Solutions

.5 Single-Component or Multicomponent, Traffic-Grade, Silicone or Urethane Joint Sealant, ASTM C920, Type S or Type M, Class 25 or Class 50 as required by joint design, for Use T

.1 Interior traffic joints as follows:

.1 Control and expansion joints in stone flooring.
.2 Control and expansion joints in tile flooring.
.3 Other joints as indicated on Drawings and Schedules.

.2 Acceptable Products: As recommended by flooring manufacturer and conforming to TTMAC guidelines.

.6 Single-Component Silicone complying with ASTM C920, Grade NS, Class 25 or butyl rubber sealant complying with ASTM C1311.

.1 Interior traffic joints as follows:

.1 Concealed sealants for bedding thresholds and sills.

.2 Acceptable Products:

.1 “Dowsil 758” by Dow Corning Corporation
.2 “Tremco Butyl Sealant” by Tremco Incorporated
.3 “BC-158” or “BA-98” by Pecora Corporation
.4 “MasterSeal NP1” by Master Builders Solutions

.7 Silicone glazing sealant, ASTM C920, Type S, Grade NS, Class 25, Use NT.

.1 Glazing applications as follows:

.1 Non-structural sealing for butt-glazing in interior applications and other non-moving glazing joints.

.2 Acceptable Products:

.1 “Dowsil 799” or “Dowsil Glazing” by Dow Chemical of Canada ULC
.2 “UltraGlaze SSG4000” or “UltraGlaze SSG4000AC” by GE Silicones (Momentive Performance Materials)
.3 “Tremsil 200” by Tremco Incorporated
.4 “Sikasil - N Plus” by Sika Canada Inc.

.8 Single-Component, Nonsag, Urethane Tamper-resistant Security Joint Sealant, ASTM C920, Type S or Type M, Grade NS, Class 12.5, for Use NT, Shore A hardness 40 +/- 5 in accordance with ASTM C661.

.1 Interior tamper-resistant security joints as follows:

.1 Moving (e.g. perimeters of exterior openings) and non-moving (e.g. fixture joints) in public and supervised locations such as [day rooms,] [exercise rooms,] [cafeterias,] and similar locations.

.2 Acceptable Products:

.1 “Pecora Dynaflex™ SC” by Pecora Corporation
.2 “Masterseal CR195” by Master Builders Solutions.
.3 “DOWSIL™ 995 Silicone Structural Sealant” by Dow Chemical of Canada ULC
.4 “Sikaflex 11FC” or “Sika Construction Adhesive”

2.3 COMPONENTS

.1 Joint Backing: Preformed, compressible, resilient, non-waxing, non-extruding, non-staining strips of closed cell polyethylene or urethane foam, compatible with joint substrates and are approved by the sealant manufacturer based on field experience and laboratory test. Sizes and shapes to suit various conditions, diameter 25% greater than joint width. Backing shall be compatible with sealant, primer and substrate.

.2 Bond Breaker Tape: As recommended by the sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

.3 Joint Primer: Non-staining, suitable for substrate surfaces, compatible with joint forming materials and as recommended by the sealant manufacturer for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

.4 Masking Tape: Provide non-staining, non-absorbent tapes and sheets which effectively mask sealant without leaving an adhesive residue compatible with joint sealants and surfaces adjacent to joints.

.5 Cleaning Material: Non-corrosive, non-staining, solvent type, xylol, methyl-ethyl-ketone (MEK), toluol, isopropyl alcohol (IPA) or as recommended by the sealant manufacturer and acceptable to the material or finish manufacturers for surfaces adjacent to sealed areas free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way and formulated to promote optimum adhesion of sealants with joint substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Examine joints for compliance with requirements for joint configuration, installation tolerances and other conditions affecting joint sealant performance. Ensure joints are suitable to accept and receive sealants.

.2 Verify that joint surfaces are clean, sound, free of defects and that dimensions are within the sealant manufacturer's size requirements.

.3 Proceed with installation only after unsatisfactory conditions have been corrected. Commencement of work implies acceptance of surfaces and conditions.

.4 Do not apply sealant to masonry until mortar has cured.

.5 Before any sealing work is commenced, test materials for indications of staining or poor adhesion.

.6 Notify the Consultant in writing of any conditions which would be detrimental to the installation. Commencement of work implies acceptance of previously completed work.

3.2 PREPARATION

.1 Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

.2 Clean joints and spaces which are to be sealed and ensure they are dry and free of dust, loose mortar, oil, grease, oxidation, coatings, form release agents, sealers and other foreign material.

.3 Clean porous surfaces such as concrete, masonry or stone by wire brushing, grinding or blast cleaning, mechanical abrading or combination of these methods as required to obtain clean and sound surfaces.

.4 Remove laitance by grinding or mechanical abrading.

.5 Remove oils by sandblast cleaning.

.6 Remove loose particles present or resulting from grinding, abrading or sandblast cleaning by thorough brushing.

.7 Clean ferrous metals of rust, mill scale and foreign materials by wire brushing, grinding or sanding.

.8 Wipe non-porous surfaces such as metal and glass to be sealed, except pre-coated metals, with cellulose sponges or clean rags soaked with solvent recommended by manufacturer and

wipe dry with clean cloth. Where joints are to be sealed with silicone based sealants clean joint with methyl-ethyl-ketone (MEK) or xylol. Do not allow solvent to air-dry without wiping. Clean pre-coated metals with solutions or compounds which will not injure finish and which are compatible with joint primer and sealant. Check ferrous metal surfaces are painted before applying sealant.

.9 Examine joint sizes and where depth of joint exceed required depth of sealant correct to achieve proper following width/depth ratio:

.1 Maintain 2:1 width/depth ratio: minimum joint size to be 6 mm (1/4") x 6 mm (1/4"), maximum depth of sealant to be 13 mm (1/2").

.10 Install joint backing material to achieve correct, uniform joint profile and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

.11 Do not leave gap between ends of sealant backing; do not stretch, twist, puncture, or tear sealant backings; remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

.12 Where joint design or depth of joint prevents use of joint backing material, apply bond breaker tape to prevent 3-sided adhesion.

.13 Do not stretch, twist, puncture or tear joint backing. Butt joint backing at intersections. Install bond breaker tape at back of joint where joint backing is not required or cannot be installed.

.14 On horizontal traffic surfaces, support joint filler against vertical movement which might result from traffic loads, including foot traffic.

.15 Where surfaces adjacent to joints are likely to become coated with sealant during application, mask them prior to priming and sealing.

.16 Do not exceed shelf life and pot life of materials and installation times, as stated by the manufacturer.

.17 Be familiar with work life of sealant to be used. Do not mix multiple component materials until required for use.

.18 Use materials as received from the manufacturer, without additions, deletions and adulterations of materials.

.19 Mix multiple component sealants and bulks sealants using mechanical mixer capable of mixing without mixing air into material, in accordance with the manufacturer’s directions and recommendations. Continue mixing until material is homogeneously blended, uniform in colour and free from streaks of unmixed material. Install compound prior to start of hardening or curing cycle.

.20 Seal joints in surfaces to be painted before surfaces are painted. Where surfaces to be sealed are prime painted in shop before sealing, check to make sure the prime paint is compatible with primer and sealant. If they are incompatible, inform the Consultant and change primer and sealant to compatible types approved by the Consultant.

.21 Where irregular surface or sensitive joint border exists, apply masking tape at edge of joint to ensure joint neatness and protection.

.22 Prime sides of joints for type of surface being sealed prior to application of joint backing, bond breaker or sealant as recommended by sealant manufacturer.

3.3 APPLICATION

.1 Apply in accordance with the manufacturer's directions and recommendations unless more stringent requirements apply.

.2 Apply sealant by proven techniques using hand operated guns or pressure equipment fitted with suitable nozzle size and equipment approved by sealant manufacturer.

.3 Force sealant into joint and against sides of joints to obtain uniform adhesion. Use sufficient pressure to completely fill all voids in joint regardless of variation in joint widths and to proper joint depth as prepared. Ensure full firm contact with interfaces of joint. Superficial pointing with skin bead is not acceptable.

.4 Finish face of compound to form smooth, uniform beads. At recesses in angular surfaces, finish compound with flat face, flush with face of materials at each side. At recesses in flush surfaces, finish compound with concave face flush with face of materials at each side.

.5 Compound may be tooled, provided such tooling does not damage seal or tear compound. Avoid pulling of sealant from sides.

.6 Tool surfaces as soon as possible after sealant application or before any skin formation has occurred, particularly when using silicone sealants.

.7 Ensure joint surfaces are straight, neatly finished, free from ridges, wrinkles, sags, dirt, stains, air pockets and embedded foreign matter or other defacement and be uniform in colour, free from marbling and/or colour streaking due to improper mixing or use of out of shelf life Products.

.8 Do not use solvent curing sealants indoors.

3.4 SEALANT LOCATIONS

.1 Use 1 of the sealants specified for each type in locations indicated in the sealant schedules below. Ensure the sealant chosen for each location is recommended by the manufacturer for use for the conditions encountered.

.2 Joint designation and application in the following tables and the fact that Drawings do not show all locations to be sealed does not limit the Contractor’s responsibility under this Section to seal all locations (except those indicated in other Sections of work) required to create and ensure continuous enclosure.

.3 Firestopping and Smoke Seal: Sealants part of firestopping systems and smoke seals provided within fire rated assemblies shall be part of the work of Section 07 84 10 and shall be carried out under supervision of those performing the work under this Section.

3.5 FIELD QUALITY CONTROL

.1 An independent inspection and testing company may be appointed and paid for by the Owner to carry out inspection and testing as directed by the Consultant.

.2 Inspect joints for complete fill, for absence of voids and for joint configuration complying with requirements specified herein. Record results in a manner acceptable to the Consultant.

.3 Tests may include sampling of installed Product where adhesion, cohesion or reversion failure is suspected.

.4 Where work or materials fail to meet requirements specified herein, as indicated by the test results, pay the costs of additional inspection and testing required for new replacement work or materials.

.5 Manufacturer’s Services:

.1 Confirm in writing that the manufacturer’s representative will be on site throughout the construction period work to inspect the application of sealant and surface preparation.

.2 Consult with the manufacturer's technical representative about the following items:

.1 weather conditions under which work will be done.
.2 anticipated frequency of joint movement.
.3 shape factor of the joint.
.4 durometer hardness, slump and curing characteristics of materials specified.
.5 joint characteristics as built.
.6 installation procedures to be adopted.
.7 mixing procedures to be adopted.
.8 conditions under which the Work will be done, in order that any alternative recommendations may be made should adverse conditions exist.

3.6 CLEANING

.1 Immediately clean adjacent surfaces which have been soiled and leave work in neat, clean condition. Remove excess materials, compounds smears or other soiling resulting from application of sealants. Use recommended cleaners and solvents. Leave finished work in neat, clean condition with no evidence of spillovers onto adjacent surfaces.

3.7 PROTECTION

.1 Provide approved, non-staining means of protection for completed joint sealant installations where required to protect work from mechanical, thermal, chemical and other damage by construction operations and traffic.

.2 Maintain protection securely in place until completion of Work. Remove protection when so directed by the Consultant.

.3 Repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION

PART 1 - GENERAL

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL INSTRUCTIONS

.1 Read and conform to:

.1 the General Conditions and the Supplementary Conditions of the Contract.

.2 Division 01 requirements and documents referred to therein.

1.3 SUMMARY

.1 Work included: Provide labour, materials, products, equipment and services to complete the steel doors and frames work specified herein. This includes, but is not necessarily limited, to:

.1 Interior hollow-metal doors and pressed steel frames

.2 Exterior hollow-metal doors and pressed steel frames

.3 Pressed steel frames for borrowed lites and screens.

.4 Frame anchors, glass mouldings and stops, inserts, in-fill panels and other auxiliary materials required for complete installation.

.5 Preparation of steel doors and frames for CSA approved wiring system and conduits for electronic hardware and automatic door operators.

.2 Related Requirements: Specifications throughout the entirety of Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.4 REFERENCES

.1 Definitions:

.1 Minimum base steel thicknesses for gauges: in accordance with Appendix 1 of CSDMA “Recommended Specifications for Commercial Steel Door and Frame Products”. Steel sheet thicknesses specified herein are base metal thicknesses prior to galvanizing.

.2 CSDMA: Canadian Steel Door Manufacturers Association

.3 NAAMM: National Association of Architectural Metal Manufacturers

.4 HMMA: Hollow Metal Manufacturer’s Association.

.2 Reference Standards: Latest published editions of reference standards listed in this Section in effect as of the closing date and time of the Request for Tenders for the Contract, including any amendments adopted, are applicable unless otherwise indicated.

1.5 DEFINITIONS

.1 Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.6 ADMINISTRATIVE REQUIREMENTS

.1 Pre-installation Meetings: Schedule, and conduct pre-installation meeting at Project Site, in order to coordinate work of this Section, with work of related Subcontractors.

.1 Ensure attendance of Subcontractor performing work of this Section and representatives of manufacturers and fabricators involved in, or affected by, installation and coordination with other materials and installations that have preceded or will follow. Advise Consultant and Owner in advance of scheduled meeting dates.

.2 Agenda: Review progress of other construction activities and preparations for the particular activity under consideration.

.3 Record significant discussions, agreements, and disagreements, including required corrective measures and actions.

.4 Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.

.2 Coordination

.1 Coordinate anchorage installation for pressed steel frames. Supply setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.7 ACTION SUBMITTALS

.1 Product Data: Submit product data in accordance with Division 01 for the following:

.1 Submit manufacturer's instructions, printed product literature and data sheets for the steel doors and frames work and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Include construction details, material descriptions, core descriptions, fire-resistance ratings, and finishes.

.2 Shop Drawings: Submit Shop Drawings in accordance with Division 01. Include the following:

.1 Indicate each type of door, frame, steel, construction and core clearly demonstrating the following:

.1 Show dimensioned door and frame product elevations and sections.

.2 Show listing of opening descriptions including locations, material thickness, and anchors.

.3 Show location and details of openings.

.4 Provide manufacturer's recommended installation instructions and procedures.

.2 Indicate material thickness, mortises, reinforcements, anchorages, locations of exposed fasteners, openings (glazed, paneled or louvered) and arrangement of standard hardware.

.3 Include schedule identifying each unit, with door marks and numbers relating to Consultant’s numbering on Drawings and Door Schedule.

.3 Samples:

.1 When requested by Consultant, submit fabrication Samples approximately 203 by 254 mm (8 by 10 inches) to demonstrate compliance with requirements for quality of materials and construction:

.1 Doors: Show vertical-edge, top, and bottom construction; core construction; and hinge and other applied hardware reinforcement. Include separate section showing glazing if applicable.

.2 Frames: Show profile, corner joint, floor and wall anchors, and silencers. Include separate section showing fixed hollow-metal panels and glazing if applicable.

.3 Samples submitted must represent, in all respects, the minimum quality of work to be supplied by the manufacturer. Do not fabricate any work represented by samples until the samples are reviewed. Deviation of fabrication quality, compared to reviewed samples, will be cause for rejection of work.

.4 Schedule: Provide a schedule of hollow-metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.

1.8 INFORMATIONAL SUBMITTALS

.1 Product Test Reports: Submit product test reports in accordance with Division 01 for each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency. As a minimum, submit the following test reports:

.1 Confirmation of Physical Endurance Test to ANSI/SDI A250.4, "Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, and Frame Anchors" to minimum Level A - 1,000,000 cycles.

.2 Confirmation that insulated doors supplied in exterior openings meet specified thermal resistance rating.

.3 Ensure reports include name of testing authority, date of test, location of test facility, descriptions of test specimens, procedures used in testing and indicate compliance with acceptance criteria of test.

1.9 QUALITY ASSURANCE

.1 Manufacturer Qualifications: Execute work in this Section by a manufacturer who is a member of CSDMA.

.1 Ensure product is manufactured by a firm experienced in design and production of standard and custom commercial steel door and frame assemblies, integration of builders' or electronic hardware and glazing assemblies, and other items affecting work.

.2 Supplier Qualifications: Ensure Product Supplier has Architectural Hardware Consultant (AHC) or person of equivalent experience, available at reasonable times to consult with Consultant, Contractor and Owner.

.3 Installer Qualifications:

.1 Provide work of this Section executed by competent installers with minimum 5 years' experience in the application of Products, systems and assemblies specified and with approval and training of Product manufacturers.

.2 Ensure retained installers are familiar with Product manufacturers specified herein and with ANSI/NFPA 80 requirements for installation of labeled fire rated steel doors, frames and hardware.

.4 Welding:

.1 Provide welding in accordance with CSA W59-M performed by a fabricator and mechanics fully approved by the Canadian Welding Bureau as specified herein.

.2 Ensure fabricator is fully certified by Canadian Welding Bureau for fusion welding of steel structures to CSA W47.1 and for fusion welding of aluminum to CSA W47.2.

.5 Single Source Responsibility: Ensure primary materials provided in this Section are obtained from 1 source by a single manufacturer and secondary materials are obtained from sources recommended by primary materials manufacturers.

1.10 DELIVERY, STORAGE, AND HANDLING

.1 Delivery and Acceptance Requirements:

.1 Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

.2 Provide additional protection to prevent damage to factory-finished units.

.3 Deliver welded frames with two temporary shipping spreader bars across bottom of frames, tack welded to jambs and mullions. Temporary spreader bars are intended for shipping and handling purposes only, and must not be used for installation purposes.

.2 Storage and Handling Requirements:

.1 Provide site storage and protection of materials in accordance with NAAMM-HMMA 840. Store items in dry, secure location on planks or dunnage.

.2 Store Door and frame Products in vertical position, spaced with blocking. Cover materials to protect them from damage but in such a manner as to permit air circulation.

.3 Immediately Make Good any damage acquired during shipping or handling. Clean scratches and touch up with rust-inhibitive primer. Replace damaged work which cannot be repaired, restored or cleaned.

.4 For welded frames, weld in two temporary jamb spreaders per door opening to maintain proper alignment during shipment and handling. Do not use temporary jamb spreaders for installation.

1.11 FIELD CONDITIONS

.1 Verify actual opening sizes and field conditions by field measurement before fabrication. Submittal drawings must reflect measurements and conditions provided, and product manufactured accordingly. Coordinate field measurements with fabrication and construction schedules to avoid delays.

.2 Verify that substrate conditions, whether existing or otherwise, are as detailed on Drawings, and are acceptable for product installation in accordance with manufacturer's instructions.

.3 Do not proceed with fabrication without receipt of reviewed Shop Drawings and reviewed construction hardware schedule.

1.12 WARRANTY

.1 Extended Rust-perforation Warranty: manufacturer’s standard form in which manufacturer agrees to repair finishes or replace doors that show evidence of excessive rusting within specified warranty period.

.2 Warranty Period: 5 years from date of Substantial Performance of the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Products of following manufacturers may be acceptable subject to conformance to requirements of Drawings, Schedules and Specifications:

.1 Artek Door Limited;

.2 Baron Hollow Metal;

.3 Daybar Industries Limited;

.4 Fleming Door Products; an Assa Abloy Group company;

.5 Gensteel Doors;

.6 LMT Group inc.;

.2 Substitution Limitations: This Specification is based on Products by Fleming Door Products.

.3 Comparable Products from manufacturers listed herein offering functionally and aesthetically equivalent products in Consultant's opinion, and subject to Consultant's review, will be considered provided they meet the requirements of this Specification.

2.2 REGULATORY REQUIREMENTS

.1 Labelling requirements:

.1 Provide label of recognized testing agency having factory inspection service and constructed as listed or classified for labeling in accordance with NFPA 80, listing authority's policies and label materials.

.2 Listing must identify manufacturer.

.3 Construct fire-rated doors and frames as listed for labeling in "Follow-Up Service Procedures/Factory Inspection Manuals" issued by listing agency.

.2 Fire-Rated Door Assemblies:

.1 Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings and temperature-rise limits indicated on Drawings and Schedules, based on testing according to CAN4-S104.

.3 Fire-Rated, Frame Assemblies:

.1 Complying with NFPA 80 and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for fire-protection ratings indicated on Drawings and Schedules, based on testing according to CAN4-S104 (Frames, transom and sidelight assemblies) and CAN4-S106 (window assemblies).

.4 Smoke- and Draft-Control Assemblies:

.1 Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.

.5 Temperature Rise Rated Assemblies: Provide fire and temperature rise rated steel doors for those openings as determined and scheduled by Consultant.

.1 As a minimum, Provide fire and temperature rise rated steel doors and frames at following locations and as indicated on Drawings and schedules:

.1 between dead end corridor and adjacent occupied spaces;

.2 between exit enclosures (stairs) and remainder of floor areas;

.3 in firewalls and other specific locations noted on Drawings or Schedules.

2.3 DESIGN AND PERFORMANCE REQUIREMENTS

.1 Unless otherwise indicated, construct doors to be minimum 44.5 mm (1-3/4 inches) thick.

.2 Construct doors to meet requirements of NAAMM-HMMA 861 and CSDMA specifications. Ensure door and frame Products are fabricated in strict accordance with reviewed Shop Drawings. Ensure steel is free of scale, pitting, coil breaks, surface blemishes, buckles, waves and other defects.

.3 Doors must meet ANSI/SDI A250.4, for Level A performance (1,000,000 cycles).

.4 Facilitate installation of electrical components complete with arrangement so conduits and wiring can be readily removed and replaced.

.5 Ensure exterior door assemblies can meet the following performance requirements as a minimum:

.1 Thermal resistance (R-Value)

.1 Nominal: Not less than RSI 1.94 K x sq. m/W (R11 deg F x h x sq. ft./Btu) in accordance with ASTM C518.

.2 Actual: Not less than RSI 0.6 K x sq. m/W (R3.4 deg F x h x sq. ft./Btu) in accordance with ASTM C1363.

.2 Thermal transmittance (U value):

.1 Nominal: Not more than 0.5 W/(sq.m· K) (0.09 BTU/(sq.ft · deg F) in accordance with ASTM C518.

.2 Actual: Not more than 3.45 W/(sq.m· K) (0.29 BTU/(sq.ft · deg F) in accordance with ASTM C1363.

.3 Air Infiltration: Maximum air leakage of 0.20 L/s per sq. m (0.04 cfm/sq. ft.) at a static-air-pressure differential of 75 Pa (1.57 lbf/sq. ft.).

2.4 MATERIALS

.1 Galvanized Steel Sheet: ASTM A653/A 653M, Commercial Steel (CS), Type B.

.1 Interior doors and frames unless indicated otherwise: Comply with A 653/A 653M, Designation ZF 120 (A40)

.2 Exterior doors and frames: Comply with ASTM A653, Designation Z275 (G90).

.2 Frame Anchors: ASTM A879/A 879M, Commercial Steel (CS), 12G (04Z) coating designation; mill phosphatized.

.1 For anchors built into exterior walls, steel sheet complying with ASTM A1008/A 1008M or ASTM A1011/A 1011M, hot-dip galvanized according to ASTM A153/A 153M, Class B.

.3 Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A153/A 153M.

.4 Grout: ASTM C476, except with a maximum slump of 102 mm (4 inches), as measured according to ASTM C143/C 143M.

.5 Mineral-Fiber Insulation: CAN/ULC S702 or equivalent to ASTM C665 (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing CAN/ULC-S114 for combustion characteristics.

.6 Glazing: Comply with requirements in Section 08 80 00, Glazing.

.7 Bituminous Coating: Cold-applied asphalt mastic, compounded for 0.4-mm (15-mil) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.5 COMPONENTS

.1 Door Core Materials:

.1 Honeycomb: Structural small cell 25.4 mm (1 inch) maximum kraft paper 'honeycomb'. Weight: 36.3 kg (80 lb.) per ream minimum, density: 16.5 kg/m3 (1.03 pcf) minimum, sanded to required thickness.

.2 Polystyrene: Rigid extruded, fire retardant, closed cell board, Type 1 with a minimum density of 16 kg/m3 (1.0 lbs/cu ft) and minimum R-value of RSI 1.05 (R6.0).

.3 Polyurethane: CAN/ULC-S704, Rigid, polyurethane, board with a density of 32 kg/m3 (2.0 lbs/cu ft) and minimum thermal resistance rating of RSI 1.92 (R11)

.4 Steel stiffened core: Continuous vertically formed steel sections, full thickness of interior space between door faces.

.1 Stiffeners: Minimum thickness 0.6 mm (22 ga. - 0.026 in) spaced 152 mm (6 in) apart and securely fastened to both face sheets by industrial glue or spot welded spaced a maximum of 127 mm (5 in) o. c. vertically.

.2 Fill spaces between stiffeners with fiberglass core (interior locations) or polyurethane core (exterior locations) as specified herein.

.5 Fire Door Cores: As required to provide fire-protection and temperature-rise ratings indicated on Drawings and Schedules.

.1 Temperature Rise Rated (TRR) Core: Where TRR cores are required, ensure core composition provides fire protection rating and limits temperature rise on unexposed side of door to 121 deg C (250 deg F) above ambient temperature after 30 minutes and 250 deg C (421 deg F) after 60 minutes, as determined by OBC requirements in accordance with testing per CAN/ULC-S104-M or equivalent to NFPA 252.

2.6 INTERIOR DOORS AND FRAMES

.1 Construct interior doors and frames to comply with the standards indicated in this Section for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

.2 Standard-Duty Doors and Frames:

.1 Doors:

.1 Materials: Galvanized steel sheet, minimum 1.06 mm (18 ga - 0.042 inch); galvannealed as specified herein.

.2 Edge Construction: Following constructions are acceptable:

.1 Full Flush; Mechanically interlocked, adhesive assisted and tack welded at top and bottom of door, 150 mm (6 inch) on centre and above and below each edge cutout, filled with metal filler and ground smooth with no visible seams.

.2 Seamless; continuously welded and ground smooth with no visible seams.

.3 Core: Kraft-paper honeycomb.

.4 Basis-of-Design: “D-Series” by Fleming or approved equivalent.

.2 Frames:

.1 Materials: Galvanized steel sheet, minimum 1.34 mm (16 ga - 0.053 inch); galvannealed as specified herein.

.2 Construction: Face welded or full profile welded unless indicated otherwise.

.3 Basis-of-Design:

.1 "M Series" by Fleming or approved equivalent for frames occurring in masonry construction.

.2 "DW Series" by Fleming or approved equivalent for frames occurring in gypsum board construction.

.3 "EXP Series" by Fleming or approved equivalent for frames occurring in existing partitions.

.3 Exposed Finish: Factory-primed for site finishing.

.4 Locations: Service Closets (mechanical, plumbing, electrical etc.)

.3 Heavy-Duty Doors and Frames:

.1 Doors:

.1 Materials: Galvanized steel sheet, minimum 1.34 mm (16 ga - 0.053 inch); galvannealed as specified herein.

.2 Edge Construction: Seamless; continuously welded and ground smooth with no visible seams.

.3 Core: Polystyrene.

.4 Basis-of-Design: "CW-Series" by Fleming or approved equivalent.

.2 Frames:

.1 Materials: Galvanized steel sheet, minimum 1.34 mm (16 ga - 0.053 inch); galvannealed as specified herein.

.2 Construction: Face welded unless indicated otherwise.

.3 Basis-of-Design:

.1 "M Series" by Fleming or approved equivalent for frames occurring in masonry construction.

.2 "DW Series" by Fleming or approved equivalent for frames occurring in gypsum board construction.

.3 "EXP Series" by Fleming or approved equivalent for frames occurring in existing partitions.

.3 Exposed Finish: Factory-primed for site finishing.

.4 Locations: Typical doors unless indicated otherwise.

.4 Extra Heavy-Duty Doors and Frames:

.1 Doors:

.1 Materials: Galvanized steel sheet, minimum 1.34 mm (16 ga - 0.053 inch); galvannealed as specified herein.

.2 Edge Construction: Seamless; continuously welded and ground smooth with no visible seams.

.3 Core: Vertical steel stiffened

.4 Basis-of-Design: “H-Series” by Fleming or approved equivalent.

.2 Frames:

.1 Materials: Galvanized steel sheet, minimum 1.70 mm (14 ga - 0.067 inch); galvannealed as specified herein.

.2 Construction: Face welded or full profile welded unless indicated otherwise.

.3 Basis-of-Design:

.1 “M Series” by Fleming or approved equivalent for frames occurring in masonry construction.

.2 “DW Series” by Fleming or approved equivalent for frames occurring in gypsum board construction.

.3 “EXP Series” by Fleming or approved equivalent for frames occurring in existing partitions.

.3 Exposed Finish: Factory-primed for site finishing.

.4 Locations: Public stairwells, cross corridors, public washrooms, emergency exit doors, exams rooms, exit-only-function doors and similar locations.

2.7 EXTERIOR HOLLOW-METAL DOORS AND FRAMES

.1 Construct exterior doors and frames to comply with the standards indicated in this Section for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

.2 Heavy-Duty Doors and Frames:

.1 Physical Performance: Level A according to ANSI/SDI A250.4.

.2 Doors:

.1 Materials: Galvanized steel sheet, minimum 1.34 mm (16 ga - 0.053 inch); galvanized as specified herein.

.2 Edge Construction: Seamless; continuously welded and ground smooth with no visible seams.

.3 Core: Polyurethane insulated, vertical steel stiffened.

.4 Basis-of-Design: “TRIO E-Series” by Fleming or approved equivalent.

.3 Frames:

.1 Materials: Galvanized steel sheet, minimum 1.70 mm (14 ga - 0.067 inch); galvannealed as specified herein.

.2 Construction: Thermally-broken unless indicated otherwise.

.3 Basis-of-Design: “TB Series” by Fleming or approved equivalent for frames occurring in masonry construction.

.4 Exposed Finish: Factory-primed for site finishing.

.5 Locations: Exterior openings indicated to receive hollow metal doors and pressed steel frames unless indicated otherwise

2.8 HOLLOW-METAL PANELS

.1 Provide hollow-metal panels of same materials, construction, and finish as adjacent door assemblies.

2.9 FABRICATION

.1 Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

.1 Provide factory-preparation and reinforcements for doors and frames including mortising, blanking, drilling and tapping for templated hardware only, in accordance with the reviewed hardware schedule and templates provided by hardware supplier.

.2 Reinforce doors and frames in factory only where required, for surface-mounted hardware, anchor hinges, thrust pivots, pivot reinforced hinges, or non-templated hardware. Perform drilling and tapping on site, at time of installation.

.3 Prior to shipment, mark each door and frame with identification number as shown on approved Shop Drawings.

.2 Hollow-Metal Doors:

.1 Holes 12.7 mm (0.5 inch) diameter and larger must be factory-prepared, except mounting and through-bolt holes, which are made on site, at time of hardware installation. Holes less than 12.7 mm (0.5 inch) diameter will be factory-prepared only when required for device (for knob, lever, cylinder, thumb or turn pieces) or when holes overlap function holes.

.2 Vertical Edges for Single-Acting Doors: Bevel edges 3 mm in 50 mm (1/8 inch in 2 inches) unless otherwise required to suit finish hardware or door swings.

.3 Top Edge Closures:

.1 Exterior Locations: Sealed, flush PVC closures.

.2 Interior locations (commercial buildings): Inverted steel closures.

.4 Bottom Edge Closures: Close bottom edges of door with end closures or channels of same material as face sheets.

.1 Exterior Locations: Sealed, flush PVC closures. Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.

.2 Interior locations (commercial buildings): Inverted steel closures.

.5 Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated on Drawings and Schedules. Extend minimum 19 mm (3/4 inch) beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.

.3 Pressed Steel Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

.1 Protect mortised cutouts in frames with steel guard boxes.

.2 Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.

.3 Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.

.4 Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.

.5 Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.

.6 Jamb Anchors: Provide anchorage appropriate to floor, wall and frame construction. Locate each anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite strike jamb.

.1 Provide number and spacing of anchors as follows:

.1 Two anchors per jamb up to 1520 mm (60 inches) high.

.2 Provide additional anchor for each additional 760 mm (30 inches) of height or frac-tion thereof up to 3050 mm (120 inches) high.

.3 Provide four anchors per jamb plus one additional anchor per jamb for each 610 mm (24 inches) or fraction thereof above 3050 mm (120 inches) high.

.2 Frames in previously placed concrete, masonry or structural steel: Locate anchors not more than 150 mm (6 inches) from the top and bottom of each jamb, and intermediate anchors at 660 mm (26 inches) o.c. maximum.

.3 Frames in stud-Wall Type: Locate anchors not more than 457 mm (18 inches) from top and bottom of frame, and intermediate anchors at 813 mm (32 inches) o.c. maximum.

.4 Where frame product is installed prior to adjacent partition, securely attach floor anchor to the inside of each jamb profile.

.1 Provide each floor anchor with two (2) holes for securing to floor. For conditions that do not permit the use of floor anchors, provide additional wall anchor, located within 150 mm (6 inches) of base of jamb.

.7 Door Silencers: Except on weather-stripped and gasketed frames, drill stops to receive door silencers as follows. Keep holes clear during construction.

.1 Single-Door Frames: Drill stop in strike jamb to receive three door silencers.

.2 Double-Door Frames: Drill stop in head jamb to receive two door silencers.

.3 Exterior Door Frames: Thermally broken.

.8 Thermally-broken Frames (exterior locations)

.1 Fabricate thermally broken door frames in accordance with Shop Drawings. Fabricate thermally broken exterior door frames with two piece steel core sections separated with closed cell PVC thermal breaks to separate interior and exterior frame sections.

.2 Provide wall and floor anchors suitable for installation conditions. Anchoring devices must not permit thermal conductivity from exterior frames to interior frame sections.

.3 Ensure welds do not cause thermal transfers between interior and exterior surfaces of frame sections. Separate interior and exterior sections of thermally broken frames by continuous thermal break.

.4 Do not assemble thermally broken sections by means of screws, grommets or other fasteners.

.5 Insulate closed sections such as mullions or center rails in shop with specified insulation. Install Insulation of open sections such as jambs, heads and sills.

.6 Incorporate head drips of same gauge material as frame and plug weld at 150 mm (6 inch) on center. Fill and sand smooth.

.9 Welded Type Frames (interior locations as noted herein):

.1 Frame products must be accurately mitered or mechanically jointed.

.2 Full Profile welded: punch-mitered - continuously welded on profile faces, rabbets, returns and soffit intersections, or saw-mitered - continuously welded on the profile faces, rabbets, returns, stops and soffit intersections.

.1 Punch or saw-mitered, at the manufacturer's discretion.

.2 All profile welded frame product exposed faces must be filled and ground to a smooth, uniform, seamless surface.

.3 Face welded: continuously welded on the profile faces, with exposed faces filled and ground to a smooth, uniform, seamless surface.

.4 Joints at mullions, sills and center rails:

.1 Must be coped accurately, butted and tightly fitted.

.2 At intersecting flush profile faces, be securely welded, filled and ground to a smooth, uniform, seamless surface.

.3 At intersecting recessed profile faces, be securely welded to concealed reinforcements, with exposed hairline face seams.

.4 At all other intersecting profile elements, have exposed hairline face seams.

.5 Glazing stops must be formed steel channels, minimum 16 mm (0.625 inch) height, accurately fitted, butted at corners and fastened to frame sections with counter-sunk oval head sheet metal screws.

.4 Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, CSDMA Specifications, Door Hardware Schedule, and templates. Refer to Section 08 71 00 for additional requirements:

.1 Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

.2 Steel thickness for hardware reinforcements to be manufacturer's standard as required to adequately support the door and hardware, but not less than the following:

.1 Lock and Strike Reinforcements:

.1 Typical: 1.34 mm

.2 Heavy-duty (or stronger) doors and frames: 2.36 mm.

.2 Hinge Reinforcements:

.1 Typical: 2.36 mm

.2 Heavy-duty (or stronger) doors and frames: 3.12 mm

.3 Flush Bolt Reinforcements:

.1 Typical: 1.34 mm

.2 Heavy-duty (or stronger) doors and frames: 2.36 mm

.4 Reinforcements for Surface Applied Hardware:

.1 Typical: 1.06 mm

.2 Heavy-duty (or stronger) doors and frames: 1.34 mm

.5 Top and Bottom Channels: 1.06 mm

.6 Steel Top Caps: 0.81 mm

.7 Mortar Guard Boxes: 0.66 mm

.8 Floor Anchors: 1.34 mm

.9 Wall Anchors:

.1 Masonry Strap Type: 1.06 mm

.2 Masonry Wire Type: 4.0 mm (0.156 inch) dia.

.3 Masonry Stirrup-Strap Type: 1.34 mm

.4 Steel/Wood Stud Type: 0.81 mm

.5 Existing Masonry /Concrete Wall Type: 0.81 mm

.6 Jamb Spreaders: 0.81 mm

.3 Where electrified hardware is specified on Hardware Schedule, Provide CSA-approved system consisting of CSA-approved conduit, junction boxes and wire harnesses complete with modular plugs for coordinated connection directly to electrified hardware.

.5 Stops and Mouldings for Glazing: Provide accurately fitted stops and mouldings around glazed lites and louvers where indicated on Drawings and Schedules. Form corners of stops and mouldings with butted hairline joints.

.1 Single Glazed Lites: Provide fixed stops and mouldings welded on secure side of hollow-metal work.

.2 Multiple Glazed Lites: Provide fixed and removable stops and mouldings so that each glazed lite is capable of being removed independently.

.3 Provide fixed frame mouldings on outside of exterior and on secure side of interior doors and frames.

.4 Provide loose stops and mouldings on inside of hollow-metal work.

.5 Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated on Drawings and Schedules.

.6 Glass Trim (Screw Fixed or Snap-In Types): 0.81 mm (20 ga - 0.032 inch)

.1 For glazing up to 8 mm (5/16 inch) thick: steel glazing trim and snap-in glazing stops as specified herein.

.2 For glazing thicker than 8 mm (5/16 inch): steel glazing trim and screwed-in glazing stops as specified herein. Screws must be #6 x 1-1/4 inch oval head self-drilling type at 300 mm (12 inch) o.c. maximum.

2.10 STEEL FINISHES

.1 Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

.1 Provide factory-applied touch up primer at areas where zinc coating has been removed during fabrication.

PART 3 - EXECUTION

3.1 EXAMINATION:

.1 Site Verification of Conditions:

.1 Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation. Commencement of work implies acceptance of previously completed work.

3.2 INSTALLATION

.1 Supply steel doors and frames to Section 06 90 00 for installation.

END OF SECTION

PART 1 - GENERAL

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL INSTRUCTIONS

.1 Read and conform to:

.1 the General Conditions and the Supplementary Conditions of the Contract.

.2 Division 01 requirements and documents referred to therein.

1.3 SUMMARY

.1 Work Included: Provide labour, materials, products, equipment and services to complete the flush wood core doors work specified herein. This includes, but is not necessarily limited, to:

.1 interior wood doors.

.2 auxiliary materials required for complete installation.

.3 preparation of doors for security system including CSA-approved wiring, conduit and junction boxes for electronic hardware.

.2 Related Requirements: Specifications throughout the entirety of Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.4 REFERENCES

.1 Reference Standards: Latest published editions of reference standards listed in this Section in effect as of the closing date and time of the Request for Tenders for the Contract, including any amendments adopted, are applicable unless otherwise indicated.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meetings:

.1 Prior to starting work of this Section, convene a pre-installation meeting at Project site to review Project requirements and site conditions with pertinent parties. Conform to requirements of Section 01 30 00.

1.6 SUBMITTALS

.1 Product Data: Submit manufacturer's instructions, printed product literature and data sheets for the flush wood doors work and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Safety Data Sheets (SDS): Submit SDS for inclusion in Operation and Maintenance Manual specified in Section 01 70 00, for adhesives, sealants and any other material designated by Consultant.

.3 Shop Drawings: Indicate the following:

.1 Elevations of each door type.

.2 Details of doors, including door cores, cut outs, undercuts, openings, fire-ratings, vertical- and horizontal-edge details.

.3 For each door and frame scheduled for electrical hardware, show following items in addition to minimum requirements:

.1 location and size of junction boxes and conduit for electrical hardware and wiring.

.2 conduit cutouts.

.3 other information related to electrical hardware or interrelated systems such as fire alarm and security systems/controls.

.4 Submit product schedule for steel doors and frames, prepared by, or under the supervision of, door supplier, using same reference numbers as those on indicated Drawings. Coordinate with final door hardware schedule.

.4 Samples: Submit samples of actual door face materials (plastic-laminate or wood veneer), approximately 150 mm (6 inches) square, for each material and finish.

.1 For wood veneers, submit set of three samples showing typical range of colour and grain to be expected in finished Work.

1.7 QUALITY ASSURANCE

.1 Qualifications:

.1 Manufacturers: Provide Products for Work of this Section by manufacturer with minimum 10 years' experience in the manufacture of such materials

.2 Manufacturers: Execute work of this Section by a manufacturer who is a member of WDMA or AWMAC and can supply Products meeting quality standards set by these Specifications.

.3 Installers: Provide work of this Section executed by competent installers with minimum 5 years' experience in the application of Products, systems and assemblies specified and with approval and training of the Product manufacturers.

.2 Single Source Responsibility: Ensure primary materials provided in this Section are obtained from one source by a single manufacturer and secondary materials are obtained from sources recommended by primary materials manufacturers.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Comply with requirements of referenced standard and manufacturer's written instructions.

.2 Do not deliver finished Products during rainy or damp weather.

.3 Do not deliver work of this Section until the building and storage areas are sufficiently dry so Products will not be damaged by excessive changes in moisture content.

.4 Do not deliver and install damaged Products. Replace in accordance with the requirements of this Section.

.5 Package doors individually in cardboard cartons and wrap bundles of doors in plastic sheeting.

.6 Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.9 SITE CONDITIONS

.1 Ambient Conditions: Ensure products are stored in climate-controlled areas with functional HVAC system and relative humidity and moisture content values that fall within the following range:

.1 Unless indicated otherwise:

.1 Moisture Content: 5-10%, Relative Humidity: 25-55%

.2 New Brunswick, Prince Edward Island, Nova Scotia, Newfoundland and Labrador:

.1 Moisture Content: 8-13%, Relative Humidity: 43-70%

.3 Alberta, Saskatchewan, and Manitoba:

.1 Moisture Content: 4-9%, Relative Humidity: 20-50%

1.10 WARRANTY

.1 Provide manufacturer's standard lifetime warranty for this Section from Substantial Performance of the Work against bubbling, delamination of faces, or edges, warp, twist bow exceeding 6 mm (1/4 inch) and telegraphing of core in accordance with General Conditions of the Contract.

.2 Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of Consultant and at no expense to Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Products of following manufacturers may be acceptable subject to conformance to requirements of Drawings, Schedules and Specifications:

.1 Baillargeon Doors, a Masonite Company;

.2 Lambton Doors;

.3 Lynden Door Inc,

.4 Marshfield Door Systems, Inc.;

.5 VT Industries.;

.2 Comparable Products from manufacturers listed herein offering functionally and aesthetically equivalent products in Consultant's opinion, and subject to Consultant's review, will be considered provided they meet the requirements of this Specification.

2.2 REGULATORY REQUIREMENTS

.1 Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings and temperature-rise limits (if applicable) indicated on Drawings and Schedules, based on testing according to the following:

.1 Fire-rated door assemblies: CAN/ULC-S104.

.2 Fire-rated frame assemblies: to CAN/ULC-S104 (Frames, transom and sidelight assemblies) and CAN/ULC-S106 (window assemblies)

.2 Smoke- and Draft-Control Assemblies: Provide assemblies with gaskets listed and labeled for smoke and draft control by a qualified testing agency, based on testing according to UL 1784 and installed in compliance with NFPA 105.

.3 Labelling requirements: Provide label of a recognized testing agency having factory inspection service, and constructed as listed or classified for labeling in accordance with NFPA 80, listing authority's policies and label materials. Listing must identify manufacturer.

.4 Composite Wood: Composite wood must be documented to have low formaldehyde emissions which meet the California Air Resources Board ATCM for formaldehyde requirements for ultra-low-emitting formaldehyde (ULEF) resins or no added formaldehyde (NAF) resins.

2.3 INTERIOR FLUSH WOOD CORE DOORS

.1 Provide solid-core, 45 mm (1-3/4 inch) thick flush wood doors unless indicated otherwise.

.2 Where STC-rated assemblies are indicated on Drawings or Schedules, provide fully operable units tested in accordance with requirements of ASTM E90 and ASTM E413.

.3 Construct doors to meet requirements of ANSI/WDMA I.S. 1A, Extra Heavy Duty and CSA O132.2 and as follows:

.1 Construction: 5-ply unless indicated otherwise. Provide 3-ply construction where doors are faced with medium density overlay (MDO)

.2 Core (non-fire-rated doors): ANSI A208.1, LD-1 minimum 448 kg/m3 (28 pcf) density solid particleboard core bonded to stiles and rails. Glued wood stave or WDMA I.S. 10 structural composite lumber cores are also acceptable.

.3 Core for Fire-Rated Doors: As required to achieve fire-protection rating indicated on Drawings and Schedules.

.4 Stiles: Minimum 30 mm (1-3/16 inch) wide hardwood with minimum 22 mm (7/8 inch) Maple or Birch edge strips or SCL. Provide fire-retardant types for fire-rated doors.

.5 Rails: Minimum 30 mm (1-3/16 inch) wide softwood or SCL. Provide fire-retardant types for fire-rated doors.

.6 Adhesives: Type I, waterproof (urea-formaldehyde free)

.7 Crossbands: Minimum 1.6 mm (1/16 inch) thick composite complete with veneer. Provide fire-retardant types for fire-rated doors.

.8 Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware.

.9 Exposed Vertical Edges: Matching-edge (ME) or Compatible Edge (CE) complying with North American Architectural Woodwork Standards (NAAWS) edge Type A. Plastic laminate edges are not acceptable.

.4 Acceptable Products:

.1 “Model No. 8500-CE” or "Model No. 8500-CE-AF" (Agrifibre Core) by Baillargeon Doors

.2 "5-PC-CE" by Lambton

.3 Approved equivalent.

2.4 DOOR FACES

.1 Provide door faces as noted on Drawings and Schedules and meeting following requirements.

.2 High Pressure Decorative Laminate (PLAM): to NEMA LD-3 or ISO 4586, type HGP, minimum 1.0 mm thick.

.1 At fire-rated locations, provide materials flame-spread and smoke developed indices of 25 and 55 respectively in accordance with CAN/ULC S102/S102.2.

.2 Colours and Finishes: Allow consultant to select up to 5 colours at a later date from manufacturer’s full colour range (including solid, and wood look), texture and finish.

.3 Acceptable Manufacturers:

.1 Formica Inc.;

.2 Nevamar Company, LLC;

.3 Wilsonart Canada;

2.5 AUXILIARY MATERIALS

.1 Astragal for Fire-Rated Pairs of Doors: Steel T-shaped astragal overlapping and recessed at face edge designed specifically for pairs of doors.

.2 Vision Framing: ULC labeled, prime painted metal framing or fire rated wooden molding kit to match door faces.

.3 Hardware: Coordinate location of interior blocking with work of Section 08 71 00.

2.6 FABRICATION

.1 Fabricate doors in accordance with Section 09 of NAAWS except as specified herein.

.2 Comply with NFPA 80 requirements for fire-rated doors.

.3 Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.

.4 Hardware:

.1 Factory machine doors for finish hardware in accordance with hardware requirements and dimensions.

.2 Locate hardware to comply with DHI-WDHS-3.

.3 Comply with final hardware schedules, door frame Shop Drawings, ANSI/BHMA-156.115-W, and hardware templates.

.4 Coordinate with hardware mortises in metal frames, to verify dimensions and alignment before factory machining.

.5 For doors scheduled to receive electrified locksets, provide factory-installed raceway and wiring to accommodate specified hardware.

.5 Openings: Factory cut and trim openings through doors.

.1 Light Openings: Trim openings with moldings of material and profile indicated.

.2 Provide hardwood glass stops, finished to match face veneer, for vision panels in unrated doors.

.3 Provide metal glass stops for vision panels in fire-rated labelled doors.

.4 Maximum opening sizes must conform to OBC requirements.

.6 Fabricate flush wood core doors with necessary interior blocking to suit hardware installation.

.7 Bevels: 3 degrees unless otherwise indicated by hardware of fire-rating requirements.

.8 Fabricate flush wood core doors with following edge clearances:

.1 3 mm (1/8 inch) clearance at top and sides.

.2 6 mm (1/4 inch) clearance at bottom to top of carpets and thresholds unless doors are indicated in the Door Schedule to be undercut.

.3 As required by NFPA 80 for fire rated doors.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Site Verification of Conditions:

.1 Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation. Commencement of work implies acceptance of previously completed work.

3.2 INSTALLATION

.1 Installation of flush wood core doors and door hardware forms part of the work of Section 06 90 00.

END OF SECTION

SEE ADD#2 Q#09

PART 1 - GENERAL

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL INSTRUCTIONS

.1 Read and conform to:

.1 the General Conditions and the Supplementary Conditions of the Contract.

.2 Division 01 requirements and documents referred to therein.

1.3 SUMMARY

.1 Work Included: Provide labour, materials, Products, equipment and services to complete the hangar doors work specified herein. This includes, but not limited to following:

.1 Bi-fold hangar doors.

.2 Auxiliary materials required for a complete installation .

.2 Related Requirements: Specifications throughout the entirety of Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.4 REFERENCES

.1 Reference Standards: Latest published editions of reference standards listed in this Section in effect as of the closing date and time of the Request for Tenders for the Contract, including any amendments adopted, are applicable unless otherwise indicated.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meetings:

.1 Prior to starting work of this Section, convene a pre-installation meeting at Project site to review Project requirements and site conditions with pertinent parties. Conform to requirements of Section 01 30 00.

.2 Required Attendance: Subcontractor performing work of this Section, representatives from manufacturers and fabricators involved in or affected by installation.

.3 Notification: Notify Consultant and Owner of scheduled meeting dates in advance; minimum 72 hour notice required.

.4 Agenda:

.1 Review progress of related construction activities and preparations for particular activity under consideration.

.2 Make note of required sequencing and coordination with materials and activities that have preceded or will follow.

.5 Reporting: Record significant discussions, agreements, and disagreements, including required corrective measures and actions.

.6 Distribution: Distribute minutes of the meeting to each party present and to other parties requiring information not more than 72 hours after meeting.

.2 Coordination:

.1 Coordinate installation of doors with framing provided under other Sections to ensure proper allowance is provided in header to accommodate deflections and support door in all positions. Reinforce door opening to carry required loads.

1.6 SUBMITTALS

.1 Product Data: Submit manufacturer's literature and data sheets for each type of material provided under this Section for Project in accordance with requirements of Section 01 30 00. Submit manufacturer’s product characteristics, catalogue cuts, installation instructions and other relevant information for each material and product used for hangar doors work specified in this Section.

.2 Safety Data Sheets (SDS): Submit SDS for inclusion in Operation and Maintenance Manual specified in Section 01 70 00, for adhesives, sealants and any other material designated by Consultant.

.3 Shop Drawings: Submit Shop Drawings indicating material layouts, details of construction, connections, and relationship with adjacent construction. As a minimum indicate following:

.1 Include equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

.2 Include points of attachment and their corresponding static and dynamic loads imposed on structure.

.3 Include details of provisions for assembly expansion and contraction and for excluding and draining moisture to the exterior.

.4 Include plans, elevations, sections and details as applicable.

.5 Indicate field-measured dimensions on Shop Drawings.

.6 Wiring Diagrams: Submit for power, signal, and control wiring.

.4 Delegated Design Submittals:

.1 Engineering design completion of hangar doors work is delegated to Contractor based on structural design criteria indicated in Contract Documents.

.2 Submit Shop Drawings for work of this Section that bear the stamp of a Professional Engineer registered in Province of Ontario.

.3 Submit copy of structural calculations upon request by Consultant.

.5 Samples: Submit selection and verification samples for Products requiring colour, texture, or design selection. Submit manufacturer’s list of finishes or colour swatches for Consultant's selection.

.6 Welding Certificate: Submit certification for welding firms and welders to verify compliance with welding qualifications specified in this section.

1.7 CLOSEOUT SUBMITTALS

.1 Closeout Submittals, generally: in accordance with Section 01 70 00, Closeout Submittals.

.2 Operating and Maintenance Data: Submit care and maintenance instructions for hangar doors to be included in building operation and maintenance manual.

.3 Warranty Documentation: Submit a copy of extended warranties specified in this Section.

1.8 QUALITY ASSURANCE

.1 Qualifications:

.1 Manufacturers: Provide Products for Work of this Section by manufacturer with minimum 10 years' experience in the manufacture of such materials.

.2 Installers: Provide work of this Section executed by competent installers with minimum 5 years' experience installing, erecting, or assembling work similar in material, design, and extent to that shown on Drawings and Schedules, and whose work has resulted in construction with a track record of successful in-service performance.

.1 Certifications: Installer must be approved and certified by manufacturer. Submit proof of certification upon request.

.2 Welding Qualifications: Qualify procedures and personnel in accordance with the following:

.1 Steel: to CSA W47.1 and CSA W59

.2 Aluminum: to CSA W47.2 and CSA W59.2

.3 Stainless Steel: to CSA W47.1 (Annex K) and CSA W59.

.3 Professional Engineer's Qualifications: Employ Professional Engineer licensed to practice in Province of Ontario who carries professional liability insurance and has at least five years' experience providing engineering services of similar kind, scope, and complexity.

.1 Professional Engineer's Responsibility:

.1 production and review of Shop Drawings,

.2 design and certification of hangar doors, including attachments for building construction, in accordance with applicable codes and regulations,

.3 stamping and signing of each Shop Drawing and associated calculations.

.4 Single Source Responsibility: Ensure primary materials provided in this Section are obtained from 1 source by a single manufacturer and secondary materials are obtained from sources recommended by primary materials manufacturers.

.5 Mock-ups/ First Installation Review: Construct mock-ups to verify selections made under submittals, demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

.1 Location: In-situ (i.e. first installation), as directed on site by Consultant.

.2 Purpose: To set benchmarks for installation and to judge subsequent work. Maintain Mock-ups during construction in undisturbed condition.

.3 Reviewed mock-ups: May become part of the completed work if undisturbed at the time of Substantial Performance of The work, provided they are undisturbed, and comply with requirements outlined in Contract Documents.

1.9 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle hangar doors materials in accordance with manufacturer's written instructions.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Store materials off-ground, in clean, dry, well-ventilated area.

.4 Replace defective or damaged materials with new.

1.10 FIELD CONDITIONS

.1 Field Measurements: Verify actual dimensions of construction contiguous with hangar doors by field measurements before fabrication.

1.11 WARRANTY

.1 Extended warranty: Submit for Owner's review and acceptance, manufacturer's extended warranty in which manufacturer commits to repair or replace components of hangar doors that fail within specified warranty period. Manufacturer's extended warranty is in addition to, and does not supersede, any other rights that Owner may have under Contract Documents.

.2 Warranty Period: Not less than 2 years from date of Substantial Performance of The work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Products of following manufacturers may be acceptable subject to conformance to requirements of Drawings, Schedules and Specifications:

.1 Schweiss Doors,

.2 Equivalent.

2.2 REGULATORY REQUIREMENTS

.1 Accessibility Standard: Comply with applicable provisions in CSA B651, the Ontario Building Code and the AODA .

2.3 DESIGN AND PERFORMANCE REQUIREMENTS

.1 Provide lift-strap bifold hangar door suitable for aircraft hangar applications. Hydraulic door systems are not acceptable.

.2 Doors must operate smoothly, efficiently, and safely under all anticipated load conditions.

.3 Provide complete system including door panels, operating mechanism, electrical controls, safety features, and necessary accessories.

.4 Engineer door to resist anticipated loads without sagging, bowing, or structural failure.

.5 Water Management: Design doors with slopes in open position to direct water away from building. Provide solid footing with sill to prevent water flow under door.

.6 Ensure door frame and components can handle operational stresses and vibrations without deformation or damage. Provide 5:1 safety factor for all lift straps and drive components.

.7 Seismic Performance: Bi-fold hangar doors shall withstand the effects of earthquake motions determined according to the requirements of the Ontario Building Code and CAN/CSA S832.

.8 Electrical Components, Devices, and Accessories: Listed and labeled as defined in CSA C22 Series, by a qualified testing agency, and marked for intended location and application.

.9 Air Infiltration: Maximum rate of 5 L/s per sq. m (1 cfm/sq. ft.) at 75 Pa when tested according to ASTM E283 or DASMA 105.

2.4 BI-FOLD HANGAR DOORS

.1 **[Material Tag: This item is noted as "OHD-#" on Drawings and Schedules.]**

.2 Description: electrically operated bifold canopy doors.

.1 Size: As noted on Drawings.

.2 Insulation: Provide insulated core filled with CFC-free closed-cell urethane foam insulation having flame spread of 25 or less when measured in accordance with CAN/ULC S102.

.1 R-value: Not less than adjacent panels.

.3 Operation: Door opens horizontally at top and center, opening by moving frame out and up. Align top hinges with building truss members.

.4 Ensure the door is self-contained with top hinges, bottom door rollers, and column followers/wind rails.

.5 Construct door framing from jig-welded steel tube sections engineered to resist loads without sagging or bowing.

.6 Steel: ASTM A500 Grade B square structural welded steel tubing for door framing members.

.7 Door Cladding: to match building panels specified in Section 07 42 46 - Insulated-Core Metal Wall Panels (non-fire-rated) ~~[XX XX XX]~~ in all respects. Preform hangar exterior wall from siding panels over rigid insulation boards, assembled in accordance with cladding manufacturer's standard specifications. Provide panels with factory finish; AAMA 2605 PVDF fluoropolymer finish.

.1 Flashing: Provide manufacturer's standard sheet metal flashings, trim molding, closure strips, caps, subgirts and other similar sheet metal accessories used in conjunction with preformed panels in same material and finish as panels. Flashing metal to be of thickness not less than that used for the panels.

~~.8 Liner Panels: Galvanized steel sheets conforming to ASTM A653/A653M, coating designation Z275 (G90), with flush interior face, and thickness to meet design loads and purlin spacing, but not less than 22 ga.~~

~~.9~~.8 Weld shop connections; bolt or weld field connections as applicable.

.3 Structural Performance: Ensure exterior Bi-fold hangar doors can withstand wind loads, gravity effects, and stresses in accordance with requirements of Ontario Building Code, within conditions and limits indicated on Drawings and Schedules.

.1 Wind Loads: to be determined in accordance with geographical location of project, but not less than uniform pressure of 0.96 kPa (20 lbf/sq. ft.), acting inward and outward. Bi-fold hangar doors must remain functional under design wind loads.

.2 Deflection Limits: Bi-fold hangar doors must resist design wind load without permanent deformation or component disengagement. Engineer doors to resist loads without sagging or bowing.

.4 Motorized Door Operation: CSA or UL listed and labeled, Provide manufacturer's standard warning devices.

.1 Standard Service: 120, 208 or 600~~208, 240, 480 or 575~~ VAC, 60 Hz three-phase, 4-wire service; Coordinate with Division 26. Use totally enclosed motors, size as recommended by manufacturer.

.2 Gear Motor: Equip gear motor with electric brake to stop and hold door in any position. Provide high starting torque, reversible, continuous duty, class A insulated electric motors complying with NEMA MG 1, with overload protection. Ensure operator design allows motor removal without disturbing limit switch adjustment or affecting emergency auxiliary operator.

.3 Motor Exposure: Exterior, wet, and humid. Provide operator cover to protect operator from weather.

.4 Explosion Resistance: Motor must be certified for use in hazardous locations, in accordance with UL 1203 and dust-ignition classification.

.5 Horsepower: Variable, to be determined by door manufacturer based on door size and operational requirements, but not less than 1/3 hp.

.5 Control Stations Provide two-button constant hold control station for opening and closing bifold door, with “dead man switch” that stops door immediately when operator releases the button.

.1 Additional Access Control: Refer to Division 28 for additional requirements regarding access control and interlocking with vehicle detection mechanisms.

.2 Ensure the door stops immediately when operator releases remote control transmitter.

.6 Electrical Disconnect: Provide electrical disconnect to disable door for service, maintenance, and emergency backup operations. Mount disconnect for floor-level accessibility.

.7 Warning Lights: Provide warning lights and horns to alert area when door is opening or closing.

.1 Emergency Operation:

.1 Manual Chain Hoist: For manual override in case of power or operational failure. Provide automatic engagement/disengagement feature with motor activation for models designed for continuous and explosion-proof use.

.2 Battery Backup: For doors intended for use in emergency situations, provide battery backup with programmable logic for minimum 10 operational cycles and extended standby.

.2 Obstruction-Detection Device: to UL325.

.1 Photo Eye: Provide electric photo eye sensors at floor level to stop and reverse door when an obstruction breaks detection beam.

.3 Limit Switches: Provide heavy-duty weatherproof limit switch box with adjustable switches interlocked with motor controls to stop door at fully opened and closed positions.

.4 Safety Switches: Install top limit override safety switches to disconnect power if upper limit fails or is overridden.

.5 Interlock Switch (motorized doors): provide interlock switch to prevent operation when lock is engaged to prevent damage.

.8 Basis-of-Design: “Designer Bifold Doors” by Schweiss or approved equivalent.

2.5 DOOR COMPONENTS

.1 Top Driveshaft / Lift Drums: solid steel driveshaft with lift drums on subframe, running continuously along door width. Attach driveshaft to subframe with greaseable bearing mounts at each strap drum location. Engineer solid driveshaft and lift drums with minimum 5:1 safety factor.

.2 Bottom Driveshaft / Lift Drums: solid steel driveshaft with lift drums on bottom cord of door, running continuously along door width. Attach driveshaft to door frame with greaseable bearing mounts at each strap drum location. Engineer solid driveshaft and lift drums with minimum 5:1 safety factor.

.3 Hinges: heavy duty steel hinges complete, with each set 267 mm (10.50 inches) wide, pins 17.5 mm (11/16 inch) diameter minimum.

.4 Door Truss: standard internal truss, with extra heavy-duty center truss on interior side and truss at door base.

.5 Side Rollers: Heavy-duty, minimum 76 mm (3 inches) guide rollers with sealed bearings on door bottom at jamb location.

.6 Column Followers / Wind Rails: Provide system to hold door base securely against building when closed, with solid square columns for wind rails.

.7 Wind Pins

.1 Manual Wind Pins: 25 mm (1 inch) diameter minimum.

.1 Automatic Wind Pins: Center wind pins 25 mm (1 inch) diameter minimum with automatic side latches.

.8 Latching System: Provide automatic latch system on both sides, unlocking and locking door before opening and after closing.

.9 Top and Bottom Rubber Seals: Provide standard seal continuous at top and bottom of each door. Equip door with neoprene weather stripping at heads and jambs. Ensure sills have fabric-reinforced high-grade rubber astragal. Ensure door perimeter is weather-tight.

.10 Weather Seal Kit: Seal sides and center of each bifold door with weather stripping. Include self-sticking foam cushion seal at center. Ensure the door perimeter is weather-tight.

~~.11 Walk-In Doors: Provide insulated walk-in door minimum dimensions of 914 mm x 1829 mm (36 inches x 72 inches).~~

~~.1 Locations and Quantity: As noted on Drawing.~~

~~.2 Color: to match adjacent building color.~~

~~.3 Equip door with cylindrical lock, master keyed to building keying system. Coordinate with Section 08 71 00. Provide safety interlock switch to prevent operation when door is open or ajar.~~

.11 Windows: Provide window frames and vision glazing (VG1) in bi-folding doors in sizes and locations as indicated on Drawings.

.12 Fasteners: Hot dipped galvanized.

2.6 GENERAL FINISH REQUIREMENTS

.1 Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

.2 Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

.3 Concealed Steel Finish: galvanized Z275 (G90) coating to ASTM A653/A653M.

.4 Exposed Steel Finish: Manufacturer's standard factory-applied PVDF fluoropolymer coating meeting AAMA 2605.

.1 Colour: to be selected by Consultant at a later date

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Site Verification of Conditions:

.1 Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation. Commencement of work implies acceptance of previously completed work.

.2 Examine locations of electrical connections.

3.2 INSTALLATION

.1 Installation, generally: Install work of this Section in strict accordance with manufacturer's written installation instructions and reviewed Shop Drawings. Supplement manufacturer's installation instructions with additional installation requirements specified in this Section to produce specified work results.

.2 Install door, track, and operating equip support necessary hardware, jamb and head mold strips, anchors, inserts, hangers, and equipment supports according to Shop Drawings, manufacturer's instructions, and as specified.

.3 Provide sway bracing, diagonal bracing, and reinforcement for rigid installation of track, hinges, and door-operating equipment.

.4 Do not exceed manufacturer's recommended clear opening setting for each bifold door.

.5 Door Cladding - Metal Building Panels: Coordinate with pre-engineered metal building erector to install exterior wall panels on bifold doors to match panels used on remainder of building. Use trims recommended by manufacturer.

.6 Accessibility: Install hangar doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

.7 Motorized Doors: Install according to UL 325.

.8 Apply proper markings for potentially hazardous locations related to door operation. Fasten warning labels to bifold door frame and operator's station according to manufacturer's instructions.

3.3 STARTUP SERVICE

.1 Engage a factory-authorized service representative to perform startup service.

.1 Perform installation and startup checks according to manufacturer's written instructions.

.2 Test and adjust controls and safety. Replace damaged and malfunctioning controls and equipment.

.3 Test door release, closing, and alarm operations when activated by smoke detector or building's fire-alarm system. Test manual operation of closed door. Reset door-closing mechanism after successful test.

.2 Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

.3 Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

3.4 ADJUSTING

.1 Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.

.2 Lubricate bearings and sliding parts as recommended by manufacturer.

.3 Adjust seals to provide weathertight fit around entire perimeter.

3.5 DEMONSTRATION

.1 Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain hangar doors.

3.6 PROTECTION

.1 Protect hangar doors from damage, soiling and contaminating substances resulting from construction activities or caused by work of other trades.

.2 Where soiling or spills have occurred, remove spills and soiling from adjacent surfaces using cleaning procedures recommended in writing by the affected material's manufacturer. Do not use materials or processes that can damage finishes, surfaces, or construction.

.3 Promptly replace hangar doors work damaged during construction that cannot be satisfactorily repaired.

3.7 CLEANING AND WASTE MANAGEMENT

.1 Cleaning: Maintain clean construction area at the end of each day. When the activities of this Section are complete, remove materials, tools, equipment and rubbish.

.2 Waste Management and Disposal: sort waste for reuse, recycling, or disposal, as specified. Remove recycling bins and containers from site and dispose of contents at the appropriate waste disposal facilities.

END OF SECTION

SEE ADD#3
Q#72

PART 1 - GENERAL

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL INSTRUCTIONS

.1 Read and conform to:

.1 the General Conditions and the Supplementary Conditions of the Contract;

.2 Division 1 requirements and documents referred to therein.

1.3 SUMMARY

.1 Work Included: Provide sectional overhead doors including but not limited to the following:

.1 insulated sectional overhead doors.

.2 door guides, tracks and accessories.

.3 counterweight and counterweight enclosures.

.4 fender guards for overhead door tracks.

.5 supplementary steel supports required for installation.

.6 operators, motors, control panels, loop detectors, photo-electric devices, remote controls for vehicles, operation and activation devices, and electrical work as specified.

.7 shop priming.

.2 Related Requirements: Specifications throughout the entirety of Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.4 REFERENCES

.1 Reference Standards: Latest published editions of reference standards listed in this Section in effect as of the closing date and time of the Request for Tenders for the Contract, including any amendments adopted, are applicable unless otherwise indicated.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Conform to requirements of Division 01 for administrative requirements.

.2 Sequencing: Coordinate installation with the work to be performed under other related Sections.

1.6 SUBMITTALS

.1 Product Data: Submit manufacturer's literature, data sheets for each type of material provided under this Section for the Project. Data sheets shall Provide all required information. Submit 3 copies of detailed instructions for maintaining, preserving and keeping materials in clean and safe conditions and give adequate warning of maintenance practices or materials detrimental to specified materials. Submit the manufacturer’s installation instructions.

.2 Safety Data Sheets (SDS): Submit SDS for inclusion in Operation and Maintenance Manual specified in Section 01 70 00, for adhesives, sealants and any other material designated by Consultant.

.3 Shop Drawings:

.1 Submit Shop Drawings for the Work of this Section in accordance with Division 01.

.2 Clearly show and describe, in detail, detailed door assemblies and adjacent construction, including elevations, sections and details of door, track, hardware and operating components, dimensions, gauges, finishes and of relationship of door, frames, track, hardware and operating components to adjacent construction. The Shop Drawing submission shall include detailed descriptions and catalog cuts of specified door controls.

.3 Submit complete electrical schematics with Shop Drawings.

.4 Submit complete engineering design data for doors to confirm doors have been designed to meet design requirements specified in the Contract Documents. Ensure design calculations are prepared by a registered Professional Engineer experienced in industrial steel door design and registered to practice in the Place of the Work. Ensure Shop Drawings bear the Professional Engineer’s seal.

.4 Samples: Submit selection and verification samples for Products requiring colour, texture, or design selection. Submit manufacturer’s list of finishes or colour swatches for Consultant's selection.

.5 Operation and Maintenance Data:

.1 Submit printed operation instructions and maintenance data for the doors, as follows:

.1 Wiring Diagrams: "As built" straight line wiring diagrams showing electrical connections and control circuitry.
.2 Instructions explaining operation.
.3 Lubrication chart indicating lubrication points and type of lubricant recommended for equipment.

1.7 QUALITY ASSURANCE

.1 Qualifications: Provide the work of this Section executed by competent installers with a minimum of 5 years’ experience in the application of the Products, systems and assemblies specified herein and with the approval and training of Product manufacturers.

.2 Licensed Professionals: Employ a structural Professional Engineer registered in the Province of Ontario, carrying a minimum $2,000,000.00 professional liability insurance, to:

.1 design the components of the Work of this Section requiring structural performance,

.2 be responsible for full assemblies and connections

.3 be responsible for determining sizes, yield strengths, gauge thicknesses and joint spacing to allow thermal movement and loading of components in accordance with OBC and standards referenced in this Section.

.4 be responsible for production and review of Shop Drawings,

.5 inspect the Work of this Section during fabrication and erection,

.6 stamp and sign each Shop Drawing, and

.7 provide site administration and inspection of this part of the Work.

.8 Submit certificate validating seismic assessment and field review of this part of the Work.

.3 Single Source Responsibility: Ensure primary materials provided in this Section are obtained from 1 source by a single manufacturer and secondary materials are obtained from sources recommended by primary materials manufacturers.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials in sequence to meet the Construction Schedule and arrange ahead for off-the-ground, undercover storage locations.

.2 Handle components with care. Protect against damage, dirt, disfigurement and weather.

.3 Protect other work adjacent to the work of this Section. Replace work which cannot be satisfactorily repaired or re-stored at no cost to the Owner.

1.9 WARRANTY

.1 The Contractor warrants the work of this Section for period of 3 years from Substantial Performance of the Work against defects and/or deficiencies in accordance with the General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within this warranty period, to the satisfaction of the Consultant and at no expense to the Owner. Defects include but are not limited to: buckling, opening of seams, bond failure and extensive colour fading.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Products of following manufacturers are acceptable subject to conformance to requirements of Drawings, schedules and Specifications:

.1 “596 Series Thermacore” by Overhead Door Corporation of Toronto;

.2 “Therm-O-Dor TD-134" by Steel-Craft Door Products Ltd.

.3 “Thermalex ®2000, Polyurethane Insulated Steel Door” by Upwardor Corporation

.4 “Garaga Industrial G-5000 Series” Garaga Inc.

.5 Substitution Limitations: This Specification is based on “Thermalex ®2000 – Thermalex TX500-20, Polyurethane Insulated Steel Door” by Upwardor Corp. Comparable Products from manufacturers listed herein will be considered provided they meet the requirements of this Specification.

2.2 DESCRIPTION

.1 Regulatory Requirements:

.1 Ensure electrical components conform to requirements of Canadian Standards Association, CSA C22.1 and Electrical Safety Authority (ESA).

.2 Design and Performance Requirements:

.1 Design exterior doors to withstand horizontal wind loads in closed position of 0.95 kN/m^2 (20 psf) positive, 0.57 kN/m^2 (12 psf) negative, with operators to function against 0.383 kPa (8 psf) wind load. Maximum deflection under full design load shall be 1/240 of the span.

.2 Calculate properties of steel sections and allowable stresses used in determination of structural performance in accordance with CSA S136.

.3 Operational Life: Design components to operate for not less than 20,000 cycles and for 10 cycles per Day.

.4 Electrical Components, Devices, and Accessories: Design electrical components for doors in accordance with CSA C22.1

.5 Refer to Section 01 83 16 for additional performance and testing requirements pertaining to the work of this Section.

.3 Seismic Performance: Design work of this Section to withstand seismic motions determined in accordance with the requirements of the OBC and CAN/CSA S832.

2.3 MATERIALS

.1 Structural Shapes, Plates, and framing members: New material conforming to CSA G40.20 and CSA G40.21, Grade 300W.

.2 Galvanized Sheet Steel: Supply 0.91 mm (20 ga) exposed face and End Stiles/ 0.45 mm (26 ga) concealed face, core thickness commercial quality to ASTM A653/A653M, CS Type A, with Z275 zinc coating designation to ASTM A653/A653M.

.3 Steel Supports: Design, fabricate and Install the following to carry the overhead doors and tracks:

.1 Galvanized steel jamb and head supports

.2 Miscellaneous framing, not shown on structural Drawings, to support operators and tracks (e.g. centre spring mount and motor anchorage plates).

.4 Overhead Sectional Doors:

.1 Insulated Sections Description:

.1 Core: R-18.4 polyurethane
.2 Outer Face Sheet: Flush Stucco Embossed Textured, Z275 galvanized sheet steel or Galvalume.
.3 Finish: 1 prime coat and 1 white finish coat
.4 Inner Face Sheet:

.1 Finish: White primer
.2 Weight: 2.25lbs/sq.ft. + 40 lbs for the track

.5 Tongue and groove complete with bubble weather seal section joints.

.2 Provide air and weather seals in the following locations:

.1 between door sections.
.2 at jambs and head.
.3 on the bottom sections.

.5 Track Description:

.1 Material: Roll formed galvanized steel – reverse angle track.

.2 Depth: 75 mm (3")

.3 Curve Radius: Minimum 400 mm (16").

.4 Thickness: 3 mm (1/8") core minimum

.5 Overlap jambs and head minimum 25 mm (1").

.6 Steel Framing, Supports, Hangers, Stiffeners and Bracing: Z275 galvanized steel minimized spangle.

.7 Verify the track design and clearances and Provide suitable highlift, standard or low headroom track if necessary.

.8 Provide sub-framing to support track hangers between the bottom chords of the roof trusses.

.9 Provide diagonal and sufficient stiffeners to prevent distortion and sagging.

.10 Provide continuous track mounting angles along tracks.

.11 Provide double bar latch cylinder locks with electrical interlock.

.6 Rollers:

.1 Bearings: Full floating, hardened steel

.2 Provide industrial grade galvanized steel roller brackets and hinges.

.7 Lifting Cables: Galvanized multi-strand aircraft type, with an 8:1 safety factor.

.8 Electrical Components:

.1 Provide CSA and ULC approved electrical components.

.2 Provide time delay timers adjustable from 0.5 to 180 seconds.

.9 Safety Edge System:

.1 Provide a door bottom safety edge to stop downward travel of door when it comes into contact with an obstruction.

.2 Provide a reversing time delay on the safety edge system operation.

.10 Electric Operators (Drawbar or Jack Shaft Side Mount):

.1 Drawbar

.1 3/4 H.P. suitable for 208V / 3 phase/60-cycle power.
.2 Provide drawbar arm so it is in the vertical position when the door is fully closed.
.3 Provide operators complete with magnetic brake, instant reversing motors and thermal overload.
.4 Provide 1 to 2 second delay timers in the reversing circuit and 1 to 5 minute timers in the close circuit.
.5 100,000 cycle oil tempered torsion springs counter balancing mechanism mounted on a 25 mm (1") keyed solid steel shaft.

.2 Jack Shaft Side Mount:

.1 3/4 H.P. suitable for 208V / 3 phase/60-cycle power.
.2 Provide operators complete with magnetic brake, instant reversing motors and thermal overload.
.3 Provide 1 to 2 second delay timers in the reversing circuit and 1 to 5 minute timers in the close circuit.
.4 100,000 cycle oil tempered torsion springs counter balancing mechanism mounted on a 25 mm (1") keyed solid steel shaft.

.11 Push Button Controls: Provide an EEMAC 1 - 3 position push button control - momentary contact - "open-close-stop" located on the interior of each opening.

.12 Exterior Weatherproof Key Switch: Provide an exterior weatherproof key switch to be located by the Consultant.

2.4 FINISHES

.1 Steel Finish: Manufacturer's standard powder coating. Colour and gloss to be selected from manufacturer's standard colors at a later date.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Employ the manufacturers' qualified representatives to Install overhead doors in accordance with the manufacturers' printed installation instructions.

.2 Provide wiring and electric metallic tube (EMT) conduit from the disconnect switch at each jamb to the operators and controls.

.3 Provide watertight operators, push buttons and wiring on the interior.

.4 Provide and connect photo cell units.

.5 On completion, adjust and lubricate moving parts in accordance with the manufacturer's recommendations, check controls and demonstrate operation and controls of doors to the Owner.

3.2 CONTROLS

.1 Provide 1 set of the following for each door:

.1 Controls.

.2 Adjustable timer.

.3 Automatic/Back-up switch.

.2 Provide following entrance controls:

.1 Automatic Activator: Buried loop push button opens door and sets timer.

.2 Safety Control: Photo switch at opening verifies opening is clear and resets timer.

.3 Back-Up Control (Non-Timed): Push buttons located at the door jamb or alternatively the emergency chain operator.

3.3 ADJUSTING AND CLEANING

.1 Lubrication:

.1 Upon completion of erection of units and operating equipment, lubricate moving parts before operation.

.2 Grease sprockets, bearings, cables, link chains and guides. Use lubricant recommended by the manufacturer.

.2 Adjust operating components to ensure smooth opening and closing.

.3 Keep guides clean of dirt, particularly in the area of bottom of guide pocket where dust and dirt can accumulate.

3.4 DEMONSTRATION

.1 Test operate new doors and demonstrate operation of same to the satisfaction of the Consultant at the time of acceptance of the completed work.

.2 Demonstrate door operation for the Owner's personnel in accordance with the requirements of Division 01.

END OF SECTION

SEE ADD#6 Q#146

Updated through ADD#8

GENERAL

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL INSTRUCTIONS

.1 Read and conform to:

.1 the General Conditions and the Supplementary Conditions of the Contract;

.2 Division 1 requirements and documents referred to therein.

1.3 SUMMARY

.1 Work Included: Pre-finished, thermally broken, aluminum glazed curtain wall and cladding systems complete with vision units and entrances ~~and spandrel panels~~ including but not limited to the following:

.1 4-sided structural sealant glazed curtain wall systems ~~with aluminum perimeter caps.~~ and entrances.

.2 materials related to work of this Section which are to be installed by those performing the work of other Sections including but not limited to:

.1 inserts, anchors and support items required for connection or support of assemblies specified in this Section

.2 entrance doors and framing, including hardware, stripping and thresholds

.3 automatic door operator components installed in door and frame openings

.4 sealing joints within work of this Section and at abutting joints of this work and work of adjacent trades.

.2 Related Requirements: Specifications throughout the entirety of the Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them

1.4 REFERENCES

.1 Reference Standards: Latest published editions of reference standards listed in this Section in effect as of the closing date and time of the Request for Tenders for the Contract, including any amendments adopted, are applicable unless otherwise indicated.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Sequencing: Coordinate installation required herein with the installation and work required to be performed under related Sections that are referenced herein.

.1 Pre-construction Site Meeting:

.1 Prior to the start of the work, arrange for a Project site meeting of the parties associated with work of this Section, including without limitation, the Subcontractor(s) performing the work of this Section, testing company's representative and other contractors and consultants of disciplines applicable to this Section. The Consultant may attend.

.2 Review the Contract Documents to ensure the work specified in this Section can proceed, and ensure complete understanding of requirements and responsibilities relative to:

.1 work included,
.2 materials to be used,
.3 storage and handling of materials,
.4 installation of materials,
.5 sequence and quality control,
.6 Project staffing, and
.7 restrictions on areas of work and other matters affecting construction.

.2 Coordination:

.1 Notify relevant and concerned trades of items required to be incorporated into the work of other Sections. Certain components specified under this Section include items which are closely integrated with air barrier/vapour retarder transitions, entrances, glazing components, flashing pieces, and architectural metalwork specified under separate Sections, and consequently require close coordination with such allied trades. Perform total coordination required to ensure correct installation procedures and results.

.2 Coordinate and cooperate with trades providing metal panel systems by installing closures and trims supplied by such trades to be installed directly into the curtain wall system.

.3 Scheduling:

.1 Prior to commencing work of this Section, arrange for the manufacturer's technical representative to review, with the Contractor and Consultant, procedures to be adopted and conditions under which the work shall be performed. Inspect surfaces to determine adequacy of existing and proposed conditions.

.2 Cooperate fully with other Subcontractors performing the Work and promptly proceed with the work of this Section as rapidly as job conditions permit.

.3 Cooperate with those performing work of other Sections for application of all miscellaneous specialties.

.4 Supply items to be built-in in ample time to be incorporated into the work of Subcontractors performing work of other Sections, together with measurements and other information required for the location of such items.

1.6 SUBMITTALS

.1 Product Data: Submit manufacturer's literature and data sheets for each type of material provided under this Section for the Project in accordance with requirements of Section 01 30 00. Ensure data sheets provide required information including detailed instructions for installing as well as maintaining, preserving and keeping materials in clean and safe conditions. Provide adequate warning of maintenance practices or cleaning agents detrimental to specified materials.

.2 Safety Data Sheets (SDS): Submit SDS for inclusion in Operation and Maintenance Manual specified in Section 01 70 00, for adhesives, sealants and any other material designated by Consultant.

.3 Shop Drawings: Submit Shop Drawings for work of this Section in accordance with Section 01 30 00. In addition to the minimum requirements indicate the following:

.1 Indicate with plans, sections, elevations and sufficient full size details to indicate all components and methods of assembly, materials and their characteristics relative to their purpose and all other fabrication information.

.2 Indicate details of field connections, anchorage, and the relationship of the work under this Section to the work required to be performed under other Sections so as to facilitate the coordination with such scopes of work.

.3 Ensure Shop Drawings are stamped by Professional Engineer registered in Province of Ontario as specified herein.

.4 Do not fabricate Work until Shop Drawings have been reviewed by the Consultant for fabrication.

.5 Field Measurements: Verify dimensions of supporting structure by field measurements before fabrication so that the curtain wall work will be accurately designed, fabricated and fitted to the structure. Indicate measurements on Shop Drawings. Coordinate the fabrication schedule with construction progress to avoid delaying the Work.

.4 Design Calculations:

.1 Submit for information only, and under seal, calculations prepared by a structural Professional Engineer registered in the Province of Ontario, providing design assumptions regarding loadings related to the OBC, standards referenced in this Section and requirements of Authorities Having Jurisdiction.

.5 Test and Evaluation Reports:

.1 Prior to fabrication of curtain wall, submit recent certified test data performed by an independent laboratory approved by Standards Council of Canada or AAMA displaying results of testing program carried out on typical curtain wall systems proposed for this Project.

.2 Submit test reports for insulating glass units indicating compliance with requirements of CAN/CGSB-12.8.

.6 Samples: Submit samples in accordance with Section 01 30 00.

.1 Submit two 75 mm x 140 mm (3" x 5-1/2") samples for each exposed metal finish required (extrusion and sheet.).

.1 Ensure samples are of specified alloy, temper, and thickness of metal required for the Work. Where finishes involve colour and texture variations, include sample sets showing full range of variations expected.

.2 Mark direction of metal grain and rolling and paint application on back of control samples.

.7 Closeout Submittals:

.1 Maintenance Instructions: Submit copies of the manufacturer's written instructions in accordance with Section 01 70 00 for adjustment, operation and maintenance of operating components forming part of curtain wall system.

1.7 QUALITY ASSURANCE

.1 Qualifications:

.1 Manufacturer Qualifications: firm producing and executing work of this Section must have a minimum of ten (10) consecutive years experience in work of similar scope and nature to that specified herein.

.2 Insulating glass unit fabricators: membership and certification in the Insulating Glass Manufacturer's Alliance (IGMA). IGMA members must participate in the certification program and successfully pass a Compliance Audit within the last 6 months.

.2 Licensed Professionals: Employ a full time structural Professional Engineer registered in the Province of Ontario, carrying a minimum $2,000,000.00 professional liability insurance, to:

.1 design the components of the Work of this Section requiring structural performance,

.2 be responsible for full assemblies and connections

.3 be responsible for determining sizes, yield strengths, gauge thicknesses and joint spacing to allow thermal movement and loading of components in accordance with OBC and standards referenced in this Section,

.4 be responsible for the production and review of Shop Drawings,

.5 inspect the Work of this Section during fabrication and erection,

.6 stamp and sign each Shop Drawing,

.7 Provide site administration and inspection of this part of the Work.

.8 submit certificate validating seismic assessment and field review of this part of the Work

.3 Field Mock-Ups:

.1 Provide Mock-ups, minimum 1 bay in width, and of sufficient height to include 2 vision panels and 1 spandrel panel, in locations designated by the Consultant and as required to demonstrate quality of workmanship.

.2 Maintain mock-ups during construction in an undisturbed condition as a standard for judging the completed work. Adjust non-compliant mock-ups at no extra cost to Owner as required to obtain acceptance. Once accepted, mock-up becomes part of completed ork, and becomes the standard for the remainder of the work under this Section.

.4 Single Source Responsibility: Ensure primary materials provided in this Section are obtained from 1 source by a single manufacturer and secondary materials are obtained from sources recommended by primary materials manufacturers.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Delivery and Acceptance Requirements: Comply with the applicable provisions of AAMA "Curtain Wall Manual #10" for the care and handling of curtain wall work from shop to site.

1.9 WARRANTY

.1 The Contractor warrants the following work of this Section against defects and/or deficiencies in accordance with General Conditions of Contract. Promptly correct any defects or deficiencies which become apparent within the warranty period, to the satisfaction of the Consultant and at no expense to the Owner.

.1 Curtain Wall System:

.1 Warranty Period: 10 years from the date of Substantial Performance of The Work.

.2 Aluminum Finishes:

.1 Warranty Period: 20 years from the date of Substantial Performance of The Work.

.3 Factory Sealed Insulating Units:

.1 Warranty Period: 10 years from the date of Substantial Performance of The Work.

.4 Sealants:

.1 Guarantee Period: 20 years from the date of Substantial Performance of The Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Curtain Wall: Products of following manufacturers may be acceptable subject to conformance to requirements of Drawings, schedules and Specifications:

.1 Alumicor Limited

.2 Kawneer Canada Limited

.3 Oldcastle Building Envelope

.4 Wicona,

.5 Windspec

.2 Substitution Limitations:

.1 Design for work of this Section is based on “ThermaWall 2600” with “Thermaporte 7700 Entrance” by Alumicor Limited with glazing units as fabricated by Guardian Industries as specified herein. Equivalent Products from manufacturers listed herein offering functionally, aesthetically equivalent Products in the Consultant’s opinion and subject to the Consultant’s review will be considered provided they meet the requirements of this Specification.

2.2 DESCRIPTION

.1 Regulatory Requirements

.1 Comply with the more stringent requirements of the OBC, applicable laws, bylaws, fire regulations, health and safety regulations, and requirements of Authorities Having Jurisdiction or requirements of this Specification. The standards specified herein to be used for the work of this Section are considered a minimum.

.2 Design and Performance Requirements:

.1 Drawings and details are diagrammatic and are intended to show design concept, configuration, components and arrangements; they are not intended to identify nor solve completely problems of thermal and structural movements, air pressure equalization, air and vapour barriers, assembly framing, fixings and anchorages, moisture disposal, water penetration and problems at the glass line associated with glazing installation, movements, pressure fracture or thermal shock and weather seal.

.2 Glass thicknesses and heat treatments indicated are minimum requirements. Glazing details shown are for convenience of detailing only and are to be confirmed by relative to cited standards and final framing details. Confirm glass thicknesses and heat treatments, verified by analysis and engineering design, as required to meet performance and testing requirements specified in this Section. Increase glazing thicknesses as required to meet project-specific loadings.

.3 Utilize Limit States Design in sizing of glass and employ a safety factor for glass to statistical probability of failure of 8 glass lites per 1000. Comply with requirements of CAN/CGSB-12.20-M and ASTM E1300 for design of glass. Design units to accommodate live, dead, lateral, wind, handling, transportation and erection loads.

.4 Structural Performance: Ensure aluminum system has passed testing in accordance with ASTM E330. Design building envelope assemblies, members and their connections to withstand, within acceptable deflection limitations as specified, their own weight, loads imposed by the motion of operable elements, and the maximum design loads and combination of loads due to snow, rain, ice, seismic loads, the pressure and suction of wind and internal pressure.

.1 Wind loads:

.1 Design glazed assembly to withstand, without detrimental effects to appearance and performance, wind loads and temperature ranges expected in the geographical location of this Project based on the OBC requirements, based on a minimum 50 year probability factor for the Project location.

.2 Loads on guards: In locations where glazed curtain wall assemblies are acting as guards pursuant to the requirements of the OBC Article 3.3.1.17, assemblies must be designed in accordance with minimum interior load impact as required for guards (Loads on Guards, and Loads for Walls Acting as Guards) under the OBC and the requirements of the CSA A500. Provide internal mullion reinforcing if required.

.3 Seismic Performance: Design the work of this Section to withstand seismic motions determined in accordance with the requirements of the OBC.

.4 Deflection of framing members:

.1 Deflection Limits:

.1 Limit deflection of framing members normal to wall plane to 1/175 of clear span or an amount that restricts edge deflection of individual glazing lites to 19 mm (3/4”), whichever is less.

.2 Limit deflection of framing members parallel to glazing plane to L/360 of clear span or 3 mm (1/8”), whichever is smaller.

.3 Cantilever Deflection: Where framing members overhang an anchor point, limit deflection to 2 times length of cantilevered member, divided by 175.

.2 Do not include glass, sealants and interior finishes to contribute to framing member strength, stiffness or lateral stability.

.3 Do not permit permanent deformation (set) in metal framing work. Ensure permanent deformation, fastener, weld, or gasket failure, component breakage or disengagement does not occur under wind loading equal to 1.5 times design wind loads (positive or negative). Permanent deformation to be taken as deflection without recovery exceeding 1/1000 times span.

.5 Design light gauge aluminum structural members in accordance with CSA S157/S157.1

.6 Design light gauge steel structural members in accordance with CAN/CSA S136-07 and CSA S136.1-07 under direct supervision of a Professional Engineer experienced in design of this work and licensed in Ontario.

.7 Design anchors, fasteners, bracing and framing fastened directly to structure in accordance with requirements of CSA S16 using Limit States Design. Design structural details and connections not shown on Drawings in accordance with CAN/CSA S16 and CSA S 136.1.

.8 Design expansion joints within assemblies to be permanently watertight and airtight under all conditions.

.9 Provide curtain wall systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

.1 Thermal Expansion Allowance: Ensure system is able to withstand temperature differential of 85 deg C for materials and surfaces without putting

stresses on members or sealants. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

.5 Thermal Design and Performance:

.1 Energy Performance: Structural-sealant-glazed curtain walls must have certified and labeled energy performance ratings according to NFRC.

.1 Thermal Transmittance (U-Factor for entire assemblies): Fixed glazing and framing areas shall have U-factor of not more than 1.30 W/sq. m x K (0.23 Btu/sq. ft. x h x deg F) as determined according to NFRC 100.

.2 Solar Heat Gain Coefficient: Fixed glazing and framing areas shall have a Solar Heat Gain Coefficient (SHGC) of no greater than 0.35 as determined according to NFRC 200.

.3 Air Infiltration: Maximum air leakage through fixed glazing and framing areas of 0.2 L/s per sq. m (0.04 cfm/sq. ft.) of fixed wall area as determined according to ASTM E283 at a minimum static-air-pressure differential of 300 Pa (6.24 lbf/sq. ft.).

.4 Provide thermal breaks between exterior and interior components and sufficient metal on interior side of glass to provide total absence of condensation on interior metal surfaces under specified design conditions. Avoid thermal bridges while securing system with concealed fastening devices.

.2 Condensation Resistance: Design fixed glazing and framing areas to prevent accumulation of condensation on interior side of curtain wall framing with condensation resistance rating of no less than 66_{frame} and 60_{glass} in accordance with AAMA 1503 under winter design conditions ~~indicated herein~~ for location of Project.

.3 Maximum Water Leakage:

.1 No evidence of water penetration through fixed glazing and framing areas when tested according to ASTM E331 at a minimum static-air-pressure differential of 20% of positive wind-load design pressure, but not less than 730 Pa (15.2 lbf/sq. ft.) and when tested in accordance with AAMA 501.1 for dynamic pressure.

.2 No uncontrolled water penetrating curtain or water appearing on systems' normally exposed interior surfaces from sources other than condensation is permitted. Water leakage does not include water controlled by flashing and gutters that is drained to exterior and water that cannot damage adjacent materials or finishes.

.4 Rain Screen Design Requirements:

.1 Design aluminium framing system based on NRC recommended “Rain Screen” principle with provisions for pressure equalization and draining. Maintain integrity of continuous air barrier/vapour retarder system with adjacent surrounding air barrier/vapour retarder.

.6 Acoustic Performance:

.1 Ensure no vibration harmonics, wind whistles, noises caused by thermal movement, loosening, weakening or fracturing of attachments or components of system occur after system has been installed.

.7 Sealants Performance:

.1 Provide all glazing sealants and seals from a single manufacturer.

.2 Ensure sealants are non-bleeding, non-staining and capable of supporting their own weight and capable of supporting specified loads associated with glazing systems.

.3 Ensure materials used for edge seals are compatible with other materials they come in contact within glazing system. If required, perform compatibility tests to ASTM C510, ASTM C794 and ASTM C1087, or others as applicable.

.4 Use sealants and other materials in glazing system which are unaffected by long term UV light exposure.

2.3 MATERIALS

.1 Aluminum extrusions, channels, bars, rods, and wire: ASTM B211 and ANSI H35.1/H35 AA6063 alloy, T6 temper.

.2 Aluminum sheet and panels: ASTM B209-07 and ANSI H35.1/H35.1M-06 AA I 100 aluminum alloy, H 14 temper, minimum 3 mm for formed sheet cladding and soffit panels, 1.5 mm thick for formed window panning. Exposed sheet: machine flattened free of distortions.

.3 Light Gauge Sheet Metal: Commercial quality galvanized sheet steel to ASTM A653M, Designation Z275 unless otherwise specified in Contract Documents.

.4 Miscellaneous and Sub-Frame Steel: CSA G40.21, Grade 300W, hot dipped galvanized after fabrication to ASTM A123/A123M, with additional zinc chromate coating to CAN/CGSB-1.132-M after fabrication. Provide internal reinforcing steel channel minimum 6 mm (1/4") thick nested in curtain wall mullions where required to meet design requirements.

.5 Gaskets and Sealants: Ensure compatibility with edge seal of glazing units and other adjacent materials.

.6 Glass: Conforming to requirements of Section 08 80 00.

.1 Tempered Glass: conforming to ASTM C1048, Kind FT or Equivalent to CAN/CGSB-12.1 and meeting requirements of ANSI Z97.1. Ensure surface compression is equal to or greater than 69 MPa (10 000 psi).

~~.2~~ Unless indicated otherwise, Provide ~~heat strengthened glass. Provide~~ fully tempered glass. ~~where safety glazing is required for code compliance and where heat strengthened glass is verified as inadequate to resist local peak wind loads or interior guard loads.~~

.3 Edges of glass to be straight cut, free from nicks and other imperfections conducive to breakage, arrissed where visible, without metal edge banding.

2.4 COMPONENTS

.1 Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads and to suit design requirements.

.2 Factory-Sealed Insulated Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E2190, IGCC or equivalent to CAN/CGSB-12.8, and complying with other requirements specified in this Section.

.1 Sealing System: Dual seal, with polyisobutylene and silicone primary and secondary.

.2 Ensure low ‘E’ coating is edge-deleted over depth of primary and secondary edge seal at units where glass edges are visible.

.3 Edge spacer core to be straight and evenly set into glass units with maximum variation in line of spacer core of +/- 2 mm (0.08 inch) and ensure primary seal does not extend past inside edge of spacer core by more than 1.5 mm (1/16 inch).

.4 All units to have IGMA certification.

.5 Spacer: Plastic-covered stainless steel in colour selected by Consultant.

.6 Low Emissivity Glass Coating (Low 'E'): Provide triple silver sputtered vacuum deposited Low 'E' coating to surfaces of sealed insulating glass unit to meet criteria specified herein. Uniformly apply Low 'E' coating to glass.

.1 Ensure low 'E' coating is edge-deleted over depth of primary and secondary edge seal at units where glass edges are visible.

.2 Clear Units, and unless indicated otherwise:

.1 Basis-of-Design: "SunGuard® SN 68" or equivalent meeting aesthetic and performance criteria by one of the following:

.1 Vitro Architectural Glass (formerly PPG)
.2 AGC Glass Industries
.3 Cardinal Glass Industries
.4 Viracon

.7 Safety / Security Window Film (FILM-S) - at all exterior glazing units up to 3 m above grade: Optically clear microlayered polyester film, with abrasion-resistant acrylic coating over one surface and a pressure sensitive adhesive on the other. Apply to surface no. 6 of triple glazed units and surface no. 4 of double glazed units.

.1 Colour: Clear.

.2 Thickness: Minimum 0.2 mm (8 mils)

.3 Impact Resistance:

.1 complying with testing requirements in ANSI Z97.1, Class A and 16 CFR 1201 for Category II.
.2 Complying with testing requirements in ASTM E1996 for "Large-Missile Test" when tested at +/- 3.6 kPA (75 psf) according to ASTM E1886; with film applied to 6.0 mm (1/4 inch) thick tempered glass.

.4 Accessories: Provide manufacturer's recommended weatherable, UV-resistant, structural sealant attachment system "3M Impact Protection Film Attachment System" by 3M Canada or Equivalent.

.5 Basis-of-Design: "3M Scotchshield Ultra S800 Safety and Security Window Film" by 3M Canada or equivalent.

2.5 ASSEMBLIES

.1 Curtain Wall Systems:

.1 ~~SSG system :~~ Provide prefinished ~~structural sealant~~ full capped glazed aluminum framed curtain wall system complete vision units, spandrel panels, metal air barrier/vapour retarders, seals, perimeter trims, stools, accessories, shims, anchors and miscellaneous framing components meeting or exceeding performance requirements indicated herein.

.1 Glazing System: ~~Retained with structural sealant on two sides with perimeter caps. Refer to Drawings for locations.~~ Retained on 4 sides.

.2 Mullion depth: as indicated on Drawings.

.3 Finish: Clear anodized

.4 Fabrication Method: Factory-fabricated system

.5 Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

.6 Steel Reinforcement: As required by manufacturer.

.7 Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

.8 Basis-of-Design: “Thermawall 2600” by Alumicor or equivalent.

.2 Glazing Units:

~~.1 Vision Glass - Type VG1: Low-E-coated, clear triple insulating glass. [TBD]~~

~~.1 Overall Unit Thickness: 44 mm (1-3/4 inch)~~

~~.2 Outdoor Lite: 6 mm thick clear tempered glass.~~

~~.3 Glazing cavity 1 - Content: 90% Argon; 10% Air~~

~~.4 Glazing Cavity 1 - Thickness: 13 mm (1/2 inch)~~

~~.5 Middle Lite: 6 mm thick clear heat-strengthened glass~~

~~.6 Glazing cavity 2 - Content: 90% Argon; 10% Air~~

~~.7 Glazing Cavity 2 - Thickness: 13 mm (1/2 inch)~~

~~.8 Indoor Lite: 6 mm thick clear tempered glass.~~

~~.9 Low-E Coating: triple-silver as specified in this Section, sputtered on surfaces no. 2 and no. 5.~~

~~.10 Bird-friendly frit: Provide ceramic frit applied by acid etching on surface no. 1 of glazing.~~

~~.1 Pattern: Provide 6 mm (1/4 inch) diameter dots at 100 mm (4 inches) on center spacing, applied to glass units, with 100% coverage of glass unit.~~
~~.2 Basis-of-Design: Walker Glass or approved Equivalent.~~

~~.11 Performance Requirements:~~

~~.1 Winter U-Value: 0.13 Maximum~~
~~.2 SHGC: 0.33 Maximum~~
~~.3 Visible Light Transmittance (VLT): Not less than 52%.~~

.2 Vision Glass - Type VG12: Low-E-coated, clear double insulating glass. ~~[TBD]~~

.1 Overall Unit Thickness: 25 mm (1 inch)

.2 Outdoor Lite: 6 mm thick clear tempered glass.

.3 Glazing cavity: 90% Argon; 10% Air

.4 Indoor Lite: 6 mm thick clear tempered glass.

.5 Low-E Coating: triple-silver as specified in this Section, sputtered on surfaces no. 2

.6 Bird-friendly frit: Provide ceramic frit applied by acid etching on surface no. 1 of glazing.

.1 Pattern: Provide 6 mm (1/4 inch) diameter dots at 100 mm (4 inches) on center spacing, applied to glass units, with 100% coverage of glass unit.
.2 Basis-of-Design: Walker Glass or approved Equivalent.

.7 Performance Requirements:

.1 Winter U-Value: 0.25 Maximum
.2 SHGC: 0.37 Maximum
.3 Visible Light Transmittance (VLT): Not less than 60%.

.3 Operable Aluminum Swing Doors and Entrances

.1 Manufacturer's standard glazed entrance doors for manual-swing operation.

.2 Door Construction: 57.2-mm (2-1/4-inch) overall thickness, with minimum 3.2-mm- (0.125-inch-) thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.

.3 Thermally-Broken Construction: High-performance plastic connectors separate aluminum members exposed to exterior from members exposed to interior.

.4 Door Design: As indicated on Drawings.

.5 Glazing for Doors:

.1 At exterior doors forming part of the building envelope, Provide glazing matching curtain wall in every respect (VG-~~2~~ 1) as noted on Drawings.

.2 At interior vestibule doors, single fully tempered glazing (TGL) as specified in Section 08 80 00 is acceptable.

.6 Glazing Stops and Gaskets: Beveled or square, snap-on, extruded-aluminum stops and preformed gaskets.

.7 Provide nonremovable glazing stops on outside of door.

.8 Door Hardware: Provide entrance door hardware and entrance door hardware sets indicated in Door And Frame Schedule for each entrance door to comply with requirements in this Section.

.9 Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.

.10 Opening-Force Requirements:

.1 Egress Doors: Not more than 67 N (15 lbf) to release the latch and not more than 133 N (30 lbf)to set the door in motion.

.2 Accessible Interior Doors: Not more than 22.2 N (5 lbf) to fully open door.

.11 Weather Stripping: Manufacturer's standard replaceable components.

.12 Compression Type: Made of ASTM D2000, molded neoprene, or ASTM D2287, molded PVC.

.13 Sliding Type: AAMA 701/702, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.

.14 Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.

.15 Basis-of-Design: “ThermaPorte 7700” by Alumicor or equivalent.

2.6 FABRICATION

.1 Curtain Wall:

.1 Fabricate glazed aluminum framing systems for curtain wall to designs, shapes, and sizes shown using materials specified and shown to produce assemblies which meet or exceed performance requirements. To greatest extent possible complete fabrication, assembly, finishing, hardware applications and other work before shipment to Project site.

.2 Ensure exposed work is carefully fitted and matched to produce continuity of line and design, with joints, being accurately fitted for hairline contact and rigidly secured. Where additional rigidity or strength is required to satisfy performance requirements reinforce aluminum framing system components with aluminum or carbon steel shapes, bars, and plates.

.3 Provide vents, weepholes and internal water passages in glazing framing recesses as recommended by respective glass and framing manufacturers to conduct infiltrating water to exterior, and to avoid condensation at unit air spaces. Provide weep baffles secured to inside of frame behind vents and weepholes. Make provisions for reglazing from interior for vision glass.

.4 Brace frames to maintain squareness and rigidity during shipment and installation. Galvanize steel clips and reinforcement with 380 g/m^2 zinc coating to ASTM A123/A123M

.5 Ensure aluminum framing system frames are installed with factory or site installed air and vapour barrier for sealing to building air and vapour barrier. Ensure compatibility with air and vapour barrier materials of building envelope assembly. Ensure materials provide required air tightness and vapour diffusion seal to building.

.6 Flashing and Trim:

.1 Provide metal flashing members, trim and accessories in contact with framing members. Fabricate exposed, concealed or semi-concealed flashing and closure sections from finish-matching 3 mm (1/8") thick aluminum from stock as previously specified.

2.7 FINISHES

.1 Finish of Exposed Aluminum Components: in accordance with the appropriate AAMA voluntary guide specification as follows:

.2 Building Exterior: AA M10 C21 or C22 A41; AAMA 611 Class I Clear Anodizing

.3 Building Interior: AA M10 C21 or C22 A31; AAMA 611 Class II Clear Anodizing

.4 Finishes on exposed metal parts of windows and doors specified in this Section or adjacent to work of this Section, excluding hardware, must be same finish as that specified for the curtain wall framing.

.5 Finish of Unexposed Aluminum Components: provided with pre-treatment, flash anodize or organic paint finish to improve sealant adhesion.

.6 Dissimilar Material Protection: Where aluminum or carbon steel surfaces are to be in contact with each other or in contact with dissimilar materials such as masonry or concrete, and where hot dip galvanizing of carbon steel is incompatible with component parts because of galvanic action or component fabrication tolerances provide one of the following:

.1 Bituminous Paint: Cold-applied, non-sagging, asphalt-mastic paint complying with SSPC-Paint 12 requirements, except containing no asbestos. Apply in two coats for an overall minimum dry film thickness of 25 mils.

.2 Zinc Rich Primer: Organic zinc-rich primer, complying with SSPC-Paint 20.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Before commencing installation, examine the work of other Sections to which work of this Section will be attached.

.2 Report immediately in writing to the Consultant all discrepancies in accuracy and suitability which will adversely affect the work of this Section. Report surfaces left unacceptable by other trades to the Consultant before commencing installation.

.3 Ensure that openings and recesses to receive work of this Section are within acceptable tolerances.

.4 Commencement of installation shall indicate acceptance of work of other Sections upon which work of this Section depends.

3.2 PREPARATION

.1 Supply anchorage devices and inserts to appropriate trades where required for building in or casting-in-place and instruct such trades as to the proper location and position.

.2 Ensure that masonry and concrete surfaces to receive adhesives and sealants are dry, firm, sound, smooth, suitable for bond, and free from loose material, projections, ice, frost, slick, grease, oil and other matter detrimental to bond.

.3 Remove dust and other loose material from openings.

.4 Preconstruction Adhesion and Compatibility Testing: Submit to the structural glazing sealant manufacturer, for testing indicated below, samples of each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member that is in close proximity to or is touching the structural or nonstructural sealants of a structural glazed system.

3.3 INSTALLATION

.1 Erect all work plumb and true and in proper alignment and relationship to established lines and grades. Comply with manufacturer's written instructions.

.2 Fit joints to produce hairline joints free of burrs and distortion. Rigidly secure nonmovement joints.

.3 Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints. Weld components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding. Seal joints watertight, unless otherwise indicated.

.4 Ensure devices for anchoring frame assemblies have sufficient adjustment to permit correct and accurate alignment. After alignment, positively secure anchorage devices to prevent movement other than those designed for expansion and contraction. Take into consideration climatic conditions prevailing at the time of installation.

.5 Site located fixings shall be subject to the Consultant's review. Perform welding and drilling of steel and drilling of concrete as required to Install fixings. Repair concrete chipped by drilling or fixing operations.

.6 Install aluminium framing system (complete with fixed and operable panes) in accordance with manufacturer’s instructions. Install materials with continuous thermal breaks located on exterior side of glazing as designed. Fill frame extrusion on warm side of thermal break with insulation.

.7 Isolate metal surfaces in contact with incompatible materials, including wood, by painting contact surfaces with bituminous coating or primer, or by applying sealant or tape recommended by the manufacturer.

.8 Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

.9 Set continuous sill members and flashing in full sealant bed as specified in Section 07 92 00 to produce weathertight installation.

.10 Erection Tolerances:

.1 Limit variations from plumb, level or dimensioned angle to the following:

.1 3mm (1/8") maximum deviation in storey height, or in 3m (10') vertical run, or in 6m (20') horizontal run.

.2 6mm (1/4") maximum deviation in 12m (40') in any direction.

.2 Limit variations from location (theoretical calculated positions in plan or evaluation based on established floor lines and column lines), including variations from plumb and level, to following:

.1 9mm (3/8") total maximum deviation for member at any location.

.2 3mm (1/8") maximum change in deviation for member for 3m (10') run, any direction.

.3 Limit offsets in end-to-end and edge-to-edge alignment of adjoining and consecutive members, which form planes, continuous runs and profiles to 1.5mm (1/16") maximum offset in flush alignment, including those which are to be 13mm (½") or less out-of-flush, and including those which are separated 50mm (2") or less by a reveal or protrusion in plane or wall.

.11 Ensure a uniform, continuous thermal and vapour barrier effect. Where adjacent insulation and vapour barriers are to be provided under other Sections, coordinate the work such that thermal and vapour barrier continuity is achieved.

.12 Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.

.13 Install glazing as specified in Section 08 80 00. Prepare surfaces that will contact structural sealant according to the sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.

.14 Install weatherseal sealant according to Section 07 92 00 and according to the sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind the sealant as recommended by the sealant manufacturer.

3.4 SITE QUALITY CONTROL

.1 Site Tests and Inspections:

.1 Curtain wall systems will be subject to tests to confirm performance criteria specified herein and in Sections 01 45 00 and Section 01 83 16. The Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

.2 Before concealing window and curtain wall work obtain required inspections from an independent testing and inspection agency. As a minimum, the following tests will be required:

.1 Water Leakage Tests: ASTM E1105 at a minimum cyclic static-air-pressure differential as specified in Section 01 83 16, and shall not evidence water penetration.

.3 In event that the curtain wall system does not pass tests performed by the inspection and testing company, take remedial action, approved by the Consultant, as necessary to correct deficiencies observed as a result of tests. Perform retesting at own expense until tests indicate satisfactory results.

3.5 CLEANING

.1 Clean work of this Section in accordance with "Cleaning Procedure" as recommended by Aluminum Company of Canada in publication D.I. 650, 1962 "Care During Construction" and as recommended by the finish applicator.

.2 Clean and polish glass on exterior and interior and remove markings indicating presence of glass.

END OF SECTION

Added through
SEE ADD#6, Q#142

PART 1 - GENERAL

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL INSTRUCTIONS

.1 Read and conform to:

.1 the General Conditions and the Supplementary Conditions of the Contract.

.2 Division 1 requirements and documents referred to therein.

1.3 SUMMARY

.1 Work Included: Provide fiberglass windows and window wall assemblies including but not limited to the following:

.1 fixed fiberglass windows.

.2 glass and glazing in work of this Section.

.2 Related Requirements: Specifications throughout the entirety of the Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.4 REFERENCES

.1 Reference Standards: Latest published editions of reference standards listed in this Section in effect as of the closing date and time of the Request for Tenders for the Contract, including any amendments adopted, are applicable unless otherwise indicated herein.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Preinstallation Conference: Conduct conference at Project site at which the Contractor shall, among other things:

.1 Review and finalize Construction Schedule and verify availability of materials, installer's personnel, equipment, and facilities needed to make progress and avoid delays.

.2 Review, discuss, and coordinate the interrelationship of fiberglass windows with other exterior wall components. Include provisions for anchoring, flashing, weeping, sealing perimeters, and protecting finishes.

.3 Review and discuss the sequence of work required to construct a watertight and weathertight exterior building envelope.

.4 Inspect and discuss the condition of substrate and other preparatory work performed by trades performing the work of other Sections.

1.6 SUBMITTALS

.1 Product Data: Submit manufacturer's literature and data sheets for each type of material provided under this Section for the Project in accordance with requirements of Division 01. Ensure data sheets provide required information including detailed instructions for installing as

well as maintaining, preserving and keeping materials in clean and safe conditions. Provide adequate warning of maintenance practices or cleaning agents detrimental to specified materials.

.2 Material Safety Data Sheets: Submit MSDS for inclusion in operation and maintenance manual without limitations for adhesives, sealants and as other materials designated later by Consultant.

.3 Shop Drawings:

.1 Submit Shop Drawings of fiberglass windows and window wall assemblies, components and accessories in accordance with Division 01.

.2 Indicate head, jamb and sill, profiles of components, (interior and exterior trim), junction between combination units, elevations of unit and description of related components. Indicate relation to adjoining work and location, construction and back-up, joint sealant, location of isolation coating, interior structure and/or details of reinforcements, glazing modules, head and frame details, mullions and details, glazing and glass stop details, thermal break sections and vinyl or neoprene mouldings (in 1/2 size), details of connections, anchorage, interfacing with adjacent work and assembly fixings. Clearly indicate materials used for every component on Shop Drawings.

.3 Clearly indicate how thermal expansion and contraction are to be accommodated and to what degree. Show connections to adjacent construction and provision made for structural deflections, contractions, expansion and other normal movement.

.4 Submit Shop Drawings bearing the stamp of a Professional Engineer registered in the Province of Ontario and experienced in this type of work. Show where anchors and shims are placed, type of anchors, shim thicknesses, widths, number of fasteners and edge clearances for fasteners.

.4 Insulating Glass Manufacturer's Association of Canada (IGMAC) Compliance Audit:

.1 Submit in accordance with Division 01.

.2 Submit written certification of successful completion of a compliance audit within the last 6 months.

.5 Samples: Submit samples in accordance with Division 01. Submit following samples in the sizes indicated:

.1 Submit 1 complete full size sample of each window type to the Consultant for approval of general appearance and quality of the work.

.2 Submit sample sections of component parts of windows and window wall assemblies including frame, sash, sill, glazing and waterproofing method, surface and finish hardware, and glass finished in specified colours. Samples of extruded shapes shall be 300 mm (12") long; samples of each type of glass shall be 300 mm (12") square.

.6 Test Reports:

.1 Submit report from an independent testing laboratory completed within the last 3 years, indicating windows and window wall assemblies meet or exceed performance requirements of CAN/CSA-A440-M with respect to air infiltration, wind load resistance, water tightness, condensation resistance, thermal performance, ease of operation, load tests on screens, forced entry resistance and mullion deflection (for combined and composite windows and window wall assemblies).

.7 Maintenance Data and Operating Instructions:

.1 Submit maintenance instructions in accordance with Division 01.

.2 Provide a demonstration with window manufacturer for building maintenance staff dealing with operation of windows and window wall assemblies, insert removal, re-glazing, cleaning and general maintenance.

1.7 QUALITY ASSURANCE

.1 Qualifications:

.1 Designers, fabricators and installers of the work of this Section: minimum of 10 years experience in the application of the Products, systems and assemblies specified herein. Installer shall be acceptable to the fiberglass window manufacturer for installation of units required for this Project.

.2 Insulating glass unit fabricators: membership and certification in the IGMAC.

.1 IGMAC members must participate in the certification program and successfully pass a compliance audit within the last 6 months.

.2 Structural Design and Inspection: Employ a structural Professional Engineer, that carries a minimum $2,000,000.00 professional liability insurance and is registered in the Province of Ontario, to:

.1 design components for work of this Section requiring structural performance.

.2 be responsible for determining sizes, joint spacing to allow thermal movement and loading of components in accordance with applicable codes and regulations.

.3 be responsible for production and review of Shop Drawings.

.4 inspect work of this Section during fabrication and erection.

.5 stamp and sign each Shop Drawing.

.6 Provide site administration and inspection of this part of the Work.

.3 Mock-Ups:

.1 Build mock-ups in building envelope wall in locations directed by Consultant:

.1 Minimum Size: 450 mm x 450 mm x 450 mm (18" x 18" x 18").
.2 Maximum Size: 600 mm x 600 mm x 600 mm (24" x 24" x 24").
.3 Include: Glazing and demonstrate airseal and anchorage systems.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Transport materials to site storage in a manner to prevent in-transit damage. These measures include, but are not limited to, crating, polyethylene wrapping system and similar protective packaging.

.2 Store in a dry, protected area on site, in original undamaged containers with manufacturer's labels and seals intact.

.3 Brace frames to maintain squareness and rigidity during shipment and installation.

.4 Provide glass units with interlayer protection between lites. Keep glass and interleaving dry and store cases in clean, cool, dry areas with temperatures above dewpoint. Circulation of cool, dry air in storage areas is essential. Open cases and inspect units periodically for moisture accumulation. Do not store glass in direct sunlight without an opaque protective covering over same.

.5 Remove damaged or unsatisfactory materials from the site and replace with new materials to satisfaction of the Consultant at no cost to the Owner.

.6 Protect the work of this Section from damage. Protect work of other trades adjacent to work of this Section.

.7 Provide at factory, strippable coatings on exposed surfaces of fiberglass windows and window wall assemblies. This coating and protective wrappings shall remain on the surfaces through the period that the work of other Sections proceeds on the building and shall be removed by those performing the work under this Section upon completion of the building.

.8 Comply with unpacking procedures as recommended by the framing and glass manufacturers.

.9 Make Good damaged work caused by failure to Provide adequate protection. Remove unsatisfactory work and replace at no expense to the Owner.

1.9 WARRANTY

.1 The Contractor warrants the work of this Section for a period of 10 years from Substantial Performance of the Work against defects and/or deficiencies in accordance with the General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within this warranty period, to the satisfaction of the Consultant and at no expense to the Owner. Defects include but are not limited to: buckling, opening of seams, bond failure and extensive colour fading.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Products of the following manufacturers are acceptable subject to conformance to the requirements of the Drawings, schedules and Specifications:

.1 Cascadia Windows;

.2 Duxton Windows:

.3 Fibertec Windows and Doors Manufacturing;

.4 Inline Fibreglass Ltd;

.2 Substitution Limitations: This Specification is based on “400 Series Windows” by Inline Fibreglass Ltd. Comparable equivalent Products from manufacturers listed herein offering functionally and aesthetically equivalent Products, as judged solely by Consultant, will be considered provided they meet the requirements of this Specification.

2.2 DESCRIPTION

.1 Design and Performance Requirements:

.1 Fiberglass window design is established in details on Drawings and performance requirements in Specifications. Design requirements are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sight lines, to one another, and to adjoining construction.

.2 Performance characteristics and design criteria specified are subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance. Do not modify intended architectural design effects except with the Consultant's approval.

.3 Furnish labor, materials and other services to complete the fabrication of new fiberglass windows, including all materials required for the supply and installation of the units in the manner, direction and performance shown on the design drawings and specified herein.

.4 Fiberglass window framing to incorporate a drained and vented system with complete air, vapor and moisture seals, allowing water entering the framing to drain to the exterior.

.5 Fiberglass inswing windows and doors to be glazed with an interior air seal using a continuous silicone heel bead from the IGU to the sash frame.

.6 Fiberglass inswing windows and doors to incorporate a concealed hinge system with a continuous interior air seal, uninterrupted by any hardware.

.7 Design fixed windows and window wall assemblies and operating units meeting or exceeding performance requirements of CAN/CSA A440/A440.1 with respect to air infiltration, wind load resistance, water tightness, condensation resistance, thermal performance, ease of operation, load tests on screens, forced entry resistance and mullion deflection as follows:

.1 Air Leakage (infiltration and exfiltration):

.1 Operable windows and window wall assemblies: maximum air leakage rate: 0.06 L/s-m^2 (0.01 cfm/ft^2)

.2 Fixed windows and window wall assemblies: 0.00 cfm/ft^2 (0.00 L/s.m^2).

.2 Water Leakage: There shall be no water infiltration at a static air pressure differential as follows when tested in accordance with AAMA 101 and ASTM E331.

.1 Water penetration resistance test pressure for all vent types, including: Fixed windows, casement, awning, tilt & turn, hopper, inswing doors, and outswing doors: 15 psf (720 Pa).

.3 Structural Performance:

.1 Performance Grade (PG) and Class of all windows and doors shall be as required to meet wind load of geographical location of the Work, but not less than the following:

.1 For fixed windows, CW-95 or higher

.2 For operable window (inswing or outswing), CW-45 or higher

.4 Resistance to Forced Entry: F20 per CAN/CSA A440/A440.1 or Grade 10 per according to ASTM F588.

.8 Thermal Requirements: Thermal Transmittance U-Value shall be certified in accordance with the National Fenestration Rating Council (NFRC).

.1 Overall U-values: Not more than 0.15 (Imperial) / 0.85 (Metric)

.9 Condensation Resistance Test (CRF): When tested in accordance with AAMA Specification 1503 and CAN/CSA-A440, the condensation resistance factor (CFR) shall not be less than: 64 (50.2 I-frame).

.10 Have work of this Section designed by a Professional Engineer licensed to design structures in the Province of Ontario.

.11 Comply with requirements of the OBC and regulations of Authorities Having Jurisdiction, which shall be a minimum, except where more stringent requirements are specified herein.

.12 Design glazing systems and framing to prevent thermal shock and fracture damage to glass. Design glass and glazing to meet CAN/CGSB-12.20. Comply with published recommendations of glass manufacturers and Glass Association of North America (GANA)'s "Glazing Manual" unless more stringent requirements are indicated.

.13 Design glazing and spanning window frame members, including any required reinforcing, in accordance with AAMA/WDMA/CSA 101/I.S.2/A440-11. There shall be no deflection in excess of L/175 of the span of any framing member.

.14 Design fiberglass work as shown on the Drawings to Provide free and noiseless movement of all components of assembly without buckling of any component and/or transmitting of stresses to any members.

.15 Design fiberglass window system to accommodate and interface with work of other Sections as applicable.

.16 Locate sealants, gaskets, air/vapour seals, thermal separations, drainage slots and holes as shown or specified in this Section as required to obtain design requirements. Ensure components and assemblies exterior to the air barrier drain to the building exterior.

.17 Design, assemble and secure work in a manner that will keep any stresses on sealants within the sealant manufacturer's recommended working range within factors of safety specified in AAMA/WDMA/CSA 101/I.S.2/A440-11.

.18 Accurately shape members at intersecting joints to obtain hairline joints, just wide enough to permit thermal expansion and contraction.

.19 Conceal securement devices unless otherwise indicated in the Contract Documents.

.20 Design attachments which will permit replacement of individual units during construction or in subsequent usage of building without dismantling or disturbance to adjoining components or units. In addition, accomplish such replacement without use of extra fasteners, splices, covers and like that alter original design features.

.21 Provide accessories, closures, and trims required and necessary to complete the work.

.22 Design window system on NRC recommended rain screen principles with pressure equalized and draining provisions. Maintain integrity of continuous air barrier/vapour retarder system with adjacent surrounding air barrier/vapour retarder.

.23 Design and detail controlled drainage path to actively discharge water, which may enter into or form within aluminum work, to exterior; prevent accumulation or storage of water within aluminum work. Prevent water from entering interior when tested in accordance with ASTM E331.

.24 Fire Performance: Where required by building type, classification, occupancy, height or building size, Provide a cladding system tested in accordance with CAN/ULC-S134 by an independent testing organization, and approved for use in non-combustible construction.

.25 Refer to Section 01 83 16 for additional performance and testing requirements pertaining to the work of this Section.

2.3 MATERIALS

.1 Basic Material: All frames and sash profiles shall be made from Pultruded Fiberglass, having a minimum thickness of 2.3mm (0.090") with minimum glass content of 60%. Non-structural accessory members are permitted to be in aluminum and are identified as such on Drawings.

.1 Frames and Sashes: Pultruded fiberglass complying with AAMA/WDMA/CSA 101/I.S.2/A440 and with exposed exterior fiberglass surfaces finished with manufacturer's standard enamel coating complying with AAMA 613 or AAMA 623.

.2 Exterior Colour: As selected by Consultant from manufacturer's full range.

.3 Interior Finish: As selected by Consultant from manufacturer's full range.

.2 Aluminum Components: ASTM B209M, size accurately formed as shown on Drawings, extruded aluminum alloy AA-6063-T5 for all aluminum except surfaces receiving anodizing which shall be AA-6061-T6. Surfaces shall be free from defects impairing appearance, strength and durability.

.3 Screws, Bolts and Fasteners: Exposed stainless steel, ASTM A167, Series Type 304 or Type 300 or hardened aluminum.

.4 Miscellaneous and Sub-Frame Steel: CSA G40.21, Grade 300W, hot dipped galvanized after fabrication to CAN/CSA-G164-M, with additional zinc chromate coating to CAN/CGSB-1.132-M after fabrication. Steel reinforcements and anchors shall conform to Section 05 50 00 requirements.

.5 Shims: Alcan Utility sheet when not in contact with cementitious substances; stainless steel when in contact with cementitious substances or galvanized steel. Thicknesses as required per CSA A440.

.6 Window Hardware: Manufacturer's standard hardware fabricated from aluminum, stainless steel, or other corrosion-resistant material compatible with aluminum; designed to smoothly operate, tightly close, and securely lock aluminum windows and window wall assemblies and sized to accommodate sash or ventilator weight and dimensions. Cadmium-plated hardware shall not be permitted. Do not use aluminum in frictional contact with other metals. Where exposed, Provide nonmagnetic stainless steel.

.7 Compression-Type Weather Stripping: Provide compressible weather stripping designed for permanently resilient sealing and completely concealed when fiberglass window is closed. Weather-Stripping Material: Elastomeric cellular preformed gaskets complying with ASTM C509. Weather-Stripping Material: Dense elastomeric gaskets complying with ASTM C864.

.8 Sealant: Multi-component conforming to CAN/CGSB-19.24-M, Type 2, Class "B" for sealant to be incorporated between fiberglass framing and adjacent structures. Colours later selected by Consultant from standard colour selection. Furnish non-hardening, non-shrinking, non-migrating non-skimming, non-sagging, non-bleeding poly-isobutylene or partially vulcanized rubber base sealant for use in concealed-sealing of thin joints in metal work.

.9 Screen for Operating Units:

.1 Design windows and window wall assemblies and hardware to accommodate screens in tight fitting, removable arrangement with minimum of exposed fasteners and latches.

.2 glass fibre fabric mesh woven into 14 x 18 mesh screen cloth, CAN/CGSB-79.1-M.

.3 Frame: extruded aluminum with baked enamel finish.

.10 Insulation within frame assemblies: Foamed-in-place type (INS-9) as specified in Section 07 21 00 in locations indicated on the Drawings.

.11 Glazing Materials:

.1 Design glass and glazing to meet CAN/CGSB-12.20-M, including appendices and design requirements listed herein as applicable. Glass thicknesses given in this Section are minimum. Ensure glass bears manufacturer's labels indicating quality. Leave labels in place until final cleaning.

.2 Factory-Sealed Insulated Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E2190, IGCC or equivalent to CAN/CGSB-12.8, and complying with other requirements specified in this Section.

.1 Sealing System: Dual seal, with polyisobutylene and silicone primary and secondary.

.1 Basis-of-Design (Silicone Secondary Seal): DOWSIL 982 or DOWSIL 3363 by The Dow Chemical Company as suitable for use or Equivalent.
.2 Colour: Black.

.2 Ensure low 'E' coating is edge-deleted over depth of primary and secondary edge seal at units where glass edges are visible.
.3 Edge spacer core to be straight and evenly set into glass units with maximum variation in line of spacer core of +/- 2 mm (0.08 inch) and ensure primary seal does not extend past inside edge of spacer core by more than 1.5 mm (1/16 inch).
.4 All units to have IGMA certification.
.5 Spacer: Plastic-covered stainless steel in colour selected by Consultant.

.1 Basis-of-Design: "CHROMATECH ULTRA" by Roll-Tech A/S; http://www.rolltech.dk or Equivalent.

.6 Low Emissivity Glass Coating (Low 'E'): Provide triple silver sputtered vacuum deposited Low 'E' coating to surfaces of sealed insulating glass unit to meet criteria specified herein. Uniformly apply Low 'E' coating to glass.

.7 Ensure low 'E' coating is edge-deleted over depth of primary and secondary edge seal at units where glass edges are visible.

.1 Basis-of-Design: "SunGuard® SN 68" or Equivalent meeting aesthetic and performance criteria by one of the following:

.1 Vitro Architectural Glass (formerly PPG)
.2 AGC Glass Industries
.3 Cardinal Glass Industries
.4 Viracon

.3 Safety / Security Window Film (FILM-S) - at all exterior glazing units: Optically clear microlayered polyester film, with abrasion-resistant acrylic coating over one surface and a pressure sensitive adhesive on the other. Apply to surface no. 2 of double glazed units.

.1 Colour: Clear.

.2 Thickness: Minimum 0.2 mm (8 mils)

.3 Impact Resistance:

.1 complying with testing requirements in ANSI Z97.1, Class A and 16 CFR 1201 for Category II.
.2 Complying with testing requirements in ASTM E1996 for "Large-Missile Test" when tested at +/- 3.6 kPA (75 psf) according to ASTM E1886; with film applied to 6.0 mm (1/4 inch) thick tempered glass.

.4 Accessories: Provide manufacturer's recommended weatherable, UV-resistant, structural sealant attachment system "3M Impact Protection Film Attachment System" by 3M Canada or Equivalent.

.5 Basis-of-Design: "3M Scotchshield Ultra S800 Safety and Security Window Film" by 3M Canada or equivalent.

.4 Vision Glass - Type VG1: Low-E-coated, clear double insulating glass.

.1 Overall Unit Thickness: 25 mm (1 inch)

.2 Outdoor Lite: 6 mm thick clear tempered glass.

.3 Glazing cavity: 90% Argon; 10% Air

.4 Indoor Lite: 6 mm thick clear tempered glass.

.5 Low-E Coating: triple-silver as specified in this Section, sputtered on surfaces no. 2

.6 Bird-friendly frit: Provide ceramic frit applied by acid etching on surface no. 1 of glazing.

.1 Pattern: Provide 6 mm (1/4 inch) diameter dots at 100 mm (4 inches) on center spacing, applied to glass units, with 100% coverage of glass unit.
.2 Basis-of-Design: Walker Glass or approved Equivalent.

.7 Performance Requirements:

.1 Winter U-Value: 0.25 Maximum
.2 SHGC: 0.37 Maximum
.3 Visible Light Transmittance (VLT): Not less than 60%.

2.4 AUXILIARY MATERIALS

.1 Preformed Silicone-Sealant Extrusion (at glazing transitions): Manufacturer's standard system consisting of cured low-modulus silicone extrusion, sized to fit opening widths, with a single-component, neutral-curing, Class 100/50 (low-modulus) silicone sealant for bonding extrusions to substrates. Acceptable Products:

.1 "Silicone Transition System (STS)" by Dow Corning Corp

.2 “Proglaze ETA” by Tremco Canada

.3 or Equivalent to the above.

.2 Sprayed Polyurethane Foam Sealant (INS-7): Foamed-in-place, polyurethane foam sealant; flame-spread index of 25 or less according to ASTM E162; with primer and substrate cleaner recommended by foam-sealant manufacturer.

.1 Acceptable Products:

.1 "Zerodraft Air Sealant Foam and Insulating Sealant" by Zerodraft (Division of Canam Building Envelope Specialists Inc.), www.zerodraft.com
.2 “Handi-Foam®” by Fomo Products, Inc.; www.fomo.com
.3 "GREAT STUFF PRO™ Series" Foam Sealant by Dow Chemical.
.4 or Equivalent to the above.

.3 Flashing and Tapes: Self-adhesive types, conforming to AAMA 711 and sized as required to provide flashing, window seal and drainage.

.1 Acceptable Products:

.1 Rough Opening Flashing and Window Seal: “Wigluv 100/150/230 Tape” by SIGA or Equivalent.

2.5 FABRICATION

.1 Fiberglass frame and sash corners shall be connected with molded reinforced polymer shear blocks and mechanically secured. All joints shall be factory sealed and neatly fitted together.

.2 Provide integral window components such as glazing perimeter airseal, frame perimeter air seal, metal clip anchors, sills and closures.

.3 Fabricate in accordance with CSA A440 requirements and the manufacturer’s written instructions.

.4 Fabricate units square and true to detail with maximum tolerance of ± 1.5 mm (1/16") for units with diagonal measurement of 1800 mm (6'-0") or less than 3.00 mm (1/8") for units with diagonal measurement over 1800 mm (6'-0"), free from defects impairing appearance, strength and durability. Overall assembled profiles shall be as detailed on the Drawings.

.5 Make provision at sealed horizontal members to lead moisture accumulation to exterior.

.6 Anchorages must be attached to warm side of fiberglass window assembly.

2.6 FINISHES

.1 Fiberglass: Manufacturer's standard electrostatically applied finish. Colour to be selected by Consultant at a later date from manufacturer's standard range.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Site Verification of Conditions: Verify actual site dimensions and location of adjacent materials prior to commencing work. Verify fiberglass window openings by field measurements before fabrication. Notify the Consultant in writing of any conditions which would be detrimental to the installation. Commencement of work implies acceptance of previously completed work.

3.2 INSTALLATION

.1 Set window framing in its correct location, level, square and plumb and at proper elevations, with the nominal face of the framing aligned in a single vertical plane. Prior to flashing installation:

.1 Substrate must be smooth, dry and free of debris, including frost, grease, dirt and sharp edges.

.2 Ensure mechanical fasteners are installed flush to substrate surface.

.3 Ensure masonry joints are struck flush.

.4 Ensure voids over 25 mm (1") are filled and tooled flush, using compatible sealant or spray foam.

.5 Use manufacturer's recommended primer where necessary to promote adhesion to surfaces.

.6 Ensure door and window rough openings are slightly sloped to the exterior to ensure proper drainage.

.7 Install materials with not less than 25 mm (1 inch) overlap to building's primary air barrier membrane.

.2 Fasten and anchor framing in place in accordance with CSA A440.6. Install in accordance with reviewed Shop Drawings. Maintain continuity of air barrier and vapour barrier membranes by installing flashings and tapes as indicated on Drawings:

.3 Erection Tolerances:

.1 Limit variations from plumb, level or dimensioned angle to the following:

.1 3 mm (1/8") maximum deviation in storey height, or in 3 m (10') vertical run, or in 6 m (20') horizontal run.

.2 6 mm (1/4") maximum deviation in 12 m (40') in any direction.

.2 Limit variations from location (theoretical calculated positions in plan or evaluation based on established floor lines and column lines), including variations from plumb and level, to following:

.1 9 mm (3/8") total maximum deviation for member at any location.
.2 3 mm (1/8") maximum change in deviation for member for 3 m (10') run, any direction.

.3 Limit offsets in end-to-end and edge-to-edge alignment of adjoining and consecutive members, which form planes, continuous runs and profiles to 1.5 mm (1/16") maximum offset in flush alignment, including those which are to be 13 mm (1/2") or less out-of-flush, and including those which are separated 50 mm (2") or less by a reveal or protrusion in plane or wall.

.4 Glazing:

.1 Use glazing and bedding compounds of type compatible with secondary sealant in insulating glass unit.

.2 Surfaces receiving glazing materials shall be thoroughly wiped with low-VOC cleaning substances recommended by the manufacturer.

.3 Install windows using “inside-glazing” methods with exterior butyl tape and integral spacer. Provide heal bead at bottom of interior edge of sealed units and up the lower 75 mm (3") of each vertical to Provide a vented glazing cavity. Provide punched louvres or holes through exterior glazing flange for venting and drainage. Snap-in glazing stop to be complete with elastomeric roll-in wedge to hold glass tight and separate glass from fiberglass frame.

.5 Caulking: At interior and exterior joints between fiberglass framing and adjacent work of other Sections:

.1 Install backer rod over compressible filler material or perimeter blocking to Provide sealant joints of proper form, thickness to width ratios, and to Provide bond break at back side of sealant. Where backer rod cannot be used or is not shown Provide bond breaker tape to back side of sealant joint substrate.

.2 Clean substrate surfaces to which sealant is to bond and apply sealant primers as recommended by the sealant manufacturer.

.3 Caulk joints continuously to produce weatherproof and visually acceptable joint installation.

3.3 FIELD QUALITY CONTROL

.1 Site Tests and Inspections:

.1 Fiberglass window systems will be subject to tests to confirm performance criteria specified herein and in Sections 01 45 00 and Section 01 83 16. The Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

.2 Before concealing fiberglass window work obtain required inspections from an independent testing and inspection agency. As a minimum, the following tests will be required:

.1 Water Leakage Tests: ASTM E1105 at a minimum cyclic static-air-pressure differential as specified in Section 01 83 16, and shall not evidence water penetration.

.2 Air Leakage Tests: ASTM E783 the rate specified in Section 01 83 16.

.3 In event that the fiberglass window system does not pass tests performed by the inspection and testing company, take remedial action, approved by the Consultant, as necessary to

correct deficiencies observed as a result of tests. Perform retesting at own expense until tests indicate satisfactory results.

3.4 CLEANING

.1 Maintain window framing in a clean condition throughout construction period, so it will be without deterioration or damage at the time of acceptance. Select methods of cleaning which will promote achievement of uniform appearance and stabilized colours and textures for materials that weather or age with exposure.

.2 Immediately before Substantial Performance of the Work, clean windows and window wall assemblies thoroughly, inside and out. Demonstrate proper cleaning methods to the Owner during this final cleaning. Prepare a "Cleaning and Maintenance Manual" listing types of cleaning compounds, cleaning methods, sealants and glazing materials of the work of this Section and submit 2 copies to the Owner.

3.5 PROTECTION

.1 Protect window surfaces from contact with contaminating substances resulting from construction operations. In addition, monitor window surfaces adjacent to and below exterior adjacent surfaces during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written recommendations.

.2 Remove protective covering and coating from fiberglass surfaces, inside and out, and clean surfaces, remove labels, stripes and protective devices and polish glass surfaces, immediately prior to final acceptance of the Work by Consultant.

END OF SECTION

Updated through ADD#10

PART 1 - GENERAL

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL INSTRUCTIONS

.1 Read and conform to:

.1 The General Conditions and Supplementary Conditions of the Contract as amended in the Contract Documents.

.2 Division 01 requirements and any additional documents referred to therein.

1.3 SUMMARY

.1 Work Included: Provide unit skylights including but not limited to following:

.1 Unit skylights and associated glazing.

.2 Auxiliary materials required for a complete installation.

.2 Related Requirements: Specifications throughout the entirety of Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.4 REFERENCES

.1 Reference Standards: Unless otherwise stipulated by a specific publication date in this Section or the Ontario Building Code, the latest published editions of reference standards in force as of the Bid Closing Deadline for the Project, including adopted amendments, are applicable.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Sequencing: Coordinate installation with other related Sections.

.2 Pre-Installation Meetings:

.1 Prior to starting work of this Section, convene a pre-installation meeting at Project site to review Project requirements and site conditions with pertinent parties. Conform to requirements of Section 01 31 00.

.2 Pre-construction Site Meeting:

.1 Prior to start of work, arrange for Project site meeting of parties associated with work of this Section, including non-exhaustively Subcontractor performing work of trade involved, testing company's representative and Contractor's consultants of applicable discipline. Consultant may attend.

.2 Review Contract Documents to permit compliance with intent of this Section for work included under this trade, and ensure complete understanding of requirements and responsibilities relative to:

.1 work included,

.2 materials to be used,

.3 storage and handling of materials,

.4 installation of materials,

.5 sequence and quality control,

.6 Project staffing,

.7 restrictions on areas of work and other matters affecting construction.

.3 In particular ensure Division 3 requirements for concrete are compatible with requirements of this Section. Ensure following meet acceptable criteria to ensure proper performance floor covering work:

.1 floor flatness and floor levelness requirements for flooring installation and their acceptability by flooring manufacturer;

.2 surface texture of finished floor required for flooring installation;

.3 acceptable approaches to remediation of high moisture and high pH floors;

.4 adhesive application and floor covering installation. Scheduling:

.4 Prior to commencing work of this Section arrange for the manufacturer's technical representative to review with Contractor and Consultant, procedures to be adopted and conditions under which work is to be performed. Inspect surfaces to determine adequacy of existing and proposed conditions.

.5 Cooperate fully with other Subcontractors on The Work and promptly proceed with work of this Section as rapidly as job conditions permit.

.6 Supply items to be built-in in ample time to be incorporated into work of other Subcontractors, together with measurements and other information required for location thereof.

.7 Ensure work which may create dust does not proceed during work related to painting and final finishing.

1.6 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's literature, data sheets for each type of material provided under this Section for Project.

.2 Data sheets shall provide all required information. Submit 3 copies of detailed instructions for maintaining, preserving and keeping materials in clean and safe conditions and give adequate warning of maintenance practices or materials detrimental to specified materials. Submit manufacturer's installation instructions.

.2 Safety Data Sheets (SDS): Submit SDS for inclusion in Operation and Maintenance Manual specified in Section 01 78 00, for adhesives, sealants and any other material designated by Consultant.

.3 Shop Drawings: Submit Shop Drawings indicating material layouts, details of construction, connections, and relationship with adjacent construction. As a minimum indicate following:

.1 Include plans, elevations, sections and details as applicable.

.2 Air Barrier Interface Detailing: Indicate details of air barrier, waterproofing and vapour retarder interface materials, accessories, fastening, seals, and relationship to The Work as necessary to coordinate The Work with other building trades.

.3 Manufacturer's literature must clearly indicate intended plane of primary air and water resistance for skylight system.

.4 Indicate field-measured dimensions on Shop Drawings.

.5 Delegated Design Submittals:

.1 Engineering design completion of unit skylights work is delegated to Contractor based on structural design criteria indicated in Contract Documents.

.2 Submit Shop Drawings for work of this Section that bear the stamp of a Professional Engineer registered in Province of the Work.

.3 Submit copy of structural calculations upon request by Consultant.

.6 Samples: Submit one 300 mm (12 inch) length of each type of skylight frame with portion of acrylic ~~dome~~pyramid.

.7 Embodied Carbon / Environmental Product Declarations (EPDs): When available, submit product-specific or industry-wide regional (i.e., North American) EPDs conforming to ISO 14025 or other recognized environmental Product declaration framework meeting following criteria:

.1 EPD Scope: must cover Cradle-to-Gate (A1 to A3) as a minimum.

.2 EPD Impact Categories: must report Global Warming Potential (GWP) in form of unit of $kgCO_2e$/declared unit as a minimum.

.3 Product Options: Give preference to Products with compliant documentation when choice is at Contractor's option.

.8 Material Ingredient Disclosure: When available, submit documentation disclosing chemical inventory of materials to at least 0.1% (1000ppm) meeting following criteria:

.1 Standard: Health Product Declaration (HPD) Open Standard, Cradle to Cradle v2 (Basic level) or Cradle to Cradle v3 (Bronze level), International Living Future Institute (ILFI) Declare, or other approved material ingredient declaration framework.

.2 Product Options: Give preference to Products with compliant documentation when choice is at Contractor's option.

.9 Low-Emitting Materials: For applicable Products specified or used for activities of this Section (i.e., site-applied coatings, adhesives, and sealants), submit certifications from third-party organizations indicating compliance with following:

.1 VOC Emissions: California Department of Public Health (CDPH) Standard Method v1.2–2017, using applicable exposure scenario.

.2 VOC Content: SCAQMD Rule 1113 (for paints and coatings) and SCAQMD Rule 1168 (for adhesives and sealants).

1.7 QUALITY ASSURANCE

.1 Qualifications:

.1 Manufacturers: Provide Products for Work of this Section by manufacturer with minimum 10 years' experience in the manufacture of such materials.

.2 Installers: Provide work of this Section executed by competent installers with minimum 5 years' experience in the application of Products, systems and assemblies specified and with approval and training of the Product manufacturers.

.2 Licensed Professionals: Employ a professional structural engineer registered in the province of Ontario, carrying minimum of $2,000,000.00 professional liability insurance to:

.1 design the components of the work of this Section requiring structural performance and their attachments to building's structure,

.2 be responsible for full assemblies and connections,

.3 be responsible for determining sizes, yield strengths, gauge thicknesses and joint spacing to allow thermal movement and loading of components in accordance with applicable codes and regulations,

.4 be responsible for production and review of Shop Drawings,

.5 inspect the work of this Section during fabrication and erection,

.6 stamp and sign each shop drawing,

.7 Provide site administration and inspection of this part of the Work.

.8 Submit certificate validating seismic assessment and field review of this part of the Work.

.3 Mock-ups:

.1 Provide Mock-ups in locations designated by Consultant and as required to demonstrate quality of workmanship.

.2 Maintain Mock-ups during construction in an undisturbed condition as a standard for judging completed work.

.4 Single Source Responsibility: Ensure primary materials provided in this Section are obtained from 1 source by a single manufacturer and secondary materials are obtained from sources recommended by primary materials manufacturers.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

.2 Sequence deliveries to avoid delays and minimize on site storage.

.3 Store materials protected from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.

.4 Wrap protective heavy paper or apply strippable sprayed plastic to prevent any marring, scratching or damage to plastic and metal during handling and after installation.

1.9 WARRANTY

.1 Warrant work of this Section for period of 5 years from Substantial Performance of the Work against defects and/or deficiencies in accordance with General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of Consultant and at no expense to Owner. Defects include but are not limited to; buckling, opening of seams, bond failure and extensive colour fading.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Products of following manufacturers may be acceptable subject to conformance to requirements of Drawings, Schedules and Specifications:

.1 A. I. A. Industries, Inc.

.2 Arc-O-Lite Skylights;

.3 Artistic Skylights;

.4 Kingspan / CPI International;

.5 Velux International

.2 Comparable Products from manufacturers listed herein offering functionally and aesthetically equivalent products in Consultant's opinion, and subject to Consultant's review, will be considered provided they meet the requirements of this Specification.

2.2 REGULATORY REQUIREMENTS

.1 Conform to OBC requirements to support snow load and wind load for location of project as minimum comply with loads specified herein.

2.3 PERFORMANCE / DESIGN CRITERIA

.1 Comply with AAMA/WDMA/CSA101/I.S.2/A440 (NAFS) or NFRC 400.

.2 Provision For Thermal Movement:

.1 Unit skylights must be designed to accommodate expansion and contraction of component materials caused by exterior metal surface temperatures ranging from 35 deg C (-31 deg F) to 85 deg C (185 deg F) without buckling, excessive stress on glass, joint seal failure, excessive stress on structural elements, damaging loads on fasteners, performance reduction, or other detrimental effects.

.3 Structural Design:

.1 Wind Loads: Design unit skylights to withstand wind loads based on Limit States Design and 1 in 50-year return period in accordance with requirements of the Applicable Building Code for geographical location of the Project.

.2 Snow Loads: Design unit skylights to withstand snow loads based on Limit States Design and in accordance with requirements of the Applicable Building Code for geographical location of the Project, but not less than 2.4 kPA (50 psf).

.3 Deflection: Limit deflection to L/180 or 25 mm (1 inch), whichever is less.

.4 Air infiltration through skylight: must not exceed ~~0.3~~ 0.5 L/s-m2 (~~0.06~~0.1 cfm/ft2) of fixed wall area plus permissible allowance specified for operable windows and doors within test area when tested in accordance with ASTM E283 at static air pressure difference of 300 Pa (~6.26 psf)

.5 Water Penetration: There must be no uncontrolled water penetration when skylight system is tested per ASTM E331at 20% of maximum inward and outward acting design wind pressure, but not less than 300 Pa (6.26 psf) or greater than 720 Pa (15.03 psf) or equivalent to ASTM E547.

.6 Provisions must be made for water entering system from the exterior to be drained back to exterior.

.7 Maximum Water penetration: No uncontrolled water penetrating assemblies or water appearing on assemblies' normally exposed interior surfaces from sources other than condensation. Water leakage does not include water controlled by flashing and gutters or water that is drained to exterior.

.8 Solar Heat Gain Coefficient (SHG): Not more than 0.5

.9 VLT: 48%

.10 U-Value (imperial): Not more than 0.7

2.4 PYRAMIDAL RECTANGULAR CURB MOUNT SKYLIGHTS

.1 Frame Composition: Corrosion-resistant extruded aluminum base frame, 6063-T5 alloy, with 76 mm (3 inches) aluminum mounting flange, heliarc welded corners, and 51 mm (2 inches) thermal insulation with rigid vinyl thermal break. Provide 8-degree sloped condensation gutter and co-extruded rubber draft seal.

.2 Material: 6063-T5 aluminum alloy, heliarc welded corners.

.3 Glazing: Sealed double acrylic ~~dome~~pyramids.

.4 Curb: Minimum ~~100 mm (4 inch) high, mill finish aluminum, two-piece construction;~~ 38 mm (1-1/2 in) as indicated on Drawings.

.5 Outer and inner wall: 1.27 mm (0.050 in).

.6 Insulation: 50 mm (2 in) thick fiberglass

.7 Mounting Flange: 75 mm (3 in) aluminum mounting flange.

.8 Size: Refer to Drawings.

.9 Basis-of-Design: "Model P-PVCCM ~~Aluminum Base Frame - Model FF~~" by Artistic Skylight Domes.

2.5 MATERIALS

.1 Aluminum: Aluminum Sections: ASTM B209M, size accurately formed as shown on Drawings, extruded aluminum alloy AA-6063-T5 for all aluminum except surfaces receiving anodizing which shall be AA-6061-T6. Surfaces shall be free from defects impairing appearance, strength and durability.

.2 Frame: Extruded aluminum, perimeter curb frame with thermal break, continuous extruded aluminum intermediate support frame with integral sloped condensation gutter, extruded aluminum retainer straps, extruded aluminum ~~dome~~pyramid retaining frame screw attached to curb frame and integrally fitted with ~~dome~~pyramid compression gasket. Provide holes for positive non-plugging drainage of condensation gutter. Include curb frame splice and expansion joint cover.

.3 Gaskets: extruded resilient vinyl or neoprene.

.4 Integral Glazing Gaskets: Continuous EPDM, Santoprene silicone, butyl rubber or neoprene designed specifically for use in aluminum frame section and held under constant pressure. Seal end-to-end joints by fusion.

.5 Seals: closed cell neoprene sponge, compressible, with full recovery after 50% compression.

.6 Screws: Stainless Steel.

.7 Isolation coating: Alkali resistant bituminous paint or epoxy coating.

2.6 AUXILIARY MATERIALS

.1 Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic, nominally free of sulfur and containing no asbestos fibers, formulated for 15-mil dry film thickness per coating.

.2 Elastomeric Sealant: ASTM C 920; Type S; Grade NS; Class 25; and Uses NT, G, A, and (as applicable to joint substrates indicated) O; recommended by unit skylight manufacturer and compatible with joint surfaces.

.3 Elastomeric Sealant: ASTM C920; Type S; Grade NS; Class 25; and Uses NT, G, A, and (as applicable to joint substrates indicated) O; recommended by unit skylight manufacturer and compatible with joint surfaces.

.4 Fasteners: stainless steel or cadmium-plated steel. Ensure exposed fasteners match the adjacent aluminum colour.

.5 Gaskets: Continuous co-extruded vinyl, neoprene, EPDM, or Santoprene rubber under constant pressure.

.6 Weep Holes: Provide condensation management system with weep holes to ensure proper drainage.

2.7 FABRICATION

.1 Fit and assemble Work in shop. Execute Work in accordance with details and reviewed Shop Drawings.

.2 Fabricate extruded aluminum square frame from alloy AA-6063-T5 free from defects impairing appearance, strength.

.3 Fabricate Work square, true, straight, plumb and level, accurately to size detailed and free from distortion, waves, twists, buckles or other defects detrimental to appearance or performance.

.4 Provide method of securing edge of flexible flaps for air seal continuity to building air/vapour barrier.

.5 Equip curb with an integral metal cap flashing of same thickness and material as curb, fully welded at corners for absolute weather tightness. Ensure insulation on exterior of curb is rigid polyurethane or glass fibre board minimum 50 mm (2") in thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Site Verification of Conditions: Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation. Commencement of work implies acceptance of previously completed work.

3.2 INSTALLATION

.1 Installation, generally: Install work of this Section in strict accordance with manufacturer's written installation instructions and reviewed Shop Drawings. Supplement manufacturer's installation instructions with additional installation requirements specified in this Section to produce specified work results.

.2 Install unit skylights in accordance with the construction details provided in the CRCA's "Canadian Roofing Reference Manual", CSA A440 and AAMA 1607.

.3 Where metal surfaces of units will contact incompatible metal or corrosive substrates, including wood, apply bituminous coating on concealed metal surfaces, or provide other permanent separation recommended in writing by unit skylight manufacturer.

.4 Anchor unit skylights securely to supporting substrates.

.5 Set unit skylight flanges in thick bed of roofing cement to form a seal, unless otherwise indicated.

.6 Where cap flashing is indicated, install to produce waterproof overlap with roofing or roof flashing. Seal with thick bead of mastic sealant except where overlap is indicated to be left open for ventilation.

3.3 FIELD QUALITY CONTROL

.1 Water Leakage Testing: After installation is complete and sealants and glazing compounds have cured nominally, but before interior finishes are installed, test each skylight unit for water leaks in accordance with AAMA 501.2.

.2 Work will be considered defective if it does not pass tests and inspections.

.3 Additional testing and inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

.4 Prepare test and inspection reports.

3.4 CLEANING

.1 Remove protective materials from ~~dome~~pyramid. Wash with mild soap and water solution. Rinse clean.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Work Included: Supply finish hardware including but not limited to the following:

.1 It is intended that the following list of hardware will cover finish hardware to complete the Project. Bring to the Consultants attention any omissions or discrepancies that will affect work in this section during the bidding period.

.2 Related Requirements:

.1 Division 01 – General Requirements

.2 Section 06 10 00 Finish Carpentry

.3 Section 06 40 00 Architectural Woodwork

.4 Division 08 Doors and Frames

.5 Section 08 12 16

.6 Division 26 Electrical

.7 Division 28 Electronic Safety and Security

1.2 GENERAL INSTRUCTIONS

.1 Read and conform to:

.1 the General Conditions and the Supplementary Conditions of the Contract;

.2 Division 1 requirements and documents referred to therein.

1.3 PRICE AND PAYMENT PROCEDURES

.1 Measurement and Payment: Measurement for progress payments for work of this Section shall be made in accordance with the requirements of Section 01 45 16.

1.4 PRODUCTS SUPPLIED BUT NOT INSTALLED IN THIS SECTION

.1 Power supplies, compressor/control boxes, junction boxes installed by Division 26

1.5 ALLOWANCE

.1 Allow for cash amount specified in Section 01 21 00 – Allowances, for supply and installation of permanent core cylinders.

1.6 REFERENCES

.1 Reference Standards: Latest published editions of reference standards listed in this Section in effect as of the Bid closing date and time for the Contract, including any amendments adopted, are applicable unless otherwise indicated.

.1 Door and Hardware Institute - Recommended locations for Architectural Hardware for Standard Steel Doors and Frames

.2 Door and Hardware Institute - Recommended locations for Architectural Hardware for Flush Wood Doors

.3 NFPA 80-Standard for Fire Doors and Windows, 1999 Edition

.4 Door and Hardware Institute - Sequence Format for Hardware Schedule

.5 Door and Hardware Institute - Key Systems and Nomenclature

.6 Door and Hardware Institute - Abbreviations and Symbols used in Architectural Door and Hardware Schedules and Specifications

.7 Door and Hardware Institute – Installation Guide for Doors and Hardware

.8 OBC

1.7 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meetings:

.1 Prior to starting the work of this Section, convene a pre-installation meeting at Project site to review Project requirements and site conditions with pertinent parties. Conform to the requirements of Section 01 33 00.

1.8 SUBMITTALS

.1 Product Data: Submit manufacturer's literature and data sheets for each type of material provided under this Section for the Project in accordance with requirements of Section 01 33 00. Ensure data sheets Provide required information including detailed instructions for installing as well as maintaining, preserving and keeping materials in clean and safe conditions. Provide adequate warning of maintenance practices or cleaning agents detrimental to specified materials.

.2 Material Safety Data Sheets: Submit MSDS for inclusion in operation and maintenance manual without limitations for adhesives, sealants and any other material later designated by the Consultant.

.3 Shop Drawings:

.1 Submit Shop Drawings for hardware installation in accordance with Section 01 33 00.

.2 Submit Shop Drawings in schedule form, prepared by an architectural hardware consultant (AHC), indicating the manufacturers' names, Product descriptions, makes, models, materials, finishes, functions, location of each item, template, complete keying schedule and other pertinent information. Repeat hardware item numbers used in Finish Hardware Schedule located at paragraph 3.6 of this Section. Include list of abbreviations and finish symbols and their meaning. Include manufacturer's cut sheets for each hardware item.

.4 Samples:

.1 Submit samples in accordance with Section 01 33 00.

.2 Do not order hardware from manufacturer until samples have been approved by the Consultant. Hardware and finishes supplied shall be identical to approved samples.

.3 Supply 1 of each item of hardware with specified finishes to Consultant. Label each sample as to manufacturer, type, finishes, size and location for use proposed. Approved samples will be retained for comparison and returned upon completion of the Work.

.4 Do not submit substitutions to accepted alternates.

.5 Updated Finish Hardware Schedule:

.1 Submit submittals in accordance with Section 01 33 00 Submittal Procedures. Prepare detailed hardware schedules in Door and Hardware (DHI) vertical format as detailed in Reference 1.5.4 listed above.

.6 Sustainable Design Submittals: Conform to requirements in Sections section 01 35 18, section 01 35 22, section 01 35 46, and section 01 74 20.

.7 Keying Schedule:

.1 After a keying meeting between representatives of the Owner, Consultant and hardware supplier furnish a keying schedule listing the levels of keying as well as an explanation of the key system's function, the key symbols used and the door numbers controlled. Utilize "Door and Hardware Institute - Key Systems and Nomenclature" as a guideline for nomenclature, definitions, and approach for selecting the optimal keying system. Provide 3 copies of the keying schedule for review prepared and detailed in accordance with the DHI publication referenced herein. Include schematic keying diagram and index each key to unique door designations. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion. Forward bitting list, key cuts and key system schematic directly to the Owner, by means as directed by Owner.

.8 Wiring Diagrams:

.1 Coordinate with related trades, meet with the Owner and the building's security provider and submit a written description of the functional use (mode of operation) of electrical hardware products specified herein. Include operation for ingress, egress, fire alarm, and after hours use where applicable. Include door and frame elevations showing the location of each item of electrical hardware to be installed, mode of operation including a diagram showing number and size of conductors. Indicate on the elevation Drawings items provided by trades performing work related to this Section, include for back boxes, and 120V power sources. Provide point to point drawings showing terminal connections necessary for a complete installation.

.9 Operations and Maintenance Data:

.1 Prior to Substantial Performance of the Work, furnish to the Owner, two (2) copies of an Owner's operation and maintenance manual in a three-ring binder with the following information:

.1 Name of hardware distributor, address and contact name

.2 Copy of final "as-built" finish hardware schedule

.3 As installed "wiring diagrams, elevations, risers, point to point"

.4 Copy of final keying schedule

.5 Copy of floor plans with keying nomenclature assigned to door numbers as per the approved keying schedule

.6 Catalogue cut sheets and product specifications for each product

.7 Parts list for each product

.8 Installation instructions and templates for each product

1.9 QUALITY ASSURANCE

.1 Review installation procedures with the Contractor's designated installers. Hold instruction meetings with the installers prior to installation and subsequent review meetings during the installation period. Submit minutes of meetings to the Consultant.

.2 Substitutions: Only approved Products specified are accepted. Make substitution requests in accordance with Division 01. Include product data and indicate the benefit to the Project

.3 Supplier Qualifications: Successful hardware distributor to have a minimum of five (5) years' experience in the door and hardware industry. Distributor to have on staff an architectural

hardware consultant (A.H.C.) whose name will be listed on the hardware schedule title page submittal and will be responsible for scheduling, detailing, (see Reference 1.5. ordering and co-ordination of the finishing hardware for this Project. If so requested by the Consultant and or the installer, this individual will be required to visit the Site for any installation problems that may occur.

.4 Designated Installers: Hardware installers must have a minimum of five (5) years' experience in the installation of hardware. Provide verification of the installer's qualification to the Consultant for approval. Installers to attend review meetings with the hardware distributor.

1.10 DELIVERY, STORAGE AND HANDLING

.1 Marking and Packaging: Mark cartons with heading number, door number, and key-set symbol where applicable in original packaging provided by the manufacturer. Pack packaged hardware in suitable wrappings and containers to protect it from damage during shipping and storage. Enclose accessories, fastening devices and other loose items with each applicable item of hardware.

.2 Delivery: Deliver hardware to trades perform work related to the work of this Section.

.3 Storage: Store in a clean, dry room with lockable man door and adequate shelving to permit organization so item numbers are readily visible:

1.11 WARRANTY

.1 Furnish warranties by the following accepted manufacturers (with warranty period lengths as described below):

Hardware Item	Length of Warranty
Continuous Hinges	Lifetime
Locks (Mortise)	3 years
Locks (Cylindrical)	3 years
Exit Devices	3 years
Door Operators	2 years
Door Closers	30 years
Electric hold open	2 years
Overhead stops/holder	1 year
Floor/Wall stops	1 year
Electric Strikes	5 years
Key Switches/ Power Supplies	1 year

1.12 MAINTENANCE

.1 Maintenance Instructions:

.1 After the building is occupied arrange an appointment with the maintenance staff from the Owner for instruction on proper use, servicing, adjusting and lubrication of hardware furnished. Submit to the Consultant a list of attendees and meeting date.

.2 Extra Materials: Furnish the following items in proper manufacturer's cartons once the job has been completed:

.1 5 of each installation tool used for locks/passage/privacy, type of door closers, and exit devices.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Products listed in the hardware are from the manufacturers listed below:

ITEM	MANUFACTURER NAME
Full Mortise Hinges	Ives
Continuous Hinges	Ives
Locksets, Latchsets/Deadbolts	Sargent
Cylinders	Sargent
Exit Devices	Von Duprin
Surface/Flush Bolts	Ives
Door Closers	LCN
Overhead Door Holders/Stops	Glynn Johnson
Door Pulls/Flatware	Ives
Wall/Floor Stops	Ives
Weather/Smoke/Sound Seals	Zero
Door Sweeps/Thresholds	Zero
Automatic Door Operators/Actuators	LCN
Keyswitch/Magnetic Locks	Schlage Electronics
Electric Strikes	Von Duprin
Power Supplies	Schlage Electronics

2.2 MATERIAL

.1 Screws and Fasteners: Screws and fasteners to be matching finish to their product and to be manufacturer's standard. Door closers, door holders and exit devices installed on fire rated wood doors and hollow metal doors to be attached with fasteners to meet NFPA 80 requirements.

.2 Materials-Acceptable Manufacturers (Note: Supply Products in a given category from the same manufacturer):

.1 Mortise Hinges

.1 Provide five knuckle bearing hinges with Non- Removable Pins (NRP) option on reverse bevel doors with locking hardware. Hinge width to accommodate door closer projection, door trim and allow for 180-degree swing. Doors up to 2286mm in height, supply 3 hinges, doors greater than 2286mm in height add one hinge for every additional 760mm of door height. Doors 915mm wide and less furnish 114 mm high hinges, doors greater than 915mm wide furnish 127mm high hinges, heavy weight

or standard weight as specified. Provide electrified hinges with quick connect “CON” as listed in the hardware groups:

.2 As Specified: Ives Hinges, 5BB1, 5BB1HW

.3 Approved Alternates: McKinney TA714, TA786, Hager AB800, AB850

.2 Continuous Hinges:

.1 Provide Ives heavy duty edge mount continuous gear type aluminum hinges. Ives aluminum hinges tested and approved to UL 10C (90 minutes). Material 6063-T6 aluminum, clear satin finish (628). Aluminum geared hinges certified to ANSI 156.26 Grade 1. Hinge length to suit door height. Hinge length 25mm (1 inch) less door height.

.1 Supply as Specified: Ives 112XY, 112XY EPT

.2 Approved Alternates: McKinney MCK-12HD, Select Hinge SLHD

.3 Flush Bolts/Co-Ordinators:

.1 Manual Flush Bolts-Metal Doors: Manual flush bolt for metal doors to be cUL listed for 3-hour fire doors with ½ inch diameter bolt tip with ¾ inch throw. Standard rod length to be 12 inches, supply longer length rods to suit higher door heights. Provide dustproof strikes with flush bolts that incorporate a bottom bolt:

.1 Supply as Specified: Ives FB458 series

.2 Approved Alternates: Hager 282D, Thomas Door Security UL-MFB-M

.2 Co-ordinators and Filler Bars: cUL listed for installation on labeled frames. COR series co-ordinator channels and fillers made of aluminum, furnished in 628 finish. Provide coordinators of correct size for use on pairs of doors when one door is required to close before the other. Provide filler bar to suit opening width to maintain architecturally clean lines. Provide mounting brackets for other soffit applied hardware. Co-ordinator units to be equipped with an override feature which allows the active door to close under extreme pressure

.1 Supply as Specified: Ives COR Series Bar Co-ordinators

.2 Approved Alternates: Rockwood 2672, ABH Manufacturing 3700 Series

.4 Locksets/Deadlocks/Privacy Sets:

.1 Mortise: Grade 1 Operational, Grade 1 Security, mortise lock for commercial and institutional buildings. Manufacture lock cases from fully wrapped, heavy 12 gage steel with a protected leading edge and screw configuration that limits access to operating parts. Lock components to be manufactured of zinc dichromate plated steel. Latch bolts to have a standard 2 ¾ inch backset with a full ¾ inch throw. Latchbolts to be non-handed, field reversible without opening the lock case. Latchbolts to be 2 piece anti-friction, manufactured from stainless steel. Solid latchbolts and/or plastic anti-friction devices are not acceptable. Deadbolts to be 1 ¾ inch total length have standard 1 inch throw with a minimum ¾ inch internal engagement when fully retracted. Deadbolts to be constructed of stainless steel, incorporating a security roller pin with a minimum Rc60 rating for surface hardness. Lever assembly (external) to be one piece design attached by threaded bushing. Lever assembly (internal) to be attached by screw less shank. Lever attachments by common tools (allen nuts and/or set screws) are not acceptable. Thru bolt lever assemblies through the door for positive interlock. Levers to have independent rotation in both directions. Lever operation to be freewheeling (clutch) when in the locked mode. Spring cages are to be incorporated into the lever assemblies. Hub

blocking plate to be solid, cast stainless steel. Manufacturers utilizing open hub designs are not acceptable. Spindles to be independent, designed to “break away” at a maximum of 75psi torque. Mounting tabs are to be automatic self-adjusting, vertically and horizontally for door bevel and strike alignment. Cylinders to be secured by a cast stainless steel, dual retainer. Manufacturers utilizing screws and/or stamped retainers are not acceptable.

.1 Supply as Specified: Schlage “L” series

.2 Approved Alternates: Sargent 8200 series, Hager 3800 Series

.2 Strike Plates: Provide lockset and latchset strike plates with lip centre dimensions sized to minimally clear trim. Where strike lip extends beyond the projection of the casing or other trim, provide curved lip strikes. Strike plates applied to inactive leaf of paired openings to have flat lip sized to fit flush with the face of the door skin

.5 Exit Devices/Device Trims/Mullions:

.1 Narrow Style: Exit device to be cUL listed for panic hardware and fire exit hardware. Supply exit devices and fire exit devices featuring coil compression springs on device mechanism subassemblies and dead latching mechanisms for active latch bolts. Supply exit devices with smooth mechanism case and “the quiet one” fluid dampener to eliminate noise associated with exit device operations. Non-handed device with touchpad assemblies with no exposed fasteners and cast end caps, reinforced aluminum with stainless steel touchpad and raised edge to minimize pinching. Doors greater than 950mm wide supply long bar exit devices, doors greater than 2134mm high supply extension rods were required. Fits door stiles as narrow as 1 ¾ inch.

.1 Supply as Specified: Von Duprin 35A series

.2 Approved Alternates: Falcon 24 Series, Corbin Russwin ED400

.2 Heavy Duty: Exit device to be cUL listed for panic hardware and fire exit hardware. Supply panic hardware and fire exit devices featuring coil compression springs on device mechanism subassemblies and dead latching mechanisms for active latch bolts. Supply exit devices with smooth mechanism case and “the quiet one” fluid dampener to eliminate noise associated with exit device operations. Non-handed device with touchpad assemblies with no exposed fasteners and cast end caps, reinforced aluminum with stainless steel touchpad and raised edge to minimize pinching. Roller strikes to be standard on rim and surface vertical rod devices, mortise exit devices (626) complete with strikes that match the same finish as the device. Doors greater than 950mm wide supply long bar exit devices, doors greater than 2134mm high supply extension rods for surface vertical rod series. 1,000,000cycle testing independently certified by ETL.

.1 Supply as Specified: Von Duprin 98 series.

.2 Approved Alternates: Falcon 25 Series, Corbin Russwin ED5000

.6 Door Closers: Door closers to have the following features:

.1 Fully hydraulic, rack and pinion action with high strength cast iron cylinders and one-piece forged steel pistons.

.2 Include high efficiency, low friction pinion bearings.

.3 Hydraulic fluid of a type requires no seasonal adjustments, ULTRA X TM fluid has constant temperature control from -35 degrees Celsius to +49 degrees Celsius.

.4 Hydraulic regulation controlled by tamper-proof, non-critical screw valves, adjustable with a hex wrench.

.5 Separate adjustments for backcheck, general speed and latch speed.

.6 Door closers with special template (ST-) numbers include required associated product, information sheets and instructions

.7 Size 1 manual door closers to provide less than 5 pounds opening force on a 900mm door leaf.

.8 Door closer with Pressure Relief Valves are not accepted.

.9 Door closer bodies, arms, covers to be powder coated

.10 Closers with powder coat finishes to exceed a minimum 100-hour salt spray test, as described in ANSI A156.18 and ASTM B117.

.11 Closers detailed with plated finishes to include plated covers (or finish plates), arms and visible fasteners.

.7 Medium Duty Mechanical (Interior/Exterior): Non-sized (1-6) and non-handed cylinder body to have 1 ¼ inch (32mm) piston diameter with 5/8 inch (16mm) single heat-treated shaft. Track closer cylinder body non-sized (2-4) or (1-2). Closers to have forged main arm and forearm (forged steel main arm and forearm EDA and CUSH type arms). Optional arms to be interchangeable within the series of closers, except track arm type closers. Track arm type closers to have single lever arm with low friction track and roller assembly and provisions for an optional bumper to assist backcheck.

.1 Supply as Specified: LCN1460 HD Full Cover series

.2 Approved Alternates: Yale 3500 Series, Norton 7700 Series

.8 Heavy Duty Mechanical (Multiple Applications): Non-sized (1-6) and non-handed cast iron cylinder body to have 1 1/2 inch piston diameter with 3/4 inch journal double heat-treated pinion shaft with 5/8 inch full complement bearings. XP closer hydraulic regulation controlled by tamper-proof, non- critical screw valves, abrasion resistant Vitron “O” ring, adjustable with a hex wrench. Closer to have “FAST” Power Adjust speed dial to show spring size power. Track closers non-sized 1-4. Closers to have forged steel main arm and forearm (forged steel main arm and forearm EDA and CUSH type arms). Optional arms to be interchangeable within the series of closers, except track arm type closers. Track arm type closers to have single lever forged arm with low friction track and roller assembly and provisions for an optional bumper to assist backcheck.

.1 Supply as Specified: LCN 4040XP series

.2 Approved Alternates: Yale 5800, Norton 8500 Series

.9 Heavy Duty Electric Operator: Provide low energy automatic operator units that are electro-mechanical design. Powered by DC motor working through reduction gears. Spring force closing. Motor is off when door is in closing mode. Door can be manually operated with power on or off without damage to operator. Provide variable adjustments, including opening and closing speed adjustment. Provide units with manual off/auto/hold-open switch, push and go function to activate power operator, vestibule interface delay, electric lock delay, hold-open delay adjustable from 2 to 30 seconds, and logic terminal to interface with accessories, mats, and sensors. Provide full length aluminum header, drop plates, angle brackets, or adapters for arms to suit details. Sequence operation of exterior and vestibule doors with automatic operators to allow ingress or egress through both sets of openings, consult with owner. Provide Rocker Switch 8310-806R where specified in hardware groups.

.1 Supply as Specified: LCN 9531, 9542, 9553 series

.2 Approved Alternates: Horton 7100, Besam SW200i

.10 Overhead Door Stops/Holders:

.1 Heavy Duty Surface Mounted: Surface overhead stops/holders to be stainless steel base, non-handed for single-acting doors with a heavy-duty channel/slide-arm design and offset jamb bracket to allow for simple field modifications of functions. Channel to be surface mounted to the door with thru bolts and the jamb bracket is surface mounted to the frame soffit

.1 Supply as Specified: Glynn-Johnson 90 series

.2 Approved Alternate: ABH Manufacturing 9000 Series, Dorma 900s

.2 Heavy Duty Concealed Mounting: Concealed overhead stops/holders to be stainless steel base, non-handed for single or double-acting doors with a low-profile channel, mortised in the door and jamb bracket is mortised in the doorframe. Unit to be fully concealed when door is in the closed position. Units to be field adjustable for function changes if required

.1 Supply as Specified: Glynn-Johnson 100 series

.2 Approved Alternate: ABH Manufacturing 1000 Series, Sargent 1760 Series

.11 Door Pulls/Flatware: Door Pulls are to be 19mm, 25.4 mm diameter. Flatware to be of stainless steel material, .050 gauge.

.1 Supply as Specified: Ives

.2 Approved Alternate: Canadian Builders Hardware Gallery

.12 Floor/Wall Stops:

.1 Floor Stops: Floor stops to be heavy-duty cast dome stop constructed of brass/bronze with grey, non-marring rubber bumper.

.1 Supply as Specified: Ives FS439

.2 Approved Alternate:Canadian Builders Hardware Gallery

.2 Wall Stops (No Button on Locking Hardware): Wall stops to be constructed of stainless-steel base with special retainer cup that makes the rubber stop tamper resistant. Convex design of rubber bumper.

.1 Supply as Specified: Ives WS406/4077CVX

.2 Approved Alternate:Canadian Builders Hardware Gallery

.13 Weather Seals/Meeting Stile Gasketing/Thresholds/Weatherstrip/Door Sweeps:

.1 Supply as Specified: IVES

.2 Approved Alternates: KN Crowder Unique Architectural

.14 Keyswitch/Electric Strikes/Magnetic Locks/Power Supplies, Power Transfers, Mortar Guards:

.1 Power Supplies: Power supplies to be tested and certified to meet UL294. Universal 120-240 VAC input, low voltage DC output, regulated and filtered. Power supplies to have 2A, 4A, 6A output,12/24VDC field selectable with jumper. Provide emergency release terminals, where required, that allow the release of devices upon activation of the fire alarm system complete with fire alarm input for initiating “no delay” exiting mode. Power supply to be flat mounting design and polarized locking connections for additional option boards specified.

.1 Supply as Specified: Schlage Electronics PS-902, PS-904, PS-906

.2 Approved Alternate Thomas Access Control Hager

.2 Power Transfer: Provide a means to transfer power from frame to door stile. Devices shall be reversible and allow a full 180° door swing with 4 1/2 inch x 4 1/2 inch butt hinges or 3/4 inch offset pivots. When door is in closed position, transfer unit shall be concealed. Transfer units shall contain ten 24 awg UL approved conductors. Rating: 10 Amps at 24 VDC (Class 1 low voltage)

.1 Supply as Specified: Von Duprin EPT

.3 Electric Strikes: Grade 1, electric strike to be cUL listed burglary-resistant and electric strike for fire doors and frames. A label for single doors and B label for double doors. Electric strike to be stainless steel construction, non handed available in 12 V or 24V AC or DC with continuous duty solenoid and accept ¾" throw latchbolts. Stirke box to be adjustable to compensate for any misalignment of the door or frame with two piece plug connector for ease of installation.

.1 Supply as specified: Von Duprin 6000 Series

.2 Approved Alternate Rutherford control RCI F2164 HES 9600

.4 Mortar Guards: Provide and supply to hollow metal supplier to weld in place TA 6400 series by Thomas Access Control at frame locations where electrified hardware components are to be mounted. Provide handing of mortar guard boxes to the hollow metal frame Supplier. The hollow metal frame Supplier is responsible for ensuring the proper location of required mortar boxes.

.5 Molex Connectors: Where scheduled in the hardware sets, provide each item of electrified hardware and wire harnesses with sufficient number and wire gauge with standardized Molex plug connectors to accommodate electric function of specified hardware. Provide Molex connectors that plug directly into connectors from harnesses, electric locking and power transfer devices. Provide through-door wire harness for each electrified locking device installed in a door and wire harness for each electrified hinge, electrified continuous hinge, electrified pivot, and electric power transfer for connection to power supplies.

.6 Junction Box: Provide high quality NEMA 1, junction box to provide convenient installation for electrified hardware. Units are surface mounted 254mm high, 254mm wide, 152mm deep and includes hinged door with twist turn lock, 20 position terminal strip to accept 24 to 12 gauge wire.

.1 Supply as Specified: Von Duprin JB7

.7 Electric Washroom Accessories: Provide electric washroom relay to compete the installation of automatic door operators for universal and barrier free washroom requirements. See Division 28 for other components.

.1 Supply as Specified: Camden – Advanced Logic Relay CX-33

2.3 FINISHES

.1 Unless otherwise specified in paragraph 3.6 of this Section, finishes to be brushed chrome (BHMA 626/652). Finishes are specified as follows:

ITEM	BHMA#	DESCRIPTION	BASE MATERIAL
Hinges	630	satin stainless steel	stainless steel
Hinges	652	satin chrome plated	steel

Continuous Hinges	689	anodized aluminum	aluminum
Lock Trim	626	satin chrome plated	brass/bronze
Exit Devices	626	satin chrome plated	brass/bronze
Door Closer	689	powder coat aluminum	steel
Door Pulls	630	satin stainless steel	stainless steel
Protective Plate	630	satin stainless steel	stainless steel
Doorstops/Holders			
Overhead	630	satin stainless steel	stainless steel
Wall/Floor	630	satin stainless steel	Stainless steel
Thresholds	628	anodized aluminum	aluminum
Weatherstrip	628	anodized aluminum	aluminum
Miscellaneous			
Key Switches	630	satin stainless steel	stainless steel

2.4 CYLINDERS, KEYING SYSTEMS AND KEY CONTROL

.1 Final keying under allowance by owner.

.2 Keying requirements to be confirmed by the Owner.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Ensure that doors and frames are prepared and reinforced to receive finish hardware prior to installation.

.2 Ensure that door frames and finished floor are plumb and level to permit proper engagement and operation of hardware.

.3 Verify power is run to door opening requiring electrified hardware.

.4 Submit in writing a list of deficiencies determined as part of the inspection required in paragraphs 3.1.1 and 3.1.2 above to supervising consultant prior to installation of finished hardware. Correct door frame installation before proceeding with finish hardware installation.

3.2 INSTALLATION

.1 Hardware installers must have a minimum of five (5) years' experience in installation of hardware. Provide verification of installer's qualification to the Consultant for approval. Installers to attend review meetings conducted by the hardware distributor.

.2 Install hardware at mounting heights as specified in the manufacturer's templates or specific references in approved hardware schedule or approved elevation Drawings.

.3 Where mounting height is not otherwise specified in the Drawings, install hardware at mounting heights as indicated in paragraphs 1.5.1 and 1.5.2 in this Section.

.4 Install hardware using only the manufacturer supplied and approved fasteners in strict adherence with the manufacturer's published installation instructions.

.5 Ensure locksets / latchsets / deadlocks are of the correct hand before installation to ensure that the cylinder is in the correct position. Handing is part of the installation procedure.

.6 Ensure that exit devices are of the correct hand and adjust device cam/drive screw for proper outside trim function prior to installation. Handing is part of the installation procedure.

.7 Follow manufactures installation instructions. Adjustment of door closers is inclusive of spring power, closing speed, latching speed and back-check, valve screws to achieve backcheck at the time of installation.

.8 Adjust delayed action door closers to forty (40) second delay for barrier free accessibility and movement of materials. Time period to be approved by the Owner.

.9 Install head seal weatherstrip prior to installation of soffit mounted hardware. Trim, cut and notch thresholds and saddles neatly to minimally fit the profile of the door frame. Install thresholds and saddles in a bed of caulking completely sealing the underside from water and air penetration.

.10 Counter sink through bolt of door pull under push plate during installation.

.11 Install blocking material in cavities of metal and wood stud walls and partitions. Located concave and convex type door bumpers at the appropriate height to properly contact protruding door trim.

.12 Outlet back boxes, provisions for power, conduit complete with pull strings for security systems power and control boxes for integrating of security system with fire alarm system and coordination of complete system to be furnished under Division 26 – Electrical.

.13 The authorized system integrator shall be responsible for mounting card readers, controllers, master controllers, input panels and interface with Electrical Access Control (EAC) hardware and power supplies. They are also responsible for low voltage wiring, wire terminations, final hookup, testing, system setup, warranty and owner turnover with training

3.3 FIELD QUALITY CONTROL

.1 Verify each door leaf opens closes and latches. Inspect fire rated openings to ensure they are installed in compliance with NFPA 80 requirements. Test access control system and electrified hardware devices for proper operation with owner to sign off on verification of operation. Verify electric door release hardware operates to close the door upon activation of the fire alarm system.

.2 Perform bi-monthly on-site inspections during hardware installation and provide inspection reports listing progress of work, unacceptable work and corrective measures. Repair or replace as directed by the Consultant.

.3 Before completion of the work but after the hardware has been installed, submit a certificate to the Consultant stating that final inspection has been made and that hardware has been checked for installation and operation.

3.4 ADJUSTING AND CLEANING

.1 Check and make final adjustments to each operating item of hardware on each door to ensure proper operation and function.

.2 Adjust doors with self-closing devices or automatic closing devices for operation after the HVAC system is balanced and adjusted. Adjust spring power of non sized door closers to close and latch the door.

.3 Hardware to be left clean and free of disfigurements.

.4 Instruct owner personnel in the operation, adjustment and maintenance of hardware.

.5 Check locked doors against approved keying schedule.

3.5 PROTECTION

.1 Protect hardware from damage during construction. Wrap locks, panic hardware, and fire exit hardware, door pull trim with kraft paper or plastic bubble materials to protect finish from damage until date of substantial completion. Remove and reinstall or where necessary, use temporary hardware to maintain finish in new condition and maintain manufacturer's warranty.

3.6 HARDWARE GROUPS

END OF SECTION

Updated through ADD#10

PART 1 - GENERAL

SEE ADD#12 Q#338

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL INSTRUCTIONS

.1 Read and conform to:

.1 the General Conditions and the Supplementary Conditions of the Contract;

.2 Division 1 requirements and documents referred to therein.

1.3 SUMMARY

.1 Work Included:

.1 Provide glass and glazing for applications including, but not limited to the following:

.1 glazing for architectural woodwork.
.2 glazing for hollow metal doors.
.3 glazing for borrowed lites and screens.
.4 glazing for flush wood core doors.
.5 glazing for aluminum doors, entrances and storefronts.
.6 miscellaneous specialty glass, gaskets, tapes and glazing materials

.2 Related Requirements: Specifications throughout the entirety of the Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them

1.4 REFERENCES

.1 Reference Standards: Latest published editions of reference standards listed in this Section in effect as of the closing date and time of the Request for Tenders for the Contract, including any amendments adopted, are applicable unless otherwise indicated.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meetings:

.1 Prior to starting work of this Section, convene a pre-installation meeting at the Project site to review the Project requirements and site conditions with pertinent parties. Conform to requirements of Section 01 30 00.

.2 In particular address the following items:

.1 Prior to commencing work of this Section arrange for the manufacturer's technical representative to review with, the Contractor and Consultant, procedures to be adopted and conditions under which work shall be performed. Inspect surfaces to determine adequacy of existing and proposed conditions.
.2 Coordinate installation with related Sections referenced herein.
.3 Coordinate and verify with tempered glass manufacturer criteria for roll wave factor (RW) to ensure optimal flatness in the glass assemblies;

.4 Cooperate fully with Subcontractors that are performing the work of other Sections and promptly proceed with the work of this Section as rapidly as job conditions permit.

.5 Cooperate.Cooperate with Subcontractors that are performing the work of other Sections for the application of all miscellaneous specialties.

.6 Supply items to be built-in in ample time to be incorporated into work of other Subcontractors, together with measurements and other information required for location of it.

.7 Ensure work which may create dust does not proceed during work related to painting and final finishing.

1.6 SUBMITTALS

.1 Product Data: Submit manufacturer's literature and data sheets for each type of material provided under this Section for the Project in accordance with requirements of Section 01 30 00. Ensure data sheets provide required information including detailed instructions for installing as well as maintaining, preserving and keeping materials in clean and safe conditions. Provide adequate warning of maintenance practices or cleaning agents detrimental to specified materials. Provide gloss measurements for acid etched glazing.

.2 Safety Data Sheets (SDS): Submit SDS for inclusion in Operation and Maintenance Manual specified in Section 01 70 00, for adhesives, sealants and any other material designated by Consultant.

.3 Samples: Submit samples of materials identifying quality and type of glass if required by Consultant before commencing work. Ensure samples are clearly labelled with manufacturer's name and type. Submit the following samples:

.1 fire resistive glass

.2 mirrors,

.3 decorative glass

.4 film types including decorative types and custom films with graphics and special colours.

.5 etched glass

.6 bird deterrent glass

.4 Test and Evaluation Reports:

.1 Provide adhesion test reports on metal and glass tested in accordance with ASTM C794, 14 Day cure and 7 Day submersion.

.2 Provide to sealant manufacturer, Shop Drawings showing size of lites, design loads and sealant dimensions for sealant manufacturer's evaluation and statement on stress.

.5 Shop Drawings: Submit Shop Drawings in accordance with Section 01 30 00. Ensure Shop Drawings indicate material characteristics, details of construction, connections and relationship with adjacent construction. Where required, ensure Shop Drawings are prepared and stamped by a Professional Engineer licensed in the Province of Ontario.

.6 Product Certificates:

.1 Submit certificates signed by manufacturers of glass and glazing Products certifying that Products furnished comply with requirements of this Section. In particular, submit data substantiating that tempered, laminated and insulated glazing units are tested in accordance with applicable standards specified herein.

.2 Adhesion and Compatibility: Provide compatibility and adhesion test reports from sealant manufacturer indicating that glazing materials were tested for compatibility and adhesion

with glazing sealants. Include sealant manufacturers interpretation of test results relative to sealant performance and recommendations for primers and substrate preparation needed for adhesion.

.7 Maintenance Data: Provide maintenance data indicating cleaning instructions for inclusion into the maintenance manual in accordance with the requirements of Section 01 70 00.

1.7 QUALITY ASSURANCE

.1 Installer's Qualifications:

.1 Ensure work of this Section is performed by an experienced installer trained, experienced and familiar with glass and glazing methods and standards specified herein.

.2 Provide work of this Section executed by competent installers with a minimum 5 years' experience in the application of the Products, systems and assemblies specified herein and with the approval and training of the Product manufacturers.

.2 Fabricator's Qualifications:

.1 Insulating Glass Fabricator: Ensure fabricator belongs to Certified Fabricator Program and comply with CAN/CGSB 12.8 and/or ASTM E2190 testing.

.2 Provide work of this Section executed by manufacturer having 10 years' experience in the manufacture and fabrication of the glass and glazing of type and quality shown and specified herein. Submit proof of experience upon request.

.3 Licensed Professionals: Employ a full time structural Professional Engineer registered in the Province of Ontario, carrying minimum $2,000,000.00 professional liability insurance, to:

.1 design the components of the Work of this Section requiring structural performance in accordance with applicable codes and regulations, review design documents, and Provide site administration and inspection of this part of the Work.

.4 Single Source Responsibility: Ensure primary materials provided in this Section are obtained from 1 source by a single manufacturer and secondary materials are obtained from sources recommended by primary materials manufacturers.

.5 Preconstruction Testing: Submit to sealant manufacturer samples of each type of glass, gasket, glazing accessory and glass framing member that will contact or affect glazing sealants for compatibility and adhesion testing. Submit test samples in sufficient time for testing and analysis of results to prevent delay in progress of work.

.6 Mock-ups:

.1 Provide mock-ups in locations designated by the Consultant and as specified in individual Sections for glazed systems and assemblies to demonstrate quality of workmanship.

.2 Prior to full production and final installation of tempered glass, submit full-size mock ups of glass assemblies; Ensure roll wave in glass assemblies are placed parallel to window sill. Allow the Consultant to view the assemblies in conditions similar to the Project locations under various light exposures and times of Day to establish acceptable optical distortion.

.3 Maintain mock-ups during construction in an undisturbed condition as a standard for judging the completed work.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Delivery and Acceptance Requirements: Deliver glass and associated materials to Site in original crates and containers with the manufacturer's name and brand distinctly marked thereon and with glass labelled as to types. Do not remove labels on glass until after work is accepted by the Consultant.

.2 Storage and Handling Requirements: Store materials within the building, in a clean, dry location, acceptable or as designated by the Consultant. Fully protect materials from damage of any kind until ready for use.

1.9 PROJECT CONDITIONS

.1 Environmental Requirements: No glazing done when temperature is less than 7 deg C (44 deg F) or sash or frames are wet, damp or frosted.

.2 Protect work of other trades from damage resulting from the work of this Section.

.3 Identify glazed openings immediately following glass installation. Use coloured tapes or flags suspended near, but not in contact with glass. Attach to frames or surround with suitable non-staining strippable adhesives or tapes.

1.10 WARRANTY

.1 The Contractor warrants mirrors for period of 10 years from Substantial Performance of the Work against defects and/or deficiencies in accordance with the General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within this warranty period, to the satisfaction of the Consultant and at no expense to the Owner. Defects include but are not limited to: visual distortion, deterioration of silvering on mirrors.

.2 The Contractor warrants laminated glass for period of 5 years from Substantial Performance of the Work against defects and deficiencies in accordance with the General Conditions of the Contract. Promptly correct defects or deficiencies which become apparent within this warranty period, to the satisfaction of the Consultant and at no additional expense to the Owner. Defects include but are not limited to: deterioration, edge separation, delamination, material obstructing vision glass and blemishes exceeding those allowed by GANA (LGSA) standards. Upon notification of such deterioration within the warranty period, Provide full replacement of glass units showing defects at no additional cost to Owner.

.3 The Contractor warrants fire resistive glass for a period of 5 years against defects and/or deficiencies in accordance with the General Conditions of the Contract.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Comparable Products from the manufacturers listed herein will be considered provided they meet the requirements of the Drawings, schedules and this Specification, offering functionally, aesthetically equivalent Products in the Consultant’s opinion and subject to Consultant’s review.

.1 Glass and Glazing:

.1 AGC Flat Glass North America, Ltd.
.2 Guardian Industries Corp.
.3 McGrory Glass
.4 Pilkington Special Glass Limited
.5 PPG Canada Inc.
.6 Schott North America Inc.
.7 Trulite Industries Limited
.8 Viracon
.9 TGP
.10 Walker Glass

.2 Architectural Decorative Glass

.1 AGC
.2 Goldray Industries Ltd.
.3 Skyline Design
.4 Walker Glass, or

.3 Polycarbonate Mirrors:

.1 Plaskolite, Inc;
.2 Curbell Plastics, Inc.

.4 Convex Surveillance Mirrors:

.1 CR Laurence;
.2 Security Mirror Industries Ltd.

.5 Glazing Security Films:

.1 3M Films;

.6 Glazing Decorative Films:

.1 Decorative Films;
.2 Llumar;

.7 Glazing Sealants and Gaskets:

.1 Dow Corning;
.2 GE Silicones;
.3 Tremco Canada;

2.2 DESCRIPTION

.1 Regulatory Requirements:

.1 Fire-Resistive Characteristics:

.1 Fire rated door assemblies shall comply with NFPA 80; tested, inspected according to NFPA 257 and shall be acceptable to Authorities Having Jurisdiction.
.2 Where required (60, 90 min Doors, 120 mins) Provide fire resistive glass tested in accordance with CAN/ULC S101 as applicable and acceptable to Authorities Having Jurisdiction for specific application.

.2 Glass and glazing used in this Project shall be designed in conformance with these Specifications, CAN/CGSB-12.20-M, the OBC and regulations of Authorities Having Jurisdiction. In case of conflict, the Contractor shall comply with most stringent requirements.

.3 Glass and glazing systems shall be, where applicable, watertight and airtight capable of withstanding thermal movement and wind and impact loads without failure of any kind, including loss or breakage of glass, failure of seal or gaskets, exudation of glazing sealants, and excessive deterioration of glazing materials.

.2 Design and Performance Requirements:

.1 Provide glass for work of this Section free from bubbles, waves, discolouration and other defects, of types specified herein for locations indicated on Drawings or noted on Door Schedules. Ensure glass bears manufacturer's label indicating quality and testing agency certifications. Leave labels in place until final cleaning.

.2 Perform work of this Section in accordance with GANA - Glazing Manual; www.glasswebsite.com and LSGASM - Standards Manual for laminated glazing installation methods.

.3 Ensure insulating glass units are manufactured in accordance with Insulating Glass Manufacturing Quality Procedures; www.igmaonline.org

.4 Determine optical distortion in accordance with ASTM C1652 requirements of fully tempered glass substrates which have been processed in a heat controlled continuous or oscillating conveyance oven; Measure the wavelength and amplitude of the roll wave factor (RW) of glass panel using planer grid, a digital camera and other software that meets ASTM C1652 requirements.

.5 Deflection: Limit glass deflection to flexural limit of glass with full recovery of glazing materials.

.6 Confirm glazing material thicknesses by analyzing Project loads and in-service conditions. Provide glazing material for various size openings in nominal thicknesses indicated, but not less than thicknesses and in strengths required to meet or exceed performance criteria.

.7 Human Impact Load Resistance: Provide glazing materials listed and labeled as complying with testing requirements of ANSI Z97.1 - Class A.

.8 Ensure solvents and/or other volatile elements in glazing system do not affect properties and performance of materials used for edge seal and sealant glass bond.

.9 Ensure materials used for edge seals are compatible with other materials they come in contact within the glazing system. If required, perform compatibility tests to ASTM C510, ASTM C794 and ASTM C1087, or others as applicable.

.10 Use sealants and other materials in glazing system which are unaffected by long term UV light exposure.

2.3 MATERIALS

.1 Heat Strengthened Glass (HSGL): Conforming to ASTM C1048, Kind HS minimum 6 mm (1/4"). Perform heat strengthening using horizontal tong free method; surface compression in range of 3,500 to 7500 psi, preferably no higher than 5000 psi.

.2 Tempered Glass (TGL/CGL): Conforming to ASTM C1048, Kind FT or CAN/CGSB-12.1-M, Type 2 tempered, Class B float glass, Category II, minimum 6 mm (1/4"). Perform heat strengthening using horizontal tong free method; surface compression not less than 10,000 psi.

.1 Visual Distortion: Ensure glass is tempered by the horizontal toughening process only and conforms to the following roll wave factor (RW) limits measured in accordance with ASTM C1652 requirements:

.1 Roller Wave: +/– 0.15 mm over 300 mm.
.2 Edge Dip: 0.25 mm maximum.

.2 Provide at all locations unless indicated otherwise.

~~.3 Laminated Glass (GL-1 and GL-1A): Provide glass laminated to interlayers to produce laminated lites free of foreign substances, air and glass pockets. [TBD]~~

~~.1 Interlayer: clear PVB interlayer of thickness as indicated in specific assemblies.~~

.4 Intumescent Fire Resistive Glass ~~(FRGLI):~~ (FGLI)

.1 Conforming to CAN/ULC S101 for fire resistance rating indicated; and impact and safety rated in accordance with ANSI Z97.1 – Class A.

.2 Provide units composed of multiple layers of annealed glass as specified herein laminated with intumescent interlayer in thicknesses required to suit design and fire resistive requirements.

.1 Acceptable Products:

.1 "Pyrostop" by Pilkington; or
.2 "Contraflam" by VetroTech;
.3 "Pyrobel" by AGC; or
.4 "Superlite II-XL" by SaftiFirst;
.5 or Equivalent to the above.

.2 Provide at all fire-rated locations unless indicated otherwise.

~~.5 Polycarbonate Security Glazing (SGL)~~

~~.1 Glass-Clad Polycarbonate: ASTM C 1349, and other requirements specified.~~

~~.2 Bullet Resistance Protection Level: Level 3 per UL 752~~

~~.3 Minimum Overall Unit Thickness: 30 mm (1-3/16 inch)~~

~~.4 Unit Makeup: Multiple Laminations of glass and polycarbonate as necessary to meet performance requirements specified in this Section. Exposed polycarbonate is not acceptable.~~

~~.5 Acceptable Manufacturers:~~

~~.1 Global Security Glazing~~
~~.2 OldCastle Glass~~
~~.3 Prelco.~~
~~.4 or Equivalent to the above.~~

~~.6 Spall-Resistant Film: Provide composite of clear polyvinyl butyral film and clear abrasion-resistant polyester film. Provide on threat side.~~

~~.1 Acceptable Products: DuPont Glass Laminating Solutions, DuPont Company; SpallShield or approved Equivalent.~~

.6 Frameless Mirrors ~~(MIR-3 and MIR-4)~~:

.1 Conforming to ASTM C1503, Mirror Select Quality, size(s) as shown on Drawings, 6 mm (1/4") thick float glass with process deposit of 5 silver coats, 3 copper coats and final protective seal.

.2 Mirror Adhesive: Compatible with silver coatings, copper coatings and protective seal applied to mirrors, recommended by manufacturer to hold mirrors permanently in position without visible signs of mirror deterioration throughout warranty period. Provide Low-VOC mirror adhesive material recommended by the glass fabricator.

.3 Edge Treatment: Square and polished. Silvered Seal edges after edge treatment to prevent chemical or atmospheric penetration of glass coating.

.4 Extruded-Aluminum Top and Bottom Trim: 1.3 mm (0.05") thick aluminum J-channels with return that produces glazing channel to accommodate mirrored glass thickness indicated.

.1 Bottom Trim: J-channels formed with front leg and back leg, and not less than 20 mm (7/8") in height.

.1 Acceptable Products: "CRL Standard Bottom J Channel Series" by CR Laurence; or equivalent.

.2 Top Trim: J-channels formed with front leg and back leg, and not less than 25 mm (1") in height.

.1 Acceptable Products: "CRL Standard Top - J-Channel Series" by CR Laurence; or equivalent.

.3 Aluminum Finish: Satin anodized.

.7 Thermally Insulated Glazing Materials: Refer to Section 08 44 00.

.8 Glazing Films:

.1 Dimensionally stable cast film, minimum 0.05-mm (2-mil) thick, with pressure-sensitive clear adhesive back for adhering to glass and releasable protective backing.

.2 Provide film with factory edge with maximum tolerance of 1.5 mm (1/16") gap between film edge and glass stop. Provide tamper-resistant clear sealant at edges of film at glass stops.

.3 Locate films on glass doors and other glazed areas indicated on Drawings and Schedules to meet code requirements. Apply film to non-public side of glass unless noted otherwise.

.4 Film Colours and Graphics: to be determined at a later date by Consultant from manufacturer's full range including custom colours to match approved samples.

.5 Apply films in sizes, extents and cutouts to suit design requirements.

.6 Security Films (FILM-S): Provide security Film "Ultra S800 Series" by 3M or equivalent by Ace Security Laminates. Provide film conforming to CPSC 16 CFR Category II (400 ft/lb) and ANSI Z97.1. Colour: As selected by the Consultant at a later date.

.7 Decorative Film Types:

.1 Translucent Film (FILM1): Provide "SOLYX SXWF-WF White Frost" by Decorative Films or Equivalent by 3M or Llumar.

.2 Opaque Film (FILM2): Provide " SOLYX SXWF-WB White/Black Out" by Decorative Films or Equivalent by 3M or Llumar.

.9 Glazing, Sealing Compounds and Accessories:

.1 Ensure glazing, sealing compounds and accessories are compatible with all contact surfaces of frames, accessories used in glazing system and contact surfaces of compounds used in glazing systems. Wood or other organic materials are not acceptable for use in glazing systems.

.2 Glazing Compound: Non-hardening modified oil type. Colour to match adjacent surfaces unless indicated otherwise.

.3 Sealant Compound: In accordance with Section 07 92 00. Provide one component type, elastomeric chemical curing, CAN/CGSB-19.13-M, Class G-2-25-A-N or ASTM C920, Type S, Grade NS Class 25 or one component, silicone base solvent curing. Colour: to match adjacent surfaces unless indicated otherwise.

.4 Elastomeric Joint Sealants: In accordance with Section 07 92 00 and ASTM C920.

.5 Sealant for Interior Non-Structural Glass-to-Glass Butt Glazing Installation: Translucent 1 part silicone sealant conforming to CAN/CGSB-19.13-M and ASTM C920, "Tremsil 200" by Tremco Canada or "DC 999" by Dow Corning Canada.

.6 Cellular Gaskets for Compression Glazing: ASTM C509 cellular, elastomeric, preformed, black. Closed cell neoprene or EPDM extrusions including molded corners where applicable by Tremco Canada or Equivalent.

.7 Dense Gaskets for Compression Glazing: ASTM C864, Option II or ASTM C1115, Type C, dense neoprene or EPDM extrusions, 60 and 70 Durometer density including molded corners where applicable by Tremco Canada or Equivalent.

.8 Glazing Splines: Neoprene or EPDM manufacturer's standard dry glazing splines to suit aluminum extrusions. Colour to match adjacent surfaces unless indicated otherwise.

.9 Glazing Points and Wire Spring Clips: Corrosion resistant, manufacturer's standards.

.10 Edge Blocking for Glass: 60 - 70 Durometer neoprene, silicone or EPDM, channel shaped, 100 mm - 150 mm (4" - 6") long.

.11 Setting Blocks: 7 mm x 100 mm (5/16 x 4") EPDM or extruded 80-90 Durometer neoprene. Width: 1.6 mm to 3 mm (1/16" to 1/8") less than design glazing pocket width.

.1 Only use EPDM at insulating glass units.
.2 At fire-rated glazed doors and partitions, use similar sized fire-rated silicone as recommended by the fire-rated glass manufacturer and identical to Product used in test assembly to obtain rating.

.12 Lateral Shims: Neoprene, silicone or EPDM, 40 - 60 Durometer, 100 mm (4") long or as required.

.13 Compression Glazing Gaskets for interior aluminum frame glazing: EPDM, neoprene, thermoplastic or other acceptable material with Shore A Durometer of 35 (± 5). Ensure material has sufficient thickness to allow 25% compression when installed. Provide "VISIONstrip®" by Tremco Canada or Equivalent by Armet, Dow Corning or PTI (or Equivalent) having the following characteristics:

.1 Resistance to permanent set: 30% maximum
.2 Tensile Strength: 2000 psi (1500 psi for silicone) minimum
.3 Minimum elongation at break: 300% (700% for silicone)

.14 Compression Glazing Tape: "Polyshim II Tape" by Tremco Canada or Equivalent with 60 durometer hardness. Ensure tape is sufficiently wide and thick to completely cover bite area of glazing unit when unit is pushed into place.

.15 Interior Structural Glazing Sealant:

.1 In accordance with Section 07 92 00. Provide one component, chemical curing, silicone based sealant, conforming to ASTM C1184 and CAN/CGSB-19.13-M (Classification MCG-2-25-A-N) unless otherwise indicated.
.2 Ensure sealant is UV resistant, ozone resistant, non-bleeding, non-staining and capable of supporting its own weight, weight of glazing units and other specified or referenced loads to meet design criteria; in conformance with OBC requirements. Where applicable, ensure silicone sealant is compatible with edge-seal of insulated glass units. Acid curing is not acceptable.
.3 Acceptable types for shop glazing: "Proglaze II Multi Component" by Tremco Canada; or "Ultraglaze 4400" (where recommended by manufacturer) by GE Silicones; or "DC-983" by Dow Corning Canada (or Equivalent).
.4 Acceptable types for field glazing: "Spectrum® 2 or Proglaze SG" by Tremco Canada; or "Ultraglaze 4000/4400" by GE Silicones; or "DC-795" by Dow Corning Canada (or Equivalent).

.10 Primer Sealers and Cleaners: To glass and plastic glazing manufacturer's standards.

2.4 FABRICATION

.1 Fabricate glazing units in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of Product manufacturer and referenced glazing standard, to comply with system performance requirements.

.2 Label each lite of glazing with registered name of Product and weight and quality.

.3 Check dimensions on job site before cutting materials.

.4 Grind and chamfer edges of unframed glass and mirrors. Grind and chamfer edges of glass shelves and sliding doors.

.5 Ensure minimum bite or lap of glazing on stops and rabbets as recommended by glazing manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Site Verification of Conditions:

.1 Verify actual site dimensions and location of adjacent materials prior to commencing work.

.2 Obtain glass dimensions on the job site. Ensure glass is not more than 4 mm (3/16") less than rebate size in either dimension, with allowance for edge spacers, shims and setting blocks as required.

.3 Ensure framing to be glazed is plumb, secure and permanently fixed in position.

.4 Notify the Consultant in writing of any conditions which would be detrimental to the installation. Commencement of work implies acceptance of previously completed work.

3.2 PREPARATION

.1 Thoroughly clean glass rebates and glass of dust, dirt, mortar and other foreign materials prior to glazing. Remove oils and grease with non-staining solvents such as Xycol or Methyl Ethyl Ketone solutions.

.2 Properly prime, before glazing, glazing rebates in wood doors.

3.3 INSTALLATION

.1 If required, thoroughly mix glazing compound as recommended by manufacturer. Thinning of glazing compound will not be permitted.

.2 Carefully remove glazing stops and replace after glazing. Take care to prevent damage to stops.

.3 Doors, Screens, Sidelites and Interior Windows:

.1 Place setting blocks on sill at 1/4 points from each corner unless otherwise directed by glazing manufacturer.

.2 Place continuous glazing gaskets on edges of glass.

.3 Centre and space each piece of glass with spacers located and installed according to manufacturer's directions.

.4 Place glass so no voids occur between glass and glazing material, and glazing stops.

.5 Secure glass in place with stops, secured in place with screws.

.4 Glazing Sealant:

.1 Compatibility: Select sealants with proven compatibility with surfaces contacted in installation and under service conditions indicated, as demonstrated by testing and field experience.

.2 Apply glazing sealant to clean, dry, grease and oil free surfaces. Provide exposed glazing sealant smooth, free from ridges, wrinkles, air pockets and embedded foreign materials.

.3 Prime surfaces if required by the glazing sealant manufacturer.

.4 Trim glazing sealant flush with tops of stops and glazing channels.

.5 Remove excess glazing sealant or droppings which would set up or become difficult to remove from finished surfaces. Remove excess sealant immediately. Do not use chemicals, scrapers, or other tools which would affect finished surfaces.

.5 Interior Glazing:

.1 Fire Rated Hollow Metal Doors and Screens:

.1 Set glass in fire rated metals doors and screens on continuous setting block with 3 mm (1/8") gap between glazing stop glass and embed in glazing compound in accordance with NFPA 80 and the OBC requirements. Strike and point exposed joints between metal and glass or Install glass in accordance to ULC tested proprietary methods of installation.

.2 Tape/Tape Method:

.1 Cut glazing tape to proper length and Install against permanent stop projecting 1.5 mm (1/16") above sightline.
.2 Place glazing tape on free perimeter of glass projecting 1.5 mm (1/16") above sightline.
.3 Trim off excess tape to sightline.

.3 Combination Method-Tape/Sealant:

.1 Cut glazing tape to proper length and Install against permanent stop projecting 1.5 mm (1/16") above sightline.
.2 Fill gap between glass and applied stop with sealant to depth equal to bite of frame on glass to uniform and level line.
.3 Trim off excess tape to sightline.

.4 Compound/Compound Method:

.1 Apply sealant to back and bottom of rabbet.
.2 Bed glass in position with non hardening compound sealant.
.3 Position and secure glass of smaller dimension only using spring wire or glaziers' clips. Apply face compound and trim sealant to slope away from light, OR Fill gaps between glass and stops with compound until flush with sightline and tool to smooth straight line.

.5 Dry Method (Gaskets):

.1 Place gasket against permanent stop and position glazing sheet.
.2 Apply removable stops. Install gaskets in frame channels.

.6 Combination Method-Tape/Gasket for intermediate and large acrylic or polycarbonate lights over 600 mm x 600 mm (24" x 24"):

.1 Cut glazing tape to proper length and Install against permanent stop.
.2 Position glass.
.3 Apply removable stops and Install gaskets in frame channel.

.7 Two Sided Butt - Joint Glazing:

.1 2 side glazing at head and sill use wet, dry, or wet/dry glazing systems.
.2 Position glazing so that vertical edges are spaced slightly apart and seal with silicone sealant.
.3 Grind vertical joint with slight kerf and polish for aesthetics.

.8 Window Film:

.1 Install window film in accordance with the manufacturer’s printed instructions by experienced film applicators as recommended by the glass film manufacturer.
.2 Ensure glass surfaces are clean and ambient temperature is between 16 deg C and 38 deg C (61 deg F and 100 deg F).

.3 Whenever 2 or more pieces of the same colour translucent film are seamed together as a continuous band of colour, they shall be matched to assure uniform reflected daytime colour and transmitted night appearance.

.6 Mirrors:

.1 Install mirrors where indicated on the Drawings. Install mirrored glass units to comply with written instructions of the mirrored glass manufacturer and with referenced GANA and NAAMM publications. Mount mirrored glass accurately in place in a manner that avoids distorting reflected images.

.2 Mount plumb and level and accurately in position and secure rigidly in position.

.3 Ensure back-up wall surface is thoroughly dry, smooth and firm and primed.

.4 Provide space for air circulation and elimination of condensation between back of mirror and wall.

.5 Install frameless mirrors with mirror edges ground and polished.

.1 Locate joints in mirrors to the Consultant's direction. Generally joints are acceptable only for locations where mirrors are longer than 2400 mm (8'-0"). Provide butt joints with ground and polished edges. Apply 6 mm (1/4") wide clear silicone bead at butt joints.

.2 Secure wall and ceiling mirrors in place over special adhesive, temporarily fixing in place until adhesive sets.

.3 Set mirrors with J-trims specified in this Section. Anchor rigidly to wall construction.

.7 Security One Way Mirrors:

.1 Install security one way tempered mirrors where indicated on Drawings.

.2 Mount plumb and level and accurately in position and secure rigidly in position.

.3 Install security one way tampered mirrors according to manufacturer's directions. Ensure reflective surface shall be facing brightly lit subject side.

.4 Subject side lighting shall be bright and evenly distributed over all walls and furnishings, but shall not be shining directly onto one way tempered mirrors. Subject side shall be bright and light in colour and shade to create a bright reflected image.

.5 Observer side lighting shall be dim with no open light sources. Observer side decorations shal be subdued, non-reflective, dark and uniform. Observer side people, objects and light source shall be at reasonable distance from one way tempered mirror area.

.6 Maintain 8:1 light ratio with subject lit brightly.

.7 Install mirrors with frames according to manufacturer's direction. Use concealed tamper proof fasteners in addition to adhesive where required.

3.4 PROTECTION

.1 Provide and maintain necessary protection of completed work against damage.

.2 Do not mark or attach anything directly to exposed glass and framing surfaces.

.3 If welding is to take place above or near completed glazing work, protect glass with plywood or other suitable means to reduce likelihood of weld spatter damaging glass surfaces.

.4 Protect glass from other trades, workers, tools and other similar materials.

.5 Replace cracked, broken, or defective glass at no additional cost to the Owner and to the Consultant's satisfaction.

.6 Identification of Glazing: Mark glass lites with temporary, easily removable, large safety markings, immediately after glass installation. Maintain safety markings until final clean-up.

3.5 CLEANING

.1 Clean installed glass and metal frequently during construction. Avoid etching and staining glass and metal during construction.

.2 Clean and polish glass. Remove labels.

.3 Remove sealant and compound droppings from finished surface.

.4 Periodically clean installed glass during construction to avoid permanent etching and staining.

.5 Remove markings at time of final clean-up. Final clean-up shall be carried out in accordance with glass and sealant manufacturer's recommendations to the Consultant's satisfaction.

.6 Avoid storing materials adjacent to glass.

.7 Protect glass from other trades.

.8 At completion of work, replace any damaged (includes scratches) or broken glass provided under this Section with similar glass.

.9 Wash glazing units on both exposed surfaces in each area of Project prior to scheduled inspections. Wash glazing units as recommended by the glazing unit manufacturer

3.6 INTERIOR GLAZING SCHEDULE

.1 Refer to Drawings and Door and Frame Schedule.

END OF SECTION

SEE ADD#8
Q#249

PART 1 - GENERAL

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL INSTRUCTIONS

.1 Read and conform to:

.1 the General Conditions and the Supplementary Conditions of the Contract;

.2 Division 1 requirements and documents referred to therein.

1.3 SUMMARY

.1 Work Included: Provide louvres including but not limited to the following:

.1 Supply and Install louvers, bird screens, blank-off panels, structural supports and attachment brackets as indicated the Drawings, as specified herein, and as needed for a complete and proper installation

.2 additional steel support framing.

.3 extruded aluminum prefinished wall louvres.

.4 bird screens.

.5 Insect screens.

.6 blank off panels.

.7 sealants.

.2 Related Requirements: Specifications throughout the entirety of the Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.4 REFERENCES

.1 Reference Standards: Latest published editions of reference standards listed in this Section in effect as of the closing date and time of the Request for Tenders for the Contract, including any amendments adopted, are applicable unless otherwise indicated.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meetings:

.1 Prior to starting the work of this Section, convene a pre-installation meeting at the Project site to review the Project requirements and site conditions with pertinent parties. Conform to requirements of Section 01 30 00.

1.6 SUBMITTALS

.1 Product Data: Submit manufacturer's literature and data sheets for each type of material provided under this Section for the Project in accordance with requirements of Section 01 30 00. Ensure data sheets provide required information including detailed instructions for installing as well as maintaining, preserving and keeping materials in clean and safe conditions. Provide

adequate warning of maintenance practices or cleaning agents detrimental to specified materials.

.2 Safety Data Sheets (SDS): Submit SDS for inclusion in Operation and Maintenance Manual specified in Section 01 70 00, for adhesives, sealants and any other material designated by Consultant.

.3 Shop Drawings: Submit Shop Drawings of the Work of this Section in accordance with Section 01 30 00. In addition to minimum requirements, indicate the following:

.1 include elevations, sections and specific details for louver.

.2 show anchorage details and connections for all component parts

.3 structural supports and framing provided as part of this Section.

.4 provision for structural and thermal movement between louvres and adjacent materials.

.4 Samples: Submit samples in accordance with Section 01 30 00. Submit following samples in sizes indicated:

.1 louvres minimum 600 mm (24") square.

.2 louvre flashing minimum 300 mm (12") square.

.5 Test Reports:

.1 Submit air flow and water entrainment performance test results.

.2 Submit test reports for air-performance, water-penetration, and wind-driven rain ratings for applicable Product being supplied complies with specified requirements and has been tested in accordance with procedures stipulated in AMCA 500-L of the Air Movement and Control Association (AMCA).

1.7 QUALITY ASSURANCE

.1 Qualifications: Provide work of this Section executed by competent installers with a minimum of 5 years' experience in the application of the Products, systems and assemblies specified herein and with the approval and training of the Product manufacturers.

.2 Licensed Professionals: Employ a full time structural Professional Engineer, registered in the province of Ontario, carrying minimum $2,000,000.00 professional liability insurance, to:

.1 design the components of the Work of this Section requiring structural performance,

.2 be responsible for full assemblies and connections

.3 be responsible for determining sizes, yield strengths, gauge thicknesses and joint spacing to allow thermal movement and loading of components in accordance with applicable codes and regulations,

.4 be responsible for production and review of Shop Drawings,

.5 inspect the Work of this Section during fabrication and erection,

.6 stamp and sign each Shop Drawing,

.7 provide site administration and inspection of this part of the Work.

.8 submit certificate validating seismic assessment and field review of this part of the Work

.3 Mock-ups:

.1 Provide mock-ups in locations designated by the Consultant and as specified louvres system and assemblies to demonstrate quality of workmanship.

.2 Prior to full production and final installation of louvre assemblies allow Consultant to view assemblies to establish quality of workmanship.

.3 Maintain mock-ups during construction in an undisturbed condition as a standard for judging the completed work.

.4 Single Source Responsibility: Ensure primary materials provided in this Section are obtained from 1 source by a single manufacturer and secondary materials are obtained from sources recommended by primary materials manufacturers.

.5 Supervision: Arrange for Product manufacturer's technical representative to:

.1 meet and discuss installation procedures and unique conditions at the Place of the Work.

.2 inspect substrate surfaces and recommend solutions to accommodate adverse conditions.

.3 periodically visit and inspect installation and report unsatisfactory conditions to the Consultant.

.4 attend final inspection and to submit written certification that Products, systems and assemblies have been installed in accordance with manufacturer's requirements.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Coordinate deliveries to comply with the Construction Schedule and arrange for strategic off-the-ground, undercover storage locations.

.2 Properly wrap louvres with protective coverings and put in suitable crates to prevent distortion and damage. Carefully unload, handle and store to prevent damage.

.3 Protect work of this Section from damage. Protect other work from damage resulting from this Work. Repair or replace damaged work to the satisfaction of the Consultant at no cost to the Owner.

1.9 WARRANTY

.1 The Contractor warrants the work of this Section for period of 5 years from Substantial Performance of the Work against defects and/or deficiencies in accordance with the General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within this warranty period, to the satisfaction of the Consultant and at no expense to the Owner. Defects include but are not limited to: extensive colour fading.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Products of the following manufacturers may be acceptable subject to conformance to requirements of the Drawings, schedules and Specifications:

.1 Construction Specialties Ltd. (C/S)

.2 McGill Architectural Products (McGill)

.3 TenPlus Architectural Products Ltd. (TenPlus)

.2 Design is based on Products by TenPlus Architectural Products Ltd. Comparable Products from manufacturers listed herein offering functionally and aesthetically equivalent Products will be considered provided they meet the requirements of this Specification.

2.2 DESCRIPTION

.1 Design and Performance Requirements:

.1 Professional Engineer Requirements: Drawings and structural calculations shall be signed and sealed by a professional engineer licensed to practice in the Province of Ontario.

.2 Design all materials to withstand wind and snow loads as required by the OBC. Maximum allowable deflection for louvre structural members shall be l/180 or (0.75”), whichever is less. Maximum allowable deflection for louvre blades shall be l/120 or (0.50”) across weak axis, whichever is less.

.3 Air-Performance, Water-Penetration, and Wind-Driven Rain Ratings: Complying with Air Movement and Control Association International (AMCA) - AMCA 500-L for anticipated wind speed and precipitation in the geographical location of the Work.

.1 Air Performance: Not more than 0.10” inch water gauge (wg) static pressure drop at 700-fpm free-area velocity.
.2 Wind-Driven Rain Performance: Not less than 95% effectiveness when subjected to a rain fall rate of 3” per hour and a wind speed of 29 mph.
.3 AMCA Seal: Mark units with AMCA Certified Ratings Seal.

.4 Louvre members shall not vibrate when subjected to design wind loading. Provide integral bosses as required.

.5 Free Area: Minimum 50%.

.6 Thermal Movement: Design louvres to accommodate the expansion and contraction of components due to temperature changes.

.7 Refer to Section 01 83 16 for additional performance and testing requirements pertaining to the work of this Section.

2.3 MATERIALS

.1 Aluminum Extrusions: ASTM B221/B221M, exposed surfaces prefinished as specified.

.2 Aluminum Sheet: ASTM B209/B209M.

.3 Fasteners: ANSI Series 304 stainless steel tamperproof screws, bolts, nuts, washers, rivets and other fasteners.

.4 Anchoring Devices: Aluminum, non-magnetic stainless steel or other non-corrosive metal compatible with aluminum.

.5 Structural Steel Supports: Grade 300W, cleaned to SSPC-SP 3 requirements and shop primed with primer conforming to CISC/CPMA 2-75.

.6 Blades, Heads, Jambs and Sills: minimum 2.0 mm (0.08") thick; blades fixed type, stormproof profile.

.7 Bird Screen: 13 mm (1/2") square woven mesh of aluminum wire, minimum 2.9 mm (0.1142”) diameter aluminum wire cloth secured to 3 mm minimum thick extruded aluminum U frame mitred at corners. Fixed aluminum or sheet steel sheet over back of louvers may be acceptable in lieu of bird screens.

.8 Insect Screen: manufacturer's standard mesh.

.9 Blank-Off Panels: Provide where indicated on the Drawings:

.1 Aluminum sheet metal, insulated, laminated sandwich panel finished to match the associated louvre. Laminate sheet metal on both sides of insulation.

.2 Blank-off panel insulation CAN/ULC-S702, type 1, minimum 38 mm thick mineral wool.

2.4 MANUFACTURED UNITS

.1 Prefinished, Fixed, Extruded-Aluminum Louvers (LVR):

.1 Provide horizontal storm-resistant louvers.

.2 Heads, sills, jambs and mullions: one-piece structural aluminum members with integral caulking slot and retaining beads. Mullions to be with integral drains.

.3 Blades: one-piece aluminum extrusions with front lip gutter and multiple secondary gutters designed to catch and direct water to jamb and mullion downspouts. Supply louvers minimum 150 mm (6") by full depth sill flashings formed from minimum 1.27mm (0.050") thick aluminum.

.4 Material thicknesses shall be as follows:

.1 Heads, sills, jambs and mullions: 2.06mm (0.081")
.2 Fixed blades: 1.52mm (0.060")
.3 Louver Depth: Not less than 100 mm (4")

.5 Acceptable Products: "4 inch Storm Blade Louvers - Model H4451" by TenPlus Architectural Products Ltd. or Equivalent.

2.5 FABRICATION

.1 Form blades, mullions and frames to sizes and shapes indicated.

.2 Provide louvre blades with extruded aluminum blade supports in section modulus and depth to resist loads anticipated and meet design requirements specified herein. Provide integral reinforcing ribs to prevent bowing and distortion.

.3 Accurately cut and fit components to produce tight hairline junctures. Securely fasten frame members together with adequate concealed welds and seal with sealant to ensure watertight joints.

.4 Fabricate bird screens using aluminum mesh securely locked into a heavy extruded aluminum channel frame. Install bird screens on the inside of louvres and screw fasten to frames to permit removal if required.

.5 Adequately secure angle reinforcing for louvred penthouses as an integral part of the assembly. Neatly mitre and heliarc weld corners of louvred penthouses.

.6 Coat surfaces of aluminum in contact with steel, concrete and/or masonry using specified bituminous coating.

2.6 FINISHES

.1 Finish louvers after assembly.

.2 General: Comply with NAAMM "Metal Finishes Manual" for finish designations and application recommendations, except as otherwise indicated. Apply finishes in factory. Protect finishes on exposed surfaces prior to shipment. Remove scratches and blemishes from exposed surfaces that will be visible after completing finishing process. Provide color as indicated or, if not otherwise indicated, as selected by Consultant.

.3 High-Performance Organic Finish: Three-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both colour coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

.1 Colour and Gloss: As selected by the Consultant from the manufacturer's full range..

.4 Isolation Coating: Bituminous paint, alkali-resistant bituminous paint or epoxy resin solution to Provide dielectric separation which will dry to be tack-free and withstand high temperatures. Cold-applied asphalt mastic complying with SSPC-Paint 12, except containing no asbestos fibers. Carboline Bitumastic 50 by Carboline Canada, or Copper Creek Top Service 760 Black by Sherwin Williams Company, 410-02 by Bakor Inc. or other Equivalent Product and manufacturer acceptable to Consultant.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Site Verification of Conditions: Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation. Commencement of work implies acceptance of previously completed work.

3.2 INSTALLATION

.1 Comply with the manufacturer's instructions and recommendations for installation of work.

.2 Verify dimensions of supporting structure at site by accurate field measurements so that Work will be accurately designed, fabricated and fitted to the structure.

.3 Anchor louvers to building substructure as indicated on the Drawings.

.4 Erection Tolerances:

.1 Maximum variation from plane or location shown on the reviewed Shop Drawings: 1/8" per 12 feet of length, but not exceeding 1/2" in any total building length or portion thereof (noncumulative).

.2 Maximum offset from true alignment between two members abutting end to end, edge-to edge in line or separated by less than 3": 1/16" (shop or field joints). This limiting condition shall prevail under both load and no load conditions.

.5 Cut and trim component parts during erection only with approval of manufacturer or fabricator, and in accordance with his recommendations. Restore finish completely. Remove and replace members where cutting and trimming has impaired strength or appearance of assembly.

.6 Do not erect warped, bowed, deformed or otherwise damaged or defaced members. Remove and replace any members damaged in erection process as directed.

.7 Set units level, plumb and true to line, with uniform joints and at correct location in openings, with bird screens on inside. Method of attachment shall be concealed.

.8 Caulk perimeter of frames to adjacent materials or to supports using joint backing and sealant. Neatly tool and finish joints.

3.3 PROTECTION

.1 Protect installed materials to prevent damage by trades performing work of other Sections. Use materials that may be easily removed without leaving residue or permanent stains.

3.4 ADJUSTING AND CLEANING

.1 Immediately clean exposed surfaces of louvers to remove fingerprints and dirt accumulation during installation process. Do not let soiling remain until final cleaning.

.2 Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to material finishes. Thoroughly rinse surfaces and dry.

.3 Restore louvers and accessory components damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by the Consultant, remove damaged materials and replace with new materials.

.4 Touch up minor abrasions in finishes with a compatible air-dried coating that matches color and gloss of factory applied coating.

END OF SECTION

PART 1 - GENERAL

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL INSTRUCTIONS

.1 Read and conform to:

.1 the General Conditions and the Supplementary Conditions of the Contract;

.2 Division 1 requirements and documents referred to therein.

1.3 SUMMARY

.1 Work Included: Provide labour, materials, products, equipment and services to complete the decorative metal screens work specified herein. This includes, but is not necessarily limited, to:

.1 Rooftop fixed decorative metal screens.

.2 Auxiliary materials required for complete installation.

.2 Related Requirements: Specifications throughout the entirety of Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.4 REFERENCES

.1 Reference Standards: Unless otherwise stipulated by a specific publication date in this Section or the Ontario Building Code, the latest published editions of reference standards in force as of the Bid Closing Deadline for the Project, including adopted amendments, are applicable.

1.5 SUBMITTALS

.1 Product Data: Submit product data in accordance with Section 01 33 00 for the following:

.1 Submit manufacturer's instructions, printed product literature and data sheets for the decorative metal screens work and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Safety Data Sheets (SDS): Submit SDS for inclusion in Operation and Maintenance Manual specified in Section 01 78 00, for adhesives, sealants and any other material designated by Consultant.

.3 Shop Drawings: Submit Shop Drawings in accordance with Section 01 33 00, for decorative metal screens and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.

.1 Show mullion profiles and locations.

.4 Samples: Submit samples in accordance with Division 01 for each type of metal finish required.

.5 Professional Engineer’s Stamped Shop Drawings and Submittals: For decorative metal screens indicated to comply with structural performance requirements and design criteria, including analysis data signed and sealed by the qualified Professional Engineer responsible for their preparation.

1.6 QUALITY ASSURANCE

.1 Welding Qualifications:

.1 Provide welding in accordance with CSA W59-M performed by a fabricator and mechanics fully approved by the Canadian Welding Bureau as specified herein.

.2 Ensure fabricator is fully certified by Canadian Welding Bureau for fusion welding of steel structures to CSA W47.1 and for fusion welding of aluminum to CSA W47.2.

.2 Fabricator qualifications. A firm experienced in producing fencing/infill/gate products similar to those indicated for the Project and with a record of successful in-service performance.

.3 Source Limitations: Obtain fixed decorative metal screens from single source from a single manufacturer where indicated to be of same type, design, or factory-applied colour finish.

1.7 FIELD CONDITIONS

.1 Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.8 WARRANTY

.1 Extended Warranty for Finishes: Repair or replace components on which finishes fail in materials or workmanship within specified warranty period.

.1 Deterioration includes, but is not limited to, the following:

.1 Colour fading more than 5 Hunter units when tested according to ASTM D2244.

.2 Chalking in excess of a No. 8 rating when tested according to ASTM D4214.

.3 Cracking, checking, peeling, or failure of paint to adhere to bare metal.

.2 Warranty Period: 10 years from date of Substantial Performance of the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Products of following manufacturers may be acceptable subject to conformance to requirements of Drawings, Schedules and Specifications:

.1 Dowco

.2 Construction Specialties

.3 Equivalent.

2.2 DESIGN AND PERFORMANCE REQUIREMENTS

.1 Professional Engineering Design and Certification: Design decorative metal screens, including comprehensive engineering analysis by a Professional Engineer licensed to practice in the Province of Ontario, using structural performance requirements and design criteria indicated.

.2 Structural Performance: Decorative metal screens shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louvre components, noise or metal fatigue caused by louvre-blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.

.1 Wind Loads: Determine loads based on pressures as indicated on Drawings.

.2 Provide additional structural supports as required to adequately secure decorative metal screens within openings.

.3 Vibration Control: Ensure louvre members do not vibrate when subjected to above wind loading. Provide integral bosses as required.

2.3 MATERIALS

.1 Steel Plates, Shapes, and Bars: ASTM A 36/A 36M or equivalent to CSA G40.20/G40.21, Grade 300W.

.2 Aluminum Extrusions: ASTM B 221M (ASTM B 221), Alloy 6063-T5, T-52, or T6.

.3 Aluminum Sheet: ASTM B 209M (ASTM B 209), Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.

.4 Fasteners: Use types and sizes to suit unit installation conditions.

.1 Use hex-head or Phillips pan-head screws for exposed fasteners unless otherwise indicated.

.2 For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.

.3 For fastening galvanized steel, use hot-dip-galvanized steel or 300 series stainless-steel fasteners.

.4 For fastening stainless steel, use 300 series stainless-steel fasteners.

.5 For color-finished decorative metal screens, use fasteners with heads that match colour of decorative metal screens.

.5 Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187.

.6 Grout: Non-shrink type, pre-mixed compound consisting of non-metallic aggregate, cement, and water-reducing and plasticizing additives.

2.4 DECORATIVE METAL SCREENS

.1 Description: decorative screen systems fabricated using durable aluminum with hidden supports and frames. Blade sizes, spacing, and configuration to be as selected by the Consultant to meet sight cutoff and aesthetic requirements.

.2 Finish: Kynar to match aluminum panels.

.3 Basis-of-Design: “Dowco with 4 in blades at 5 in o/c” or Construction Specialties VAC-301

2.5 ACCESSORIES

.1 Mounting Hardware: Provide necessary fasteners, anchors, and brackets for proper installation of screen system. Hardware to be non-corrosive, and compatible with aluminum to prevent galvanic action; conceal from view.

.2 Roof Penetration Sealing System: sealing system composed of precast modular polyester curbs, polyester adhesive and 1-part moisture-cure, self-levelling, pourable sealer.

.1 Acceptable Products: “ChemCurb System” by Chem Link Inc.,

2.6 FABRICATION

.1 Factory assemble decorative metal screens to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

.2 Maintain equal louvre blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.

.3 Include supports, anchorages, and accessories required for complete assembly.

.4 Join frame members to each other and to fixed louvre blades with fillet welds concealed from view unless otherwise indicated or size of louvre assembly makes bolted connections between frame members necessary.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 EXAMINATION

.1 Site Verification of Conditions: Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to installation. Commencement of work implies acceptance of previously completed work.

.2 Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 PREPARATION

.1 Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.4 INSTALLATION

.1 Install the decorative screen system in accordance with the manufacturer's written instructions and as indicated on Drawings. Ensure components are securely fastened and aligned, with hidden supports and frames.

.2 Locate and place decorative metal screens level, plumb, and at indicated alignment with adjacent work. Use concealed anchorages where possible.

.3 Form closely fitted joints with exposed connections accurately located and secured.

.4 Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

.5 Protect unpainted galvanized and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.

.6 Install concealed gaskets, flashings, joint fillers, and insulation as louvre installation progresses, where weathertight louvre joints are required. Comply with Section 07 92 00, Joint Sealants for sealants applied during louvre installation.

.7 Use roof penetration sealant systems at all penetrations.

3.5 FIELD QUALITY CONTROL

.1 Manufacturer Services: Arrange for Product manufacturer’s technical representative to:

.1 meet and discuss installation procedures and unique conditions at the Place of the Work.

.2 inspect substrate surfaces and recommend solutions to accommodate adverse conditions.

.3 periodically visit and inspect installation and report unsatisfactory conditions to Contractor.

.4 attend final inspection and to submit written certification that Products, systems and assemblies have been installed in accordance with manufacturer’s requirements.

3.6 ADJUSTING AND CLEANING

.1 Clean exposed louvre surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.

.2 Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.

.3 Restore decorative metal screens damaged during installation and construction so no evidence remains of corrective work. If the results of restoration are unsuccessful, as determined by Consultant, remove damaged units and replace with new units.

.1 Touch up minor abrasions in finishes with air-dried coating that matches colour and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION

PART 1 - GENERAL

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL INSTRUCTIONS

.1 Read and conform to:

.1 the General Conditions and the Supplementary Conditions of the Contract;

.2 Division 1 requirements and documents referred to therein.

1.3 SUMMARY

.1 Work Included: Provide gypsum board work including but not limited to following:

.1 framing components (studs, channels, furring and other cold-formed metal members.)

.2 suspended ceiling components

.3 concealed reinforcing

.4 interior boards

.5 joint treatments

.6 trims and accessories

.7 ballistic-rated panels in partitions where noted on Drawings and Schedules

.8 seismic bracing

.9 auxiliary materials

.2 Related Requirements: Specifications throughout the entirety of the Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.4 REFERENCES

.1 Definitions used in this Section:

.1 Drywall: Gypsum Board.

.2 Critical Lighting: Strong side lighting from windows or surface-mounted light fixtures.

.3 Textured Wall Finishes: Regular or irregular patterns typically produced by applying a mixture of joint compound and water, or proprietary texture materials to a gypsum board surface previously coated with primer.

.4 Steel Thickness:

.1 Base Steel Thickness: Thickness of bare steel exclusive of coatings.

.2 Design Thickness: Target or "nominal" thickness used to determine structural properties of the cold formed Products.

.3 Minimum Thickness: Design thickness minus minimum allowable under-tolerance required by CSA S136 (95% of design thickness) or material specification; whichever is more stringent.

.4 Designation Thickness: For the purposes of this Section; thicknesses provided will be minimum base steel thicknesses in accordance with CSA S136 and determined by the following table:

Designation Thickness	Minimum Base Steel Thickness		Gauge No. (For reference Only)	Colour
(mils)	(in)	(mm)	Ga	
18	0.0179	0.455	25	Not Painted
33	0.0329	0.836	20	White
43	0.0428	1.087	18	Yellow
54	0.0538	1.367	16	Green
68	0.0677	1.72	14	Orange

.2 Reference Standards: Latest published editions of reference standards listed in this Section in effect as of the closing date and time of the Request for Tenders for the Contract, including any amendments adopted, are applicable unless otherwise indicated.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meetings:

.1 Prior to starting work of this Section, convene a pre-installation meeting at the Project site to review the Project requirements and site conditions with pertinent parties. Conform to requirements of Section 01 30 00.

.2 Coordination:

.1 Coordinate the installation of suspension systems with the installation of the overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

.2 Coordinate installation and cooperate with mechanical and electrical trades to accommodate mechanical electrical items and any other work required to be incorporated into or coordinated with ceiling and soffit systems.

.3 Coordinate work of this Section with application of firestopping and fireproofing work to ensure assemblies provided meet requirements of Authorities Having Jurisdiction.

1.6 SUBMITTALS

.1 Product Data: Submit manufacturer's literature and data sheets for each type of material provided under this Section for the Project in accordance with requirements of Section 01 30 00. Ensure data sheets provide required information including detailed instructions for installing as well as maintaining, preserving and keeping materials in clean and safe conditions. Provide adequate warning of maintenance practices or cleaning agents detrimental to specified materials.

.2 Safety Data Sheets (SDS): Submit SDS for inclusion in Operation and Maintenance Manual specified in Section 01 70 00, for adhesives, sealants and any other material designated by Consultant.

.3 Shop Drawings: Submit Shop Drawings indicating material characteristics, details of construction, in particular locations of construction joints, connections and relationship with adjacent construction. Take field measurements prior to preparation of Shop Drawings and fabrication to ensure proper fitting of work. Ensure Shop Drawings show following:

.1 standard construction of assemblies,

.2 sound attenuating construction,

.3 locations of access panels,

.4 elevations,

.5 finishes and relevant details of furring,

.6 seismic bracing

.4 Certificates:

.1 Submit certification from structural Professional Engineer registered in Province of Ontario stating that installed suspended ceiling system is capable of supporting its own weight and weight of lighting, grilles and other mechanical and electrical fixtures required by the Mechanical and Electrical Divisions of the Specifications and are capable of resisting seismic motions in accordance with requirements specified herein.

.2 Obtain approval of electrical utility Authorities Having Jurisdiction for support of light fixtures, by ceiling grid and supports. Adjust grid, fixing devices and support hangers as required to obtain approval.

.5 Samples: Submit samples in accordance with Section 01 30 00. Submit following samples in sizes indicated:

.1 each trim accessory minimum 300 mm (12") long.

1.7 QUALITY ASSURANCE

.1 Applicator Qualifications: Provide work of this Section executed by competent installers with a minimum of 5 years' experience in the application of the Products, systems and assemblies specified herein.

.2 Licensed Professionals: Employ a structural Professional Engineer registered in the Province of Ontario, carrying minimum $2,000,000.00 professional liability insurance, to:

.1 design the components of the Work of this Section requiring structural performance,

.2 be responsible for full assemblies and connections

.3 be responsible for determining sizes, yield strengths, gauge thicknesses and joint spacing to allow thermal movement and loading of components in accordance with applicable codes and regulations,

.4 be responsible for production and review of Shop Drawings,

.5 inspect the Work of this Section during fabrication and erection,

.6 stamp and sign each Shop Drawing,

.7 provide site administration and inspection of this part of the Work.

.8 submit certificate validating seismic assessment and field review of this part of the Work

.3 Mock-ups: Provide minimum 9 m2 (100 sq. ft) Mock-ups in locations designated by Consultant and as required to demonstrate quality of workmanship. Maintain Mock-ups during construction in an undisturbed condition as a standard for judging the completed work. Approved Mock-ups may become part of finished Work if undisturbed at time of Substantial Performance. Provide Mock-ups for following:

.1 Level 4 and Level 5 gypsum board finish indicated herein.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials to site with manufacturer's original labels intact. Do not remove wrappings until ready for use.

.2 No outside storage permitted. Store in clean, dry area, off ground. Provide adequate ventilation to avoid excess moisture, surface relative humidity and mould or fungal growth. Remove immediately any board showing signs of mould, mildew or fungal growth.

.3 Stack gypsum board flat on level and dry surface without overhanging boards. Prevent sagging and damage to edges, ends and surfaces. Protect bagged Products from moisture or wetting.

1.9 PROJECT CONDITIONS

.1 Cooperate and coordinate with Sections applying wet trades and trades installing mechanical and electrical services.

.2 Do not Install panels that are wet, those that are moisture damaged, and those that are mold damaged.

.3 Do not Install work of this Section in any area unless satisfied that work in place has dried out and that no further installation of materials requiring wetness, moisture or dampness is contemplated.

.4 Relative humidity in area of work of this Section shall not exceed 55% for duration of the Project. Coordinate stud layout at partitions accommodating wall mounted fixtures by other trades.

.5 Ensure temperature of surrounding areas is minimum 13 deg C (55 deg F) and maximum 21 deg C (70 deg F) for 7 Days before and during application of gypsum board; maintain for 4 Days thereafter.

.6 Ensure heat is provided at appropriate time before work has started to bring surrounding and adjacent materials up to required temperature and maintained as specified. Avoid concentrated or irregular heating during drying by means of deflectors or protective screens.

.7 Ensure ventilation is provided for proper drying of joint filler and adhesive and to prevent excessive humidity. Do not force dry adhesives and joint treatment.

.8 Provide protection of materials and work of this Section from damage by weather and other causes. Protect work of other trades from damage resulting from the work of this Section. Make Good such damage immediately.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Products of the following manufacturers (or Equivalent) may be acceptable subject to conformance to requirements of Drawings, schedules and Specifications:

.1 Metal Framing:

.1 Bailey Metal Products Ltd.

.2 Dietrich Metal Framing

.3 Gordon Incorporated.

.4 Trim-Tex Inc.

.5 Roll Formed Specialty

.6 Unifix Inc.

.7 Chicago Metallic

.2 Gypsum Board and Accessories:

.1 CertainTeed Gypsum Canada Inc.

.2 CGC Inc.

.3 Georgia-Pacific Canada, L.P.

2.2 DESCRIPTION

.1 Regulatory Requirements:

.1 Fire-resistance:

.1 Design fire rated construction including ceiling, partition or fire protective membranes and furring in accordance with OBC - Supplementary Standards SB-3 and to approved ULC or cUL design requirements.

.2 Provide materials and construction identical to those tested in assembly indicated according to standards referenced above, by an independent testing agency.

.2 Design and Performance Requirements:

.1 Gypsum Partition Design:

.1 Typical interior partitions shall be of depth indicated on the Drawings with metal studs spaced at intervals specified in this Section with minimum 1 layer of 15.9 mm thick (5/8”) gypsum board on each side. Provide heavier gauges where required for extra unsupported height or wall-mounted accessories or equipment mounting.

.2 Provide moisture resistant gypsum board (MRGB) at all wet areas and toilet rooms. Provide tile backer board at walls surrounding showers. Refer to Drawings for exact locations.

.3 As a minimum, Provide full height partitions at the following locations:

.1 mechanical, electrical, security, and telecommunications rooms, stairs, elevator shafts, chases and toilets, at fire rated walls, private offices, conference rooms, and break rooms unless otherwise indicated on Drawings.

.4 Ensure partition design can accommodate following loadings with deflection not exceeding L/240 in any direction:

.1 Minimum Lateral Load for Partitions: 0.24 kPA (5 psf)
.2 Minimum Lateral Load for Firewalls: 0.51 kPA (10 psf)
.3 Minimum Lateral Load for Cavity Shaft Walls: 0.73 kPA (15 psf)

.2 Shaft Wall and Ceiling Design:

.1 Design and size partitions surrounding elevator shafts to accommodate all internal structural members completely within the required fire resistance rated construction, while maintaining the shaft wall rating without interruption. Shaftwall system for elevator shafts shall not have pointed ends of screws penetrating into shaft.

.2 Supply components from same manufacturer. Ensure components are compatible and tested by approved independent testing facilities acceptable to Authorities Having Jurisdiction.

.3 Ensure shaftwall framing, shaftliner, gypsum board and joint treatment materials Provide 1 or 2 or 3 hour fire resistance rating as noted on Drawings when tested in accordance with ULC S101.

.3 Reinforcing:

.1 Provide reinforcing where required to support manufactured component items such as washroom accessories, casework/millwork, wall mounted equipment, expansion control covers, and similar items.

.2 Provide boxed double studs at each door jamb.

.4 Gypsum Board Ceiling Design:

.1 Design ceiling suspension system in accordance with manufacturer's printed directions and conforming to ASTM C754 requirements.

.2 Design metal ceiling suspension system to sustain loads imposed to L/360 deflection limit in any direction.

.3 Use grid of hangers, runner and furring channels securely anchored to structure above. Allow for thermal movement.

.4 Design hanger anchor and entire suspension system static loading not to exceed 25% of their ultimate capacity including lighting fixture dead loads.

.5 Design suspension system to support weight of mechanical and electrical items such as air grilles and lighting fixtures and other items with adequate support to allow rotation / relocation of light fixtures. Design sub-framing as necessary to accommodate, and to circumvent, conflicts and interferences where ducts or other equipment prevent regular spacing of hangers.

.6 Design exterior soffit and ceiling system where applicable to withstand positive and negative wind loads effect to suit Project design requirements.

.5 Acoustic Design:

.1 Provide sound rated construction having STC rating indicated in accordance with OBC- Supplementary Standards SB-3 and tested in accordance with ASTM E90 and classified according to ASTM E413 by an independent testing agency.

.2 Provide sound attenuation batts as specified herein within cavities of partitions indicated on Drawings.

.6 Seismic Performance:

.1 Design work of this Section to withstand seismic motions determined in accordance with requirements for designated seismic category for location of Project as determined by Ontario Building Code (Supplementary Standard SB-1) and CAN/CSA S832.

.7 Comply with following guide recommendations unless specified otherwise in the Contract Documents:

.1 Gypsum Association, Fire Resistance Design Manual, 20th Edition, GA-600-2012

.2 Applications Guide CGC folder SA-130;

.3 Fire Resistant Assemblies CGC folder SA-100;

.4 Acoustical Assemblies CGC folder SA-200;

.5 Abuse-Resistant Assemblies CGC folder SA-929;

.6 Moisture Resistant Assemblies CGC folder SA-934;

.7 Shaft Wall Systems CGC folder SA-926;

.8 Gypsum Fire Wall Systems CGC folder SA-925.

2.3 MATERIALS

.1 Framing Members:

.1 Comply with ASTM C754 for steel framing and conditions indicated.

.2 Steel Sheet Components: Comply with ASTM C645 requirements for metal, unless otherwise indicated.

.3 Minimum base-metal thicknesses indicated in this Section are minimums, Provide heavier thicknesses where required at unrestrained heights, to frame openings or for impact resistance requirements.

.4 Ensure all studs are screwable with crimped web and returned flanges and in maximum continuous lengths practicable.

.5 Provide knockout openings in stud webs at 600 mm (24") o.c. to accommodate (if required) horizontal mechanical and electrical service lines and bracing.

.6 Galvanized sheet steel: Conforming to ASTM A653/A653M, structural and commercial quality sheets; specially treated by phosphate conversion process if steel is to be exposed and finish painted.

.7 Hot-Dip Galvanizing: Conforming to ASTM A123/A123M, for galvanizing steel and iron Products; and ASTM A153/A 153M, for galvanizing steel and iron hardware.

.8 Protective Coating: All framing members shall be coated as follows: ASTM A653/A653M, G60 (Z180) unless otherwise noted.

2.4 FRAMING COMPONENTS

.1 Partition Framing

.1 Regular Steel Studs:

.1 Minimum Base-Metal Thickness: 18 mils (0.0179 inch - 0.455 mm – 25 ga - Not Painted)

.2 Depth: As indicated on Drawings.

.3 Locations: all gypsum board partitions unless otherwise indicated.

.2 Heavy Duty Steel Studs:

.1 Minimum Base-Metal Thickness: 43 mils (0.0428” – 1.087mm – 18ga – Yellow) unless otherwise indicated.

.1 Provide 54 mils (0.0538” – 1.367mm - 16ga – Green) boxed studs to frame all openings unless otherwise indicated.

.2 Depth: As indicated on Drawings.

.3 Locations:

.1 At abuse-resistant and impact-resistant partitions.
.2 Where required for unrestrained heights or in openings.
.3 As indicated on Drawings and schedules

.3 Specialty Studs:

.1 High Capacity Studs: Provide studs produced from high quality materials using patented construction to achieve increased spans while maintaining structural and acoustic integrity

.1 Minimum Base-Metal Thickness: 18 mils (0.0179" – 0.455 mm – 25 ga – Not Painted) unless otherwise indicated.
.2 Depth: As indicated on Drawings. Conform to limiting height table substantiating performance of sections as recommended by manufacturer.
.3 Locations:

.1 Where required in order to maintain acoustic ratings
.2 As indicated on Drawings and schedules

.4 Acceptable Product: B18™ (HARD BOARD) Stud by Bailey Metal Products Ltd or equivalent.

.2 Shaftwall Framing: Studs and runners including C-T, C-H and E studs and J-L Corners, J track and J runners and other associated components designed for use in shaft wall construction and as specified by shaftwall liner panel manufacturer.

.1 Minimum Base-Metal Thickness: 33 mils (0.0329" – 0.836mm – 20ga – White).
.2 Depth: as indicated on Drawings.

.4 Floor and Ceiling Partition Runners:

.1 Minimum Base-Metal Thickness: 18 mils (0.0179" – 0.455 mm – 25 ga – Not Painted)

.2 Dimensions: 30 mm (1/4") minimum leg length x width to suit stud depth. Provide top track with longer legs where required to compensate for deflection of structure above.

.5 Furring Channels: Conforming to ASTM C645.

.1 Hat-Shaped Furring Channels:

.1 Minimum Base Metal Thickness: 18 mils (0.0179" – 0.455 mm – 25 ga – Not Painted)
.2 Depth: 38 mm (1-1/2") unless otherwise indicated on Drawings.

.6 Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

.1 Acceptable Products: "Multi-Slot Track" by Bailey complete with Bailey Top Deflection Clip (TDC) or VertiClip SLD or VertiTrack VTD Series by The Steel Network Inc; to accommodate anticipated deflections and loadings or equivalent.

.2 Suspended Ceiling Components: At Contractor's option, Provide either traditional framed suspension system components consisting of tie wires, hangers, anchorages channels and attachments OR Provide manufactured direct-hung grid suspension system as specified herein.

.1 Traditional Framing:

.1 Tie Wire: ASTM A641/A 641M, Class 1 zinc coating, soft temper, minimum 1.291 mm (0.051" – 16 AWG) diameter wire.

.2 Wire Hangers: ASTM A641, soft, Class 1 galvanized wire, soft temper, minimum 3.26 mm (0.129" – 8 AWG) diameter.

.3 Furring anchorages: ASTM C754, 1.291 mm (0.051" – 16 AWG) diameter galvanized wire ties, manufacturer's standard wire type clips, bolts, nails or screws as recommended by furring manufacturer.

.4 Hanger Attachments:

.1 Cast-in-Place Concrete Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E488 by an independent testing agency.

.1 Acceptable Products: "HHDCA Ceiling Hanger" by Hilti (Canada) Inc. or Equivalent.

.2 Composite Deck Anchors: Ceiling wire fastening assembly, "X-CW Ceiling Wire Assembly" by Hilti or Equivalent.

.3 Attachment to structural steel components: Comply with ASTM C754 unless otherwise indicated

.5 Carrying Channels: ASTM C645, Cold-rolled, commercial-steel.

.1 Minimum Base Metal Thickness: 18 mils (0.0179" – 0.455 mm – 25 ga – Not Painted)

.1 For Gypsum Board: Provide 33 mils (0.0329" – 0.836mm – 20ga – White) thickness.

.2 For Cement Board: Provide 54 mils (0.0538" – 1.367 mm – 16 ga – Green) thickness

.2 Dimensions: 38 mm (1-1/2") high with 19 mm (3/4") flanges, for primary carrying member in suspended ceilings and as horizontal stiffeners or bracing in metal stud systems.

OR

.2 Grid Suspension System for Ceilings:

.1 ASTM C645, direct-hung system composed of commercial-quality, cold-rolled steel, main beams and cross-furring members that interlock with following characteristics:

.1 Main Tees: Fire-Rated Heavy Duty classification with integral reversible splice with knurled face.
.2 Cross Members: Fire-Rated members with knurled face.
.3 Cross Tees: cross tee 38mm high x 1220mm long with 38mm wide face.
.4 Furring Channel: furring channel 22mm high x 1220mm long with 38mm face.
.5 Accessory Cross Tees: Complete with knurled faces.
.6 Wall moldings: Single web with knurled face.
.7 Accessories: Transition clips, Splice clips, wall attachment clips, splice plates and dome hubs as recommended by manufacturer for specific applications.
.8 Finish: Hot-dip galvanized.

.2 Acceptable Products:

.1 "Drywall Grid Systems" by Armstrong World Industries, Inc.

.2 "Drywall Suspension System" by CGC Inc.
.3 Equivalent by Rockfon.
.4 or Equivalent to the above.

.3 Concealed Reinforcing:

.1 Sheet Steel Reinforcing and Backing Plates: Steel sheet for blocking and bracing in locations, lengths and widths indicated on Drawings.

.1 Minimum Base-Metal Thickness: Minimum 43 mils (0.0428" – 1.087mm – 18ga – Yellow) commercial quality cold rolled galvanized sheet steel.

.2 Structural Shapes, Plates, Reinforcements: 3 mm (1/8") New material conforming to CSA G40.20 and CSA G40.21, Grade 300W. Hot dipped galvanizing with minimum zinc coating of 600 g/m^2 to ASTM A153/A 153M

.3 Metal Studs used as Reinforcements: Minimum 43 mils (0.0428" – 1.087mm – 18ga – Yellow) studs as specified herein in locations indicated on Drawings and as required to support building components.

.1 Depth: As indicated on Drawings.

.4 Stud Spacer Bars: Pre-notched bridging and spacing bar to facilitate erection of interior, non load-bearing studs and to Provide resistance to stud rotation and displacement. Acceptable Product: "Spazzer® 9200 Spacing Bar" by Dietrich Metal Framing or Equivalent.

2.5 BOARD TYPES

.1 Interior Board Types:

.1 General-Purpose Gypsum Board (GB): Conform to ASTM C1396M. Unless indicated otherwise use 15.9 mm (5/8") thick by 1200 mm (4') wide standard facing board in maximum continuous lengths up to 3600 mm (12') with beveled and/or tapered edges with butted square ends to suit design requirements:

.1 Walls: Provide 15.9 mm (5/8") (Type X) thick with tapered edges unless otherwise specified.

.1 Acceptable Products:

.1 "Sheetrock® - Regular Gypsum Panels" by CGC
.2 "ToughRock® Gypsum Boards" by Georgia-Pacific Canada, L.P. "Air Renew Essential (Type X) Indoor Air Quality Gypsum Board" by CertainTeed
.3 or Equivalent to the above.

.2 Ceilings: 15.9 mm (5/8") thick (Type X) gypsum board or 13 mm (1/2") thick anti-sag interior ceiling gypsum board.

.1 Acceptable Products:

.1 "Sheetrock® - Regular Gypsum Panels" or "Sheetrock® - Sag-Resistant Interior Gypsum Ceiling Board" by CGC
.2 "ToughRock® Gypsum Boards" or "ToughRock® CD® Ceiling Board" by Georgia-Pacific Canada, L.P.
.3 " Interior Ceiling Gypsum Board" by CertainTeed
.4 or Equivalent to the above.

.3 Fire Rated Gypsum Board (GB): ASTM C1396M, Type X, 15.9 mm (5/8") thick by 1200 mm (4') wide gypsum board in maximum practical lengths and tapered edges as required by each fire resistance assembly.

.1 Acceptable Products:

.1 “ToughRock® Fireguard or Fireguard C” by Georgia-Pacific Canada, L.P.
.2 “Sheetrock Firecode or Firecode C Core” by CGC Inc.
.3 “Type X or Type C Indoor Air Quality Gypsum Board” by CertainTeed Gypsum Canada Inc.
.4 or Equivalent to the above.

.2 Moisture Resistant Gypsum Board (MRGB): 15.9 mm (5/8") (Type X) thick glass mat reinforced board with moisture treated core conforming to ASTM C1658M and ASTM C1396M with following characteristics:

.1 Mold Resistance Rating: 10 with no mold growth after 4 weeks exposure in accordance with ASTM D3273.

.2 Permeance (for tile backer boards at showers and other areas exposed to high moisture only): < 85.71 ng/(Pa s m²) when tested with no tile or coating and in accordance with ASTM E96.

.3 Boards containing paper or other organic materials in their composition are not acceptable.

.4 Acceptable Fiberglass mat faced (Paperless)Products:

.1 Regular-purpose type (limited moisture exposure e.g sink backsplashes):

.1 “Dens Armor Plus High performance Interior Panel” by Georgia-Pacific Canada, L.P.
.2 "SheetRock Brand Glass-Mat Panel – Mold Tough" by CGC
.3 Equivalent containing no paper or organic materials in core assembly.

.2 Tile backer board (high moisture exposure e.g showers): Refer to Section 09 30 13.

.3 Abuse-resistant Gypsum Board (ARGB): 15.9 mm (5/8") thick (Type X) board smooth paintable surface consisting of fibre-reinforced gypsum core with fibre-reinforced gypsum perlite interlayers and embedded fibreglass with moisture treated core conforming to ASTM C1396M with following characteristics:

.1 Mold Resistance Rating: 10 with no mold growth after 4 weeks exposure in accordance with ASTM D3273.

.2 Abuse resistance: in accordance with ASTM C1629.

.1 Minimum Surface Abrasion: Level 1
.2 Minimum Surface Indentation: Level 1
.3 Minimum Soft body impact: Level 1

.3 Boards containing paper or other organic materials in their composition are not acceptable.

.4 Acceptable Products:

.1 Paperless type (at locations exposed to moisture and/or at dry locations):

.1 "DensArmour Plus Abuse Guard Paperless Interior Drywall” by Georgia-Pacific Canada, L.P.,
.2 "Sheetrock Glass Mat Abuse Resistant Panel Mold Tough" by CGC Inc.
.3 Equivalent containing no paper or other organic materials.

.2 Paper-faced type (at dry locations only):

.1 “ToughRock Abuse Resistant Gypsum Board” by Georgia-Pacific Canada, L.P.
.2 “AirRenew® Extreme Abuse Resistant Gypsum Board” by CertainTeed Gypsum Canada Inc.,
.3 "Sheetrock Mold Tough Abuse Resistant Gypsum Panels" by CGC Inc.
.4 or Equivalent to the above.

.2 Shaft Walls:

.1 Liner Panels: 25 mm (1") thick (Type X), shaft wall liner panels consisting of water-resistant, noncombustible gypsum core with bevelled edges conforming to ASTM C1658 with following characteristics:

.1 Mold Resistance Rating: 10 with no mold growth after 4 weeks exposure in accordance with ASTM D3273.

.2 Fire-performance: non combustible according to CAN4-S114-M; flame spread: 0, smoke developed: 0 in accordance with CAN/ULC-S102-M.

.3 Boards containing paper or other organic materials in their composition are not acceptable.

.4 Acceptable fiberglass mat faced (Paperless) Products:

.1 Dens Glass Ultra Shaftliner by Georgia-Pacific Canada, L.P.
.2 “GlasRoc® Shaft Liner Type X” by CertainTeed Gypsum, Canada Inc.
.3 “Sheetrock Brand Glass Mat liner Panels” by CGC Inc.
.4 or Equivalent

.2 Face Boards: 15.9 mm (5/8") thick fire-rated gypsum board as specified herein.

.3 Exterior Board Types: Refer to Section 06 16 00.

2.6 JOINT TREATMENTS

.1 Conforming to ASTM C475 and gypsum board manufacturer’s recommendations. Confirm all Products with board manufacturer prior to application.

.2 For fire rated assemblies ensure setting compound is tested in accordance with ASTM E814 and ULC-S115 for required rating.

.3 Joint Tape:

.1 Interior Boards:

.1 General-Purpose Gypsum Board: Minimum 50 mm (2") wide kraft paper tape with feathered edges or fibreglass tape as recommended by manufacturer.

.2 Moisture-resistant gypsum board: Minimum 50 mm (2") wide mould resistant fibreglass mesh tape as recommended by panel manufacturer.

.3 Shaft walls: As recommended by panel manufacturer.

.2 Exterior Boards: 50 mm (2") and 100 mm (4") wide fibreglass mesh tape as recommended by panel manufacturer with pressure sensitive adhesive on 1 side.

.4 Joint Compound: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

.1 Interior Applications: Minimum application of 3 coats.

.1 Prefilling: At open joints and damaged surface areas, use setting-type taping compound as recommended by panel manufacturer.

.2 General-Purpose Gypsum Board:

.1 1st Coat (Embedding): Setting-type taping or drying-type, all-purpose compound as recommended by panel manufacturer for embedding tape and first coat on joints, fasteners, and trim flanges.

.1 Use setting-type compound for installing paper-faced metal trim accessories.

.2 2nd Coat (Fill Coat): Use setting-type, sandable topping or drying-type, all-purpose compound as recommended by panel manufacturer.

.3 3rd Coat (Finish Coat): For third coat, use setting-type, sandable topping or drying-type, all-purpose compound as recommended by panel manufacturer.

.4 Skim Coat (final coat of Level 5 finish): One of the following methods are acceptable:

.1 setting-type, sandable topping compound
.2 drying-type, all-purpose compound
.3 high-build interior coating Product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish.
.4 High Build Surface Primer in accordance with GA-214 - Recommended Levels of Gypsum Board Finish; refer to Section 09 91 00 for additional information.

.3 Moisture resistant gypsum board (MRGB):

.1 1st Coat: High density setting-type taping, low shrinkage type compound. Acceptable Products:

.1 “Durabond 90 Compound” by CGC Inc.,
.2 “High Density 90 - ProRoc” by CertainTeed Canada Inc.
.3 or Equivalent

.2 2nd Coat (Fill Coat): use drying-type, all-purpose compound as recommended by panel manufacturer.

.3 3rd Coat (Finish Coat): use drying-type, all-purpose compound as recommended by panel manufacturer.

.4 Skim Coat (where MRGB is left exposed): high-build interior coating Product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish.

.5 Sealant for Moisture Resistant Gypsum Board Edges: Provide water resistant sealant as recommended by gypsum board manufacturer and acceptable to Consultant.

.4 Abuse-resistant and Impact-Resistant Gypsum Board: Minimum 50 mm (2") wide mould resistant fibreglass mesh tape as recommended by panel manufacturer.

.5 Provide Dust Control Drywall Compound in lieu of regular all-purpose drywall compounds in existing facilities.

.1 Acceptable Products: “Dust Control Drywall Compound” by CGC Inc or “Dust Away” by CertainTeed Canada Inc.; for ProRoc M2Tech use ProRoc 90 M2Tech Ready Mix Compound or Equivalent.

.2 Exterior Applications: Use setting-type taping compound and setting-type, sandable topping compound as recommended by the panel manufacturer.

2.7 TRIMS AND ACCESSORIES

.1 Conforming to ASTM C1047 and gypsum board manufacturer's recommendations, Provide accessories used in conjunction with gypsum board assemblies to protect edges, corners and for design features. Confirm compatibility of trim and accessory Products with board manufacturer prior to application.

.2 Joint and Corner Trims: Provide paper-faced metal or plastic Products as specified herein.

.1 Paper-Faced Metal (dry locations only): Provide "CGC Beadex® Brand Paper-Faced Metal Drywall Beads And Trims" by CGC or Equivalent in the following shapes:

.1 Cornerbead.

.2 Bullnose bead.

.3 Bullnose Cornerbead: With notched or flexible flanges.

.4 LC-Bead: J-shaped; exposed long flange receives joint compound.

.5 L-Bead: L-shaped; exposed long flange receives joint compound.

.6 U-Bead: J-shaped; exposed short flange does not receive joint compound.

.7 Control joints.

2.8 AUXILLIARY MATERIALS

.1 Provide auxiliary materials that comply with installation standards referenced herein.

.2 Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

.1 Screws for Sheet Steel Members: ASTM C954, self-drilling, self-tapping gypsum board screws. Provide minimum 25 mm (1") long, #6 for single layer application; and minimum 38 mm (1-1/2") long #7 for double layer application meeting the following requirements:

.1 For single layer application over metal framing: self-drilling, self-tapping, case hardened, No. 6 contoured Phillips head or Type S bugle head. Fasteners to be corrosion resistant. Use drill point screws for abuse resistant gypsum panels.

.2 For double layer application over gypsum backing board and existing gypsum board; 38 mm (1-1/2") Type G bugle head. For each additional layer of board, increase length of fasteners proportionally.

.2 Fasteners for Cement Board: Galvanized or coated streaker type screw, 32 mm (1-1/4") long.

.3 Dust Barrier: Minimum 0.152 mm (6 mil) polyethylene, CAN/CGSB-51.33-M, Type 2.

.4 Laminating Compound: Low VOC, asbestos-free adhesive or joint compound recommended by manufacturer for directly adhering gypsum panels to continuous substrate. At fire-rated construction, use adhesive which conforms to that used in applicable fire tests.

.1 Acceptable Products:

.1 "Sheetrock brand laminating compound" by CGC Inc.

.2 "Dehydratine 9T" by W.R. Grace and Co.

.3 "Stangard Foamastic by Standard Chemicals" Ltd.

.4 or Equivalent to the above.

.5 Isolation Strip for Studs: Provide one of the following:

.1 Asphalt-Saturated Organic Felt: ASTM D226, Type I (No. 15 asphalt felt), nonperforated or CSA A123.3; No. 15 Type.

.2 Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch (3.2 mm) thick, in width to suit steel stud size.

.1 “Rubatex” by Rubatex Corp. or “Perma-Stik 122X” by Jacobs and Thompson Inc.

.2 “Arnofoam” by Arno Adhesive Tapes Incorporated

.3 “Greyflex Expanding Foam Sealant” by Emseal Corporation.

.6 Firestop Track Top Gasket: intumescent cover for ceiling tracks to Provide fire, smoke, and acoustic ratings for head-of-wall joints between gypsum walls and concrete floor slabs.

.1 Size: To suit stud dimensions.

.1 Use only firestop top track seal Product that has been UL 2079 tested for specific fire-rated construction conditions conforming to construction assembly type, space requirements and fire-rating required for each application.

.2 Performance Requirements:

.1 Surface Burning Characteristics (CAN/ULC S102): Flame Spread: 15; Smoke Developed: 35.

.3 Size: To suit stud dimensions.

.4 Acceptable Products: "SERIES TTG Track Top Gasket" by Specified Technologies; or CFS-TTS Firestop Top Track Seal by Hilti or Equivalent.

.7 Sound Control Materials:

.1 Acoustic Insulation: As specified in Section 07 21 00.

.1 One of the following types are acceptable:

.1 Mineral Wool: CAN/ULC-S702, Type 1; ASTM C553 (Type VII) and non-combustible in accordance with requirements of CAN/ULC-S114. Acceptable Products:

.1 "ROXUL AFB" by Roxul Inc.
.2 “Thermafibre Sound Attenuation Blankets” by CGC Inc
.3 “MinWool Sound Attenuation Fire Batts” by Johns Manville.
.4 or Equivalent to the above.

.2 Mineral Glass Fibre: CAN/ULC-S702, Type 1; ASTM C553 (TYPE VII) and non-combustible in accordance with requirements of ULC CAN/ULC-S114. Acceptable Products:

.1 “EcoTouch™ QuietZone® PINK™ FiberGlas® Acoustical Batts” by Owens Corning Canada LP
.2 “NoiseReducer Sound Attenuation Batts” by CertainTeed.
.3 “Sound-Shield Formaldehyde-Free Fiber glass Insulation” by Johns Manville.
.4 or Equivalent to the above.

.2 Acoustical Sealant: Conforming to requirements of Section 07 92 00

.1 Gun applied, smoke-rated and acoustic sealant:

.1 ASTM C834, Type P, Grade -18°C and ASTM C920, Class 12.5.
.2 Flammability: CAN/ULC S102.

.3 Mold resistance: Complying with ASTM G21.
.4 Acceptable Products:

.1 QuietZone Acoustic Sealant" by Owens-Corning Canada Inc.
.2 "Tremstop Acrylic Acoustical Sealant" by Tremco Ltd.,
.3 "QuietSeal Pro" by Pabco Gypsum.
.4 "CP506 – Smoke and Acoustic Sealant" by Hilti (Canada) Limited; or equivalent.
.5 or Equivalent to the above.

.2 Acoustic Sprayed-on Sealant: Acrylic based, sprayed-on acoustic seal for sealing joint openings in non fire-rated acoustic assemblies and smoke partitions;

.1 Material Characteristics: Minimum 12.5% movement capacity.
.2 Flammability: CAN/ULC S102.
.3 Mold resistance: Complying with ASTM G21.
.4 Acceptable Products: "CP572 – Smoke and Acoustic Spray" by Hilti or Equivalent.

.3 Putty Pad for sealing electrical boxes and other penetrations: Non corrosive, easily cleanable, QuietPutty 380 by Pabco Gypsum, fire-rated, mouldable putty, to maintain performance of acoustically rated walls with penetrations such as electrical outlets, HVAC ducts, water hookups and cables. Fire rating: 1 hour fire in accordance with UL 1479 or CAN/ULC S115.

.4 Gaskets: ASTM D1056, Closed cell neoprene, 3 mm (1/8") thick x 64 mm (2-1/2") wide.

.8 Access Doors for Architectural, Mechanical and Electrical: Where supplied by Division 21, 22 23 and 26 shall be installed under this Section.

.1 Flush Non-Rated Access Doors and Frames: Fabricated from galvanized sheet steel.

.1 Door: Minimum 1.5 mm (0.060") sheet metal, set flush with exposed face flange of frame.

.2 Frame: Minimum 1.5-mm (0.060") thick sheet metal with 25-mm (1") wide, surface-mounted trim.

.3 Hinges: Spring-loaded, concealed-pin type or Continuous piano as required.

.4 Latch: cylinder lock and key.

.5 Size: As indicated on Drawings, minimum 16" x 16".

.6 Acceptable Products:

.1 "N/W Series, Flush Non-Rated Access Panels" by Nystrom Building Products; or "DW-5040" by Acudor Products Inc.; or Equivalent.

.2 Fire-Rated Access Doors and Frames: Fabricated from galvanized sheet steel.

.1 Fire-Resistance Rating: Not less than that of adjacent construction

.2 Temperature Rise Rating: As required by Authorities Having Jurisdiction but not less than 139 deg C (250 deg F) at the end of 30 minutes.

.3 Door: Flush panel with a core of mineral-fiber insulation enclosed in sheet metal with a minimum thickness of 0.9 mm (0.036")

.4 Frame: Minimum 1.5 mm (0.060") thick sheet metal with 25 mm (1") wide, surface-mounted trim.

.5 Hinges: Continuous piano type.

.6 Automatic Closer: Spring type.

.7 Latch: Self-latching device operated by flush key with interior release

.8 Acceptable Products:

.1 “Nystrom’s I-Series Insulated Access Door” by Nystrom Building Products; or “FW-5050" by Acudor Products Inc.; or Equivalent.

.9 Ballistic-Rated Panels:

.1 Conforming to UL 752, and suitable for use in fire-rated partitions tested to CAN/ULC S101, provide fiberglass panels consisting of multiple layers of woven roving ballistic grade fiberglass woven in house impregnated with a thermoset polyester resin and compressed into flat rigid sheets designed to capture projectiles with following characteristics:

.1 Nominal thickness: 13 mm (1/2”)

.2 Nominal weight: 5.25 lbs per sq. ft.

.3 Size: As required to suit installation, but not less than 1220 mm x 2440 mm (4’ x 8’)

.4 Ballistic rating: Minimum Level 3 per UL 752.

.5 Acceptable Product: “O.F. 300 Opaque Fiberglass Panels” by Armortex or equivalent by ArmorCo. (or Equivalent).

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Examine substrate for compliance with applicable requirements, including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance.

.2 Do not proceed until unsatisfactory conditions have been corrected. Beginning of installation shall indicate acceptance of substrate conditions.

3.2 PREPARATION

.1 Provide adequate ventilation to eliminate excessive moisture before commencing and during work to ensure proper drying of joint filler and adhesive. Do not force dry adhesive and joint treatment.

.2 Give a minimum of 48 hours’ notice to the Consultant to permit it to perform an inspection of the internal wall/partition elements and services prior to concealing with gypsum board.

3.3 INSTALLATION

.1 Comply with ASTM C754 unless otherwise indicated.

.1 Interior Gypsum Board Assemblies: Comply with requirements in ASTM C840 that apply to framing installation. Provide partitions complete to underside of structure, unless otherwise indicated on Drawings.

.2 Refer to Drawings for partition types and their respective sound attenuation and fire-rating requirements.

.3 Exterior Gypsum Assemblies: Comply with requirements in ASTM C1280 that apply to application of exterior gypsum panel Products.

.4 Conform to installation recommendations contained in CGC Drywall Steel-Framed Systems for metal stud partitions, ceilings, column fireproofing and bulkhead detailing.

.2 Install supplementary concealed reinforcement framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

.3 Install bracing at terminations in assemblies.

.4 Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 FRAMING SYTEMS

.1 Gypsum Board Partitions:

.1 Install studs so flanges within framing system point in same direction.

.2 Co-ordinate erection of studs and installation of service lines.

.3 Provide continuous gasket between floor tracks and structure to separate metal framing from masonry and/or concrete.

.1 Provide isolation strips under steel studs runners for stud walls constructed on slab on grades, slabs above grades, stud at roofing curbs and stud on below grade concrete slabs.

.2 Install resilient sponge tape where gypsum board ceilings abut heads of door frames and where wallboard abuts heads or jambs of exterior door and window frames.

.4 Do not secure studs to exterior window framing or to ceiling grid members.

.5 Space studs as follows:

.1 Single-Layer Application: 400 mm (16”) o.c., unless otherwise indicated.

.2 Multilayer Application: 400 mm (16”) o.c., unless otherwise indicated.

.3 Tile backing panels: 400 mm (16”) o.c., unless otherwise indicated.

.6 Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling. Align accurately.

.7 Deflection Tracks: Where framing extends to overhead structural supports, Install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.

.8 Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; Install runner track section (for cripple studs) at head and secure to jamb studs.

.1 Install two heavy duty boxed studs at each side of openings. Extend each stud through suspended ceilings and attach to underside of overhead structure.

.2 Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (12.7-mm) clearance from jamb stud to allow for installation of control joint in finished assembly.

.9 Other Framed Openings: Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.

.10 Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.

.1 Firestop Track: Where indicated, Install to maintain continuity of fire-resistance-rated assembly indicated.

.11 Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.

.12 Metal Furring:

.1 Provide furring rigid, secure, square, level or plumb, framed and erected to maintain finish dimensions and contours indicated. Allow for thermal movement.

.2 Provide furring around ducts, pipes and dropped beams occurring in finished areas and for vertical gypsum board breaks within or at termination of ceilings.

.3 Provide metal furring channels fastened to masonry or concrete surfaces in parallel rows at 400 mm (16") oc unless gypsum board is indicated to be adhered directly to masonry or concrete surfaces. Shim metal furring channels to Provide a level surface.

.13 Concealed Reinforcements in Partitions:

.1 Provide hollow structural steel, stud, angle and steel plate sections, galvanized sheet steel as specified herein where required to support manufactured components.

.2 Provide rigid and secure installation capable of offering resistance to minimum pull force requirements specified herein. In general, weld connections.

.3 Install stud spacer bars specified herein as required to restrain studs against lateral and torsional movement and to Provide supplementary horizontal bracing.

.4 Sheet Steel Reinforcing/Backing Plate: Provide galvanized sheet steel plate as specified herein where required to support manufactured components. Provide additional sheet plates, reinforcing framing studs, angles, furring channels secured between studs and other accessories to support components including, but not limited to:

.1 washroom accessories.
.2 access panels.
.3 architectural woodwork.
.4 wall mounted miscellaneous specialties and equipment.
.5 wall protection.
.6 handrails and guardrails,
.7 wall-mounted monitors.

.2 Suspended Systems:

.1 Install suspension system components in sizes and spacings indicated on the Drawings, but not less than those required by installation standards that are referenced herein for assembly types and other assembly components indicated.

.2 Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

.3 Provide additional cross-reinforcing at bulkheads and at other openings.

.4 Suspend hangers from building structure as follows:

.1 Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.

.1 Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

.2 Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, Install supplemental suspension members and hangers in the form of trapezes or equivalent devices.

.3 Wire Hangers:

.1 Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
.2 Fasten all ceiling hanger wires to structural members of floor or roof above. Where supporting member is an open web joist or truss, loop wires around bottom chord of joist or truss.
.3 Where the supporting member of roof or floor is concrete, embed wire in concrete prior to casting. Embed wire 250 mm (10”) minimum and looped three times. For precast concrete, loop wire around metal angle which is fastened to the concrete with an approved fastener.

.4 Carrying channels: Secure with hanger wire saddle-tied along channels. Provide metal furring channels at right angles to carrying channels. Attach furring channels to carrying channels with saddle-tie of double strand tie wire.

.1 Provide 25 mm (1") clearance between runners and walls. Provide splicers behind joints. Level channels to a maximum tolerance of 3 mm (1/8") over 3600 mm (12').
.2 Provide 25 mm (1") clearance between furring ends and abutting walls.

.5 Runner Attachment: Support terminal ends of each cross runner and main runner maximum 200 mm (8”) from each wall or ceiling discontinuity with wire hanger. Loop all vertical support wires around runners, joists, screw eyes, and similar items, with a minimum of three turns, then twisted about themselves a minimum of three times.

.6 Do not attach hangers to steel roof deck.

.7 Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.

.8 Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.

.9 Do not connect or suspend steel framing from ducts, pipes, or conduit.

.10 Do not support ceiling fixtures from main runners or cross runners causing excessive deflections of ceiling suspension system. In such cases, support fixture load independently by supplemental hangers within each corner.

.11 Locate fixtures to avoid eccentric loading of main runners and cross runners, except where provisions are made to prevent undesirable section rotation and displacement.

.12 Runners supporting ceiling fixtures cannot rotate more than 2 degrees under fixture loads. Devices to limit rotation shall support fixture in a manner that main and cross runners are loaded symmetrically and not eccentrically.

.13 Space suspended ceiling system components as follows:

.1 Wire hangers: maximum 1200 mm (4') o.c along carrying channels and within 150 mm (6") of ends of carrying channel runs.
.2 Carrying channels: maximum 1200 mm (4') oc and within 150 mm (6") of walls.
.3 Metal Furring: maximum 600 mm (24") o.c. and within 150 mm (6") of walls.

.5 Seismic Bracing: Sway-brace suspension systems with seismic connections, supports and Lateral-Force Bracings. Conform to requirements of ASTM E580.

.1 Install lateral-force bracing to ceilings where gypsum wallboard panels are attached by screws to metal suspension members and ceilings extend to walls;

.2 Install hanger wires splayed 90 degrees from each other at an angle not exceeding 45 degrees from horizontal plane of ceiling to satisfy force-bracing requirements. A

.3 Attach wires to main runners and place within 50 mm (2“) of intersection of cross tees. Bracing points shall not exceed 3600 mm (12’) on center with first point of bracing within 1200 mm (4’) of perimeter of suspended ceiling system.

.4 Fasten vertical uplift strut to and extends from main runner near bracing points to structural support members above. Design and installation of uplift strut shall be determined for each ceiling system to suit design requirements.

.5 Partition Bracing: Brace nonbearing interior partitions to suspended ceilings by providing No. 12 gage galvanized, soft annealed mild steel suspension hanger wire laid at 45 degrees maximum to horizontal plane of ceiling at 2400 mm (8’) on center. Attach walls to metal suspension runners with a positive attachment designed by the metal suspension system manufacturer.

.6 Provide wider wall moulding on all sides to support individual panels around perimeter. Minimum size: 50 mm (2”).

.6 Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

3.5 INTERIOR BOARD APPLICATION

.1 Provide gypsum board in accordance with manufacturer's written installation instructions and finish to requirements of ASTM C840. Provide finished work plumb, level and true, free from perceptible waves or ridges and square with adjoining work.

.2 Provide gypsum board perpendicular to framing and in lengths that will span ceilings and walls without creating end (butt) joints. Stagger abutting end joints of adjacent panels not less than one framing member. Accurately fit exposed butt joints together and make edges smooth.

.3 Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1.5 mm (1/16”) of open space between panels. Do not force into place.

.4 Maintain wallboard panels minimum 6 mm (1/4") and maximum 13 mm (1/2") above floor to prevent moisture transfer. Extend panels to underside of deck or structure.

.5 Isolate perimeter of gypsum board applied to non-load-bearing partitions (except shaft walls) at structural abutments, except floors. Provide 6 mm (1/4”) wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

.6 Erect plain wallboard vertically or horizontally, whichever results in fewer end joints. Keep end joints away from prominent locations and central portions of ceilings. Locate vertical joints at least 300 mm (12") from jamb lines of openings.

.7 Cut and fit gypsum board to accommodate or fit around other parts of the Work. Apply sealant beads at perimeter of services and similar objects which penetrate wallboard in accordance with manufacturer's directions.

.8 Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, within walls and spaces that will not be visible in the Work). Do taping and filling of concealed surfaces above ceiling line, at fire rated and sound rated partitions and walls.

.9 Fasten gypsum board to metal furring and metal studs with screws. Space screws at 200 mm (8") oc at board edges and 300 mm (12") oc on board field. Ensure perimeter screws are not less than 9 mm (3/8") nor more than 13 mm (1/2") from edges and ends are opposite screws on adjacent boards.

.10 Do not secure gypsum board by installing screws into aluminum or steel window and door frames. At fire-rated assemblies, reduce spacings to comply with labelling authorities assembly listings. For other specialty boards screw spacing shall be in accordance with manufacturer’s recommendations.

.11 Joint Treatment:

.1 Mix joint compound or ready-to-use compounds according to manufacturer's directions. Use pure, unadulterated, clean water for mixing. Do not use set or hardened compound.

.2 Tape and fill joints and corners in accordance with gypsum board manufacturer's printed instructions. Fill either manually, using hand tools or by mechanical taping and filling machine of proven efficiency.

.3 Allow sufficient drying time between coat applications and prior to sanding. Conform to the manufacturers’ instructions.

.4 Provide finished work smooth, seamless, plumb and true, flush and with square plumb neat corners.

.12 Single-Layer Application:

.1 Ceilings: apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.

.2 Partitions/walls: apply gypsum panels with long dimension parallel to supports, unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints. Locate end joints over supporting members. Locate vertical joints at least 300 mm (12") from jamb lines of openings.

.3 Fastening Methods: Apply gypsum panels to supports with steel drill screws as specified herein. Ensure perimeter screws are not less than 9 mm (3/8") and not more than 13 mm (1/2") from edges and ends of adjacent boards.

.4 Joints: Finish all joints unless specified otherwise in this Section.

.13 Multilayer Application:

.1 Lay out work to minimize end joints on face layer. Offset parallel joints between face and base layers by at least 250 mm (10") and to apply face layer at right angles to base layer.

.2 Base Layer: Same as face layer unless otherwise indicated on Drawings.

.3 Ceiling: Apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.

.4 Partitions/walls: Apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless

otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.

.5 Fastening Methods: Fasten base layers with screws spaced 300 mm (12") o.c.; fasten face layers with adhesive with notched spreader to leave 9 mm x 13 mm (3/8" x 1/2") ribbons, 38 mm (1-1/2") apart over entire back side of face layer. Provide supplementary fasteners. Follow manufacturer's recommendations for adhesive application. Temporarily brace or fasten gypsum panels until fastening adhesive has set.

.6 Joints: Finish joints in face layers only, unless otherwise required to achieve fire resistant ratings indicated. Setting compound for fire rated construction shall conform to requirements of Authorities Having Jurisdiction to obtain fire rating shown on Drawings.

.14 Laminating to Substrate (Concrete Block or Masonry): Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.

.1 Joints: Finish all joints unless specified otherwise. Do not treat joints of laminated gypsum board for at least 24 hrs after lamination.

.15 Moisture Resistant Gypsum Board:

.1 Install in locations indicated on Drawings. Ensure moisture resistant gypsum board is installed on any wall/partition containing a plumbing fixture (i.e. water closets, sinks, tubs and similar fixtures) whether or not explicitly shown on Drawings.

.2 Provide in accordance with manufacturer's written installation instructions.

.3 Install with 6 mm (1/4") gap where panels abut other construction or penetrations.

.4 Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

.5 Joint Finish: Ensure surface is smooth and free of tool marks and ridges.

.1 All joints and interior angles shall have fiberglass tape embedded in high density setting joint compound as specified herein. Provide 2 separate coats of joint compound applied over all flat joints and 1 separate coat of joint compound applied over interior angles.

.2 Cover fasteners heads and accessories with 3 separate coats of joint compound.

.3 Conform to manufacturer's instructions.

.16 Sound Rated Assemblies:

.1 Where indicated on Drawings, Provide sound rated partitions and ceilings to meet required minimum STC ratings.

.2 Acoustic Sealant:

.1 Comply with ASTM C919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings. Seal off piping, electrical output boxes, and ductwork with acoustical treatments.

.2 Install a continuous bead of acoustical sealant at both faces of partitions, at perimeters, at every air gap (such as gaps around perimeter of wall), between wall panels, at perimeters, behind control joints, at openings and through any penetrations made for plumbing/electrical wiring and similar locations.

.3 Treat junction boxes with acoustic putty, treat piping and duct work either with fiberglass duct liner or damping material or both. Treat frame with gasket material (weather-strip) and Install security flap on bottom of door to seal it off.

.4 At all partitions except shaft walls, apply 1 continuous 6 mm (1/4") bead of acoustical sealant to each side of partition where gypsum board meets dissimilar materials. Where 2 layers of gypsum board per face are required, apply bead of sealant at perimeter of base layer only.

.3 Acoustic Insulation:

.1 Provide acoustic insulation to completely fill height of stud cavities. Tightly butt ends and sides of blankets within cavities. Cut blankets to fit small spaces.

.2 Carefully fit blankets behind electrical outlets, bracing, fixture attachments and mechanical and electrical services.

.3 Install sound attenuation blankets before installing gypsum panels. Staple blankets to back of gypsum board as recommended by gypsum board manufacturer.

.17 Fire-rated Assemblies:

.1 Provide fire rated enclosures, separations and assemblies as indicated on Drawings. Ensure materials for fire rated construction conform to requirements of Authorities Having Jurisdiction to obtain fire rating shown on Drawings. Work in cooperation with those performing the work required under the Section providing for firestopping work.

.2 Where dissimilar components are built into fire rated assemblies ensure continuity of fire separation by boxing in elements with gypsum board and framing to suit requirements of Authorities Having Jurisdiction.

.3 Provide fire resistive joint system between gypsum board wall assembly and steel columns in accordance with OBC requirements. One of the following methods are acceptable:

.1 Provide mineral fiber insulation flush with interior and exterior faces of gypsum board, fire resistant joint sealants and fire stop joint spray in accordance with applicable ULC design.

.2 Provide firestop track top gaskets between gypsum walls and concrete floor slabs as specified herein adhered on top stud runners.

.18 Shaft Wall:

.1 Construct shaft wall assemblies to Provide fire resistance ratings indicated, from both sides, and to maintain airtight seal. Apply continuous sealant around partitions to ensure airtight shaft enclosures.

.2 Install shaft wall studs at centres to meet design requirements in accordance with manufacturer's instructions or fire rated test design. Provide framing to enclose sides, tops and bottoms of shafts terminating at floor or in ceiling space, to maintain fire rating of shaft assembly.

.3 Install shaft wall liner in accordance with manufacturer's instructions at areas where specially designed studs require shaft wall liner panel application as required.

.4 Provide firestopping and smoke seals at penetrations as specified under Section 07 84 10.

.5 Where shaft wall height exceeds maximum available panel height, liner panel joints shall be positioned within upper and lower third points of wall, and shall be staggered to prevent continuous horizontal joint.

.6 Frame around duct openings through shaft walls with 'J' runners.

3.6 APPLICATION OF TRIMS AND ACCESSORIES

.1 For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

.2 Control Joints:

.1 Form control and expansion joints with space between edges of adjoining gypsum panels. Provide pre-fabricated, pre-manufactured control joints unless otherwise indicated.

.2 Provide control joints full height (floor-to-ceiling or door header-to-ceiling) in partitions and furring runs.

.3 Provide control joints from wall to wall in ceiling areas.

.4 Provide continuous polyethylene dust barrier behind and across control joints.

.5 Install control joints at locations indicated on Drawings and in accordance with requirements of ASTM C840 but not more than 9000 mm (30') on centre. As a minimum, Install control at following locations:

.1 at both sides of frames ().

.2 at locations where changes in support framing/construction occurs.

.6 Obtain the Consultant's approval for exact locations of control joints.

.3 Joint and Corner Trim:

.1 Provide interior trims and beads at reveals, ceiling-wall intersections, partition perimeters; and at intersection of dissimilar constructions such as gypsum board-to-concrete or gypsum board-to-acoustic tile ceilings.

.2 Provide metal trim and beads where gypsum board abutts against a surface having no trim concealing junction.

.3 Provide 13 mm (1/2") separation gasket between interior trim and window frames or other cold surfaces or Provide sponge tape between gypsum board framing, where such framing abuts exterior door or window frame. Tape shall be either full width or 1 strip of 9 mm (3/8") wide on each side of framing member.

.4 Unless otherwise indicated on the Drawings, Install trims as follows:

.1 Cornerbead: at outside corners, unless otherwise indicated.

.2 Bullnose Bead: at outside corners where indicated on the Drawings.

.3 U-Bead and LC-Bead: at exposed panel edges.

.4 L-Bead: where indicated on the Drawings.

.4 Aluminum Wall Trims and Reveals:

.1 Provide metal trim casing bead or reveals at junctions with dissimilar materials as indicated on Drawings.

.2 Install in locations indicated on the Drawings.

.5 Access Doors and Panels: Install access doors and panels supplied as part of the work of Divisions 21, 22, 23 and 26 and where required as part of work of this Section. Coordinate with the work to be performed under other Sections for locations and sizes.

.1 Install access panels in accordance with the manufacturer’s instructions.

.2 Install access panels in locations including but not limited in walls, bulkheads, ceilings and soffits. Final locations to be determined by coordination with trades installing mechanical,

electrical and other building services. Obtain the Consultant's confirmation of locations prior to installation.

.3 Consultant reserves right to relocate access panels up to 3600 mm (12') from locations shown on Drawings due to site conditions, providing ample warning is given prior to installation.

.6 Ballistic Rated Panels:

.1 Cut fiberglass to appropriate sizes. Install using self tapping dry wall screws. Provide minimum 100 mm (4") overlap strips (battens) at seams. Install prior to installing gypsum board in locations indicated on Drawings and schedules.

3.7 TOLERANCES

.1 Framing Tolerances: Install each framing member so fastening surfaces vary not more than 3 mm (1/8 ") in 3000 mm (10'-0") in any direction.

3.8 CLEANING

.1 Cooperate and coordinate with those performing the work of other Sections to obtain satisfactory gypsum board finish work. Do all cutting, patching and Make Good as required as a result of the installation work of other Sections.

.2 Clean off beads, casings, joint cement droppings and similar items and remove surplus materials and rubbish on completion and as directed by the Consultant.

3.9 FIELD QUALITY CONTROL

.1 Carry out work using skilled tradesmen carefully supervised by competent foremen. Take all measurements accurately.

3.10 GYPSUM BOARD FINISHING SCHEDULE

.1 Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

.2 Prefill open joints and damaged surface areas.

.3 Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

.4 Finish panels to levels indicated below and according to ASTM C840:

Finishing Level	General Areas	Final Appearance
0	Temporary construction areas and unfinished construction areas.	Unfinished
1	Plenum areas above ceilings, service corridors or any places not viewed by public and where assembly would generally be concealed.	Tool marks and ridges are acceptable.

Finishing Level	General Areas	Final Appearance
2	Following Areas: - where moisture resistant gypsum backing board (MRGB) is used as substrate for tile; -exposed assemblies in garages, warehouse storage areas and service corridors.	Tool marks and ridges are acceptable. Thin coating of compound covers tape; one coat compound over fastener heads.
3	Areas scheduled to receive textured finishes (spray or hand applied) and not subject to critical lighting.	No marks or ridges. Ready for priming, to be followed by textured finish.
4	All public exposed areas where **flat, velvet, eggshell paints, glazed coatings, light textured finishes or wall coverings** (including wall protection items) are scheduled to be applied.	No marks or ridges. Ready for priming, followed by wall coverings, flat paints or light textures.
5	Public exposed areas as follows: - At all lobbies and atriums - Where wallcoverings and gypsum-applied finishes less than 3 mm (1/8”) thick are scheduled to be installed. - where **satin, gloss, semi-gloss or high gloss** paint finish are scheduled to be applied; - where accent paint colours are scheduled to be applied on gypsum board. Coordination with Section 09 91 00; - where severe lighting conditions occur (walls and ceiling areas near windows, skylights, long hallways and atriums with large surface areas exposed to artificial and natural light) - where exposed moisture-resistant gypsum board (MRGB) or fiberglass-mat faced gypsum board (ARGB) is scheduled to be installed.	No marks or ridges. Entire surface covered with skim coat of compound and ready for priming.

END OF SECTION

PART 1 - GENERAL

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL INSTRUCTIONS

.1 Read and conform to:

.1 the General Conditions and the Supplementary Conditions of the Contract;

.2 Division 1 requirements and documents referred to therein.

1.3 SUMMARY

.1 Work Included: Provide ceramic tile including but not limited to the following:

.1 ceramic/porcelain floor tile complete with base, trims and fittings.

.2 crack isolation membrane.

.3 waterproof isolation membrane (in wet areas).

.4 expansion control (control joints and expansion joints).

.5 transitions and trims.

.6 installation systems, levelers, mortars and grouts.

.7 joint sealing.

.8 slip-resistant coating applied to tiles.

.2 Related Requirements: Specifications throughout the entirety of the Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.4 REFERENCES

.1 Definitions used in this Section:

.1 Ceramic Tile: Ceramic surfacing unit relatively thin in relation to facial area, made from clay or mixture of clay and ceramic materials, fired at temperature sufficiently high enough to produce specific physical properties and characteristics conforming to the standards specified herein above.

.2 Porcelain Tile: Porcelain tile manufactured in various thickness and sizes having matt or unglazed or high polish finish is ceramic tile that is generally made by dust pressed method from a composition which results in tile that is dense, impervious, fine grained, smooth and textured with sharply formed face. Water absorption conforming to ASTM C373.

.2 Reference Standards: Latest published editions of reference standards listed in this Section in effect as of the closing date and time of the Request for Tenders for the Contract, including any amendments adopted, are applicable unless otherwise indicated.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meetings: Prior to starting the work of this Section, convene a pre-installation meeting at the Project site to review the Project requirements and site conditions with pertinent parties. Conform to requirements of Division 01.

.2 Coordination:

.1 In particular ensure requirements for concrete subfloor preparation are compatible with the requirements of this Section. Ensure the following meet acceptable criteria to ensure proper performance floor covering work:

.1 floor flatness and floor levelness requirements for flooring installation and their acceptability by flooring manufacturer;
.2 surface texture of finished floor required for flooring installation;
.3 acceptable approaches to remediation of high moisture and high pH floors;
.4 adhesive application and floor covering installation.

1.6 SUBMITTALS

.1 Product Data: Submit manufacturer's literature and data sheets for each type of material provided under this Section for the Project in accordance with requirements of Division 01. Ensure data sheets provide required information including detailed instructions for installing as well as maintaining, preserving and keeping materials in clean and safe conditions. Provide adequate warning of maintenance practices or cleaning agents detrimental to specified materials.

.2 Safety Data Sheets (SDS): Submit SDS for inclusion in Operation and Maintenance Manual specified in Division 01, for adhesives, sealants and any other material designated by Consultant.

.3 Shop Drawings: Submit Shop Drawings for the work of this Section in accordance with Division 01.

.1 Ensure Shop Drawings indicate material characteristics, dimensions, details of construction, joint layouts including movement joints, connections and relationship with adjacent construction.

.4 Samples: Submit samples in accordance with Division 01.

.1 Manufacturer's colour charts consisting of actual tiles or sections of tiles showing full range of colours, textures, and patterns available for each type and composition of tile indicated. Include Samples of accessories involving colour selection.

.2 Manufacturer's colour charts consisting of actual sections of grout showing the full range of colours available for each type of grout indicated.

.3 Submit full size units of each type of trim and accessory in each colour required for installation; minimum 150 mm (6”) lengths .

.4 Tiles: Submit four (4) pieces of each tile specified and selected.

.5 Submit individual sample panels of each colour of ceramic tile, set with adhesive, grouting and bonding method as specified, showing quality, colour and finish of material, grout and pattern of tiles. Each panel shall be minimum 600 mm x 600 mm (24" x 24").

1.7 PROJECT CLOSEOUT SUBMITTALS

.1 Maintenance Instructions:

.1 Submit maintenance instructions in accordance with Division 01. Provide Owner with 3 copies of TTMAC Maintenance Guide.

.2 Include specific warnings of any maintenance practice or materials which may damage or disfigure tile work. Include cleaning methods, cleaning solutions recommended, stain removal methods, polishes and waxes recommended.

.3 Provide manufacturer's maintenance data sheets for floor sealers and other non-tile maintenance materials and accessories.

.2 Maintenance Materials:

.1 Deliver 5% of the total of each tile material used for the work, packaged neatly in original containers to prevent damage, from same lot or batch with minimum of 1 box with 8 pieces of each colour and type; clearly marked to identify following:

.1 Manufacturer and Distributor’s name;
.2 Material Series Name and Stocking number;
.3 Material description including colour and pattern if applicable.

.2 Deliver extra stock to the Owner as soon as permanent, locking storage facilities are available. Place extra stock in designated storage area where directed.

1.8 QUALITY ASSURANCE

.1 Qualifications:

.1 Manufacturers: Provide Products for Work of this Section by manufacturer with minimum 10 years’ experience in the manufacture of such materials.

.2 Installers: Provide work of this Section executed by competent installers with minimum 5 years’ experience in the application of Products, systems and assemblies specified and with approval and training of the Product manufacturers.

.2 Single Source Responsibility: Ensure primary materials provided in this Section are obtained from 1 source by a single manufacturer and secondary materials are obtained from sources recommended by primary materials manufacturers.

.3 *Mock-Ups*:

.1 Where designated or requested, *Provide Mock-Ups* on site, of each type, style, finish, size, colour of ceramic tile, trims and threshold along with respective installation system.

.2 Record pertinent remarks, observations and recommendations discussed in presence of participants.

.3 Sample flooring area, once accepted, including recorded remarks and recommendations shall become a permanent part of *Project* and shall be the standard of workmanship against which balance of ceramic tile work will be judged.

.4 Maintain *Mock-ups* which are not part of *Project* during construction in an undisturbed condition as a standard for judging completed work; demolish and remove *Mock-ups* from *Project* when directed by *Consultant* .

1.9 DELIVERY, STORAGE AND HANDLING

.1 Delivery and Acceptance Requirements:

.1 Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use in accordance with ANSI A 108.1 for labelling sealed tile packages .

.2 Comply with the material manufacturer's ordering instructions and lead time requirements to avoid delays.

.3 Coordinate deliveries to comply with Construction Schedule arrange for above ground, under cover storage before materials are delivered to the Site.

.2 Storage and Handling Requirements:

.1 Store packaged materials in original containers with seals unbroken complete with labels in accordance with the manufacturer's instructions.

.2 Prevent damage to materials and Products during handling and storage. Keep delivered materials dry and free from stains inside weatherproof structure or otherwise protected from freezing and elements. Store cementitious materials off damp surfaces.

.3 Protect epoxy adhesives, additives, mortar mixes and grouts from freezing, moisture and excessive heat during transportation and storage. Maintain temperatures in storage area between 15 deg C (59 deg F) and 20 deg C (68 deg F).

1.10 PROJECT CONDITIONS

.1 Ambient Conditions:

.1 Do not perform of this Section below 12 deg C (54 deg F) when working with portland cement mortars, dry set mortars, latex portland mortars, bond coat. Keep temperature between 12 deg C (54 deg F) to 32 deg C (90 deg F).

.2 Tile areas: maintain temperature 12 deg C (54 deg F) to 35 deg C (95 deg F) during installation and for 7 Days post-installation, unless directed otherwise by manufacturer and ANSI A108.

.3 Provide ventilation, environmental protection as recommended by manufacturer. Maintain suitable environmental conditions, protect work during/after installation. Adhere to trade standards, manufacturer's Product instructions. Follow Product MSDS, label instructions for safety, health, precautionary, environmental protection. Comply with relevant federal, provincial, local, statutory regulations.

.4 Follow manufacturer's recommended working temperatures for adhesives, grouts installation. Ensure epoxy mortars, grouts surface temperatures between 16 deg C (60 deg F) and 32 deg C (90 deg F) at installation.

.2 Site Conditions:

.1 Close doors and windows and turn off direct forced ventilation systems and apparatus. Turn off radiant floor heating systems and protect work area from direct draft, sun and heat exposure during installation and for at least 72 hours after completion.

.2 When necessary build temporary shelter and use indirect auxiliary heaters to maintain adequate temperature level in working environment.

.3 Exhaust temporary heaters to building exterior to prevent health hazards and damage to work from toxic fumes and emanations.

.4 Protect work of this Section against damage by other trades during application and 3 Days after application.

1.11 WARRANTY

.1 The Contractor warrants the work of this Section for a period of 10 years from Substantial Performance of the Work against defects, excessive wear, and loss of adhesion including replacement of defective tile work, materials, labour costs for demolition of defective work,

accessories, and installation systems at the Owner's convenience. Defective work includes without limitation, tiles broken in normal use due to deficiencies in setting bed, loose tiles or grout and similar defects which can be attributed to poor performance of work or defective materials.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Products of following manufacturers (or Equivalent) may be acceptable subject to conformance to requirements of Drawings, schedules and Specifications:

.1 Setting Materials and Adhesives:

.1 Ardex Engineered Cements
.2 Flextile Ltd.
.3 Kiesel
.4 Laticrete International, Inc.
.5 Mapei Inc.

2.2 REGULATORY REQUIREMENTS

.1 Conform to OBC requirements and in particular slip resistance requirements of tile surfaces in horizontal applications

2.3 DESIGN AND PERFORMANCE REQUIREMENTS

.1 Provide tile Products that comply with ANSI A137.1 (minimum Standard Grade) or equivalent ISO 10545 or CAN/CGSB-75.1 characteristics for types, compositions, and other characteristics indicated.

.2 Slip Resistance (Coefficient of Friction):

.1 Provide tile products that comply with ANSI A137.1 (minimum Standard Grade) or equivalent ISO 10545 or CAN/CGSB-75.1 characteristics for types, compositions, and other characteristics indicated.

.2 Slip Resistance (Coefficient of Friction):

.3 Dry areas: Provide materials having a minimum Dynamic Coefficient of Friction (DCOF) of 0.42 in accordance with ANSI A326.3 when tested using the BOT 3000 Digital Tribometer.

.4 Wet areas: Provide materials having a minimum Dynamic Coefficient of Friction (DCOF) of 0.6 (wet) in accordance with ANSI A326.3 when tested using the BOT 3000 Digital Tribometer.

.3 Installation Materials: Provide materials complying with ANSI A108.02, reference standards indicated herein, ANSI standards referenced by TTMAC installation methods specified in TTMAC- Specification Guide 09 30 00; Tile Installation Manual 2012/2014, and other requirements specified herein.

.4 Provide tile trims and accessories such as bullnoses, copings, caps, cut base (to match CT-101), nosings, corner pieces, and other special units as specified, indicated, and required. Without limitations and unless noted otherwise, Provide tile trim and accessories for each type of tile including:

.1 rounded and squared finished edges;

.2 inside and outside corners;

.3 outer and inner cove bases;

.5 Substrate and Backing Surface Flatness Tolerances: Section 03 35 00 establishes a flatness requirement for F_F25 for slabs on grade and F_F20 for suspended slabs for in place concrete and is considered as the starting flatness for work of this Section; final measurement for flatness and level using mortar bed or self levelling screed materials provided by this Section will be measured in same manner as specified in Section 03 35 00 to achieve the following:

.1 Small Format Floor Tile: Tiles having dimensions less than 100 mm x 100 mm require floor flatness as specified in Section 03 35 00 .

.2 Standard Format Floor Tile: Tiles having dimensions from 100 mm x 100 mm and less than 400 mm x 400 mm require floor flatness measured to a minimum F_F35; equivalent to 5 mm with no more than 2 gaps under a 3000 mm straightedge measurement.

.3 Large Format Floor Tile: Tiles having dimensions 400 mm x 400 mm and larger require floor flatness measured to a minimum of F_F50; equivalent to 3 mm with no more than 2 gaps under 3000 mm straightedge measurement.

.4 Wall Tiles: Provide wall levelling similar to that specified for floors for tiles having similar sizes listed above.

MATERIALS

.6 Tile Types:

Generic Location (Refer to Drawings for specific locations)	Code	Basis-of-Design Manufacturer (or Equivalent)	Basis-of-Design Product (or Equivalent)
Porcelain Tile (Lobby / Corridor)	CT-101	Stone Tile	Product: “Masterplan” Colour: “Cinder Plain Matte” Size: 600 mm x1200 mm / (24 in x 48 in)
Porcelain Tile (Washrooms / Shower Floor)	CT-201	Olympia Tile	Product: “Spectra Small Grain” Finish: “Matte” Colour: to be selected by Consultant at a later date. Size: 20 cm x 20 cm
Ceramic Tile (Washroom / Locker Room Walls)	CT-401	Olympia Tile	Product: “Colour and Dimension” Colour and Finish: “Arctic White – Bright” Size: 10 cm x 60 cm

.1 Chemical Resistant Grouts:

.1 Epoxy Grout (Floors and Walls at wet areas only): ANSI A118.3; 100% Solids, two component water based washable epoxy grout, consisting of hardening resin and premixed portion of epoxy resin, colour pigments, and graded aggregate; *Acceptable Products:*

.1 "Epoxy Grout Flex-Epoxy 100" by Flextile Ltd.,
.2 "SPECTRALock Pro Gout" by Laticrete International, Inc.
.3 "Kerapoxy " by Mapei Inc.

.4 “ARDEX WA” by Ardex Engineered Cements
.5 “Okapox F/K” wall and floor by Kiesel

.2 Urethane Grout (Floors and Walls): ANSI A118.3, 1 component urethane grout; *Supply* following: "Colour Max Chemical and Stain Resistant Grout" by Flextile Ltd. or approved equivalent.

.2 Cementitious Grout:

.1 Walls (Unsanded): ANSI A118.7, for porous and absorbent type tiles, non-vitreous clay tiles, marbles or soft glazed wall tiles; *Acceptable Products:*

.1 "Flextile 500 Series Polymer Modified Grout" by Flextile Ltd.
.2 "Laticrete Unsanded Grout, 1600 series with Laticrete 1776 grout admixture" by Laticrete International Inc.
.3 “Keracolor-U” or “Ultracolor® Plus” (Fast Set) by Mapei Corporation.
.4 “ARDEX FG-C Grout by Ardex Engineered Cements
.5 “Servoperl royal” universal, high performance grout by Kiesel

.2 Floors (Sanded): ANSI A118.7, highly abrasion resistant grout for impervious and vitreous tile types; Acceptable Products:

.1 “600 Polymer Modified Sanded Grout” or "1600 RSF (fast set)"by Flextile Ltd.,
.2 “Laticrete sanded grout, 500 series” with “Laticrete 1776” grout admixture by Laticrete International, Inc.
.3 “Keracolor-S” or “Ultracolor® Plus” (Fast Set) by Mapei Corporation.
.4 “ARDEX FL Grout” by Ardex Engineered Cements
.5 “Servoperl royal” universal, high performance grout by Kiesel

.3 Grout Sealer: Penetrating sealer as recommended by grout manufacturer to suit grout selected.

.4 Grout Colours: As selected by the Consultant from the manufacturer's full range at a later date.

.7 Transitions and Trims: Provide aluminum profiles designed specifically for flooring applications with height, profile and type to suit tile and setting-bed thickness and installation requirements. Unless indicated otherwise, transitions and trim finishes to be satin aluminum.

.1 Same-height Transitions:

.1 New Construction: Provide L-shaped profile with 3 mm (1/8”) wide visible surface, integrated trapezoid-perforated anchoring leg, and integrated grout joint spacer.

.1 Acceptable Products (TRANSITION 2): "Schluter-SCHIENE" by Schlüter Systems or Equivalent.

.2 Varying-height (Sloped) Transitions: ADA compliant-type. Provide minimum width to height ratio to conform to barrier-free requirements specified in CSA B651 and AODA. Following types are acceptable:

.1 Unless otherwise indicated, Provide profile with sloped exposed surface, 4 mm (5/32”) tall leading edge, integrated trapezoid-perforated anchoring leg, and integrated grout joint spacer.

.1 Acceptable Products (TRANSITION 1): "Schluter-RENO-U" by Schlüter Systems or Equivalent.

.3 Trims edge-protection, inside and outside corner profiles:

.1 TRIM-1: Provide J-shaped stainless steel profile with integrated trapezoid-perforated anchoring leg, and integrated grout joint spacer.

.1 Acceptable Products: "Schluter-QUADEC" by Schlüter Systems or Equivalent.

.2 TRIM-2: Provide L-shaped stainless steel profile with integrated trapezoid-perforated anchoring leg, and integrated grout joint spacer.

.1 Acceptable Products: "Schluter-JOLLY" by Schlüter Systems or Equivalent.

.4 Movement and Control Joints: Manufacturer's recommended PVC or soft rubber profiles and products to accommodate job-specific movement conditions and to meet design requirements.

.1 Acceptable Products: "Schlüter – DILEX Series" by Schlüter Systems or Equivalent. Specific profile as recommended by manufacturer.

.5 Tactile Indicator Tiles (TWS-2): Provide tactile walking surface indicators with truncated domes. Colour to be selected by the Consultant at a later date.

.1 Acceptable products: "Elan Tile" by Kinesik or Equivalent.

.6 Stair Nosing: Cast stainless steel nosing, with an integral abrasive, as-cast finish consisting of aluminum oxide, silicon carbide, or a combination of both complete with anchoring legs and end caps. Fabricate units in lengths necessary to accurately fit openings or conditions. Provide nosing to protect tiled stair edges and provide easily visible, slip-resistant wear surface.

.1 Acceptable Products: "Schluter®-TREP-E/EK" by Schlüter Systems or Equivalent.
.2 Coordinate with Section 05 51 00.

.7 Shower Dam Profiles: Provide 8 mm (5/16 inch) high collapsible barrier-free shower dams in locations indicated on Drawings.

.1 Acceptable Products: "Shower Profile WSK" by Schlüter Systems or Equivalent.

.8 Surface Preparation:

.1 Mixes and Accessories: Provide the following as required for installation systems indicated. Conform to admixture manufacturer's recommendations for Products and mixtures.

.1 Cement: CSA A3000 grey or white Portland cement; white for grout.
.2 Sand: ASTM C144 or CSA A23.1, sharp, screened mortar sand free from organic and deleterious materials.
.3 Water: Potable.
.4 Lime: ASTM C207, Type S, hydrated lime (where recommended),

.2 Self Levelling and Smoothing Underlayment: Cementitious self levelling smoothing underlayment meeting or exceeding requirements of ANSI A108.1, Type 2 for levelling up to 50 mm (2 inch) and as follows:

.1 "ARDEX Liquid Backer Board" by Ardex Engineered Cements
.2 "Flex-Flo Plus" by Flextile Ltd.
.3 "Servoplan S 111" (40 mm) or "Servoplan E600" (80 mm) with "Servoplan Ki 1" by Kiesel GmbH.
.4 Or Equivalent to the above.

.9 Crack Isolation Membrane:

.1 2 part system: ANSI A118.10 & ANSI A118.12, crack isolation membrane made up of liquid rubber and reinforcing fabric to Provide crack bridging capability over non-structural cracks, compatible with thin set mortar. Acceptable Products are:

.1 "Laticrete Blue 92" by Laticrete International, Inc.,
.2 "WP-980 Waterproof & Crack Isolation Membrane" by Flextile Ltd.
.3 "Servoflex DMS 1K SuperTec and Crack Isolation Membrane" by Kiesel
.4 or Equivalent to the above.

.2 Single component System (Peel and Stick): ANSI A118.10 & ANSI A118.12, highly flexible load bearing "peel and stick" sheet membrane and primer compatible with tile/stone setting mortars. Acceptable Products are:

.1 "Mapeguard Primer and Mapeguard 2" by Mapei Corporation
.2 "Flexilastic 1000 Crack Isolation Membrane" complete with primer by Flextile Ltd.
.3 "Servoflex DMS 1K SuperTec" by Kiesel
.4 or Equivalent to the above.

.10 Waterproofing & Crack isolation Membrane: load bearing membrane for installation of ceramic tile in wet areas**.** Following types are acceptable:

.1 2 part system: ANSI A118.10, extra heavy duty, seamless, Ensure reinforcing fabric is non-woven fabric designed specifically for use with waterproofing membrane. Acceptable Products:

.1 "Flextile WP-980 Waterproof & Crack Isolation Membrane with Reinforcing Fabric" by Flextile Ltd.
.2 "Latacrete 9235" waterproof membrane system with Latacrete's fiberglass cloth reinforcement by Laticrete International, Inc.
.3 "Mapelastic™ 315" by Mapei Corporation.
.4 "ARDEX 8+9 Waterproofing & Crack Isolation Membrane with SK Mesh" by Ardex Engineered Cements
.5 "Servoflex DMS 1K SuperTec and Crack Isolation Membrane" by Kiesel
.6 or Equivalent to the above.

.2 Uncoupling Membrane (for all large-format tiles): Load bearing, pre-manufactured membrane meeting requirements of ANSI A118.12; thickness as recommended by manufacturer to accommodate in-plane substrate movement of 3 mm (1/8 inch) in thin set applications meeting or exceeding requirements of ANSI A108.1 and as follows:

.1 "Flexbone" by Ardex Engineered Cements
.2 "FlexMat" by Flextile Ltd.
.3 "Strata Mat" or "Strata Mat XT" by Laticrete International, Inc
.4 "Schluter 'DITRA XL'" Schluter Systems.
.5 "Mapeguard UM" by Mapei,Inc.
.6 Or Equivalent to the above.

.3 Tile Backer Board (at showers): Lightweight, high density, waterproof extruded polystyrene core with a reinforced, waterproof membrane on both sides:

.1 Thickness: not less than 16 mm (5/8 inch)
.2 Provide product complete with accessories required to provide a complete waterproofing system.
.3 Acceptable Product: "Kerdi Board Panels" by Schluter Inc. including required accessories or Equivalent.

.11 Mortars and Bond Coats:

.1 Latex Modified Thin-Set System (Floor and Wall Applications): ANSI A118.4, Latex portland mortar consisting of 2 component liquid latex mixed with factory blended dry set mortar. *Provide* as bond coat for setting tiles on masonry, concrete, cementitious backer units, coated glass mat backer boards and other suitable backing.

.1 Performance characteristics: *Provide* setting *Products* that exceed the requirements of ANSI A118.4 as indicated below.

.2 Acceptable Products:

.1 "Flextile #51 Thin-Set Mortar" and "Flextile #44 Acrylic Latex Mortar Additive" by Flextile Ltd.
.2 "Laticrete 4237" with "211 Crete Filler Powder" by Laticrete International Ltd.
.3 "Kerabond/Keralastic" by Mapei Inc.
.4 “X77 Microtec Fiber-reinforced” by Ardex Americas
.5 “Servolight S2 SuperTec” walls and floors, Servoflex Trio SuperTec (floors only) by Kiesel

.2 Thin-Set and Medium Bed System (Wall and Floor Applications – Large Format Tiles): ANSI A118.4, Nonsagging mortar.

.1 Performance characteristics: *Provide* setting *Products* that exceed the requirements of ANSI A118.4 as indicated below.

.2 *Acceptable Products:*

.1 “56SR Non-Sag Mortar” by Flextile
.2 “Ultraflex LFT” by Mapei.
.3 “ARDEX X 5 Thin Set Mortar” by Ardex Engineered Cements
.4 “Servolight S2 SuperTec” walls and floors, Servoflex Trio SuperTec (floors only) by Kiesel

.12 Elastomeric Sealants: Provide sealants, primers, backer rods, and other sealant accessories that comply with applicable requirements of Section 07 92 00.

.13 Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

.1 Self-leveling Underlayment:

.1 "Flex-Flo" (up to 12 mm (15/32 inch)) or "Flex-Flo Plus" (up to 50 mm (2 inch)), by Flextile Ltd.
.2 "Laticrete 86" (up to 12 mm (15/32 inch)), by Laticrete International, Inc.
.3 "Ultra Plan/Ultra Plan MB" (up to 5 mm (3/16 inch)) or "Planicrete M20" (up to 50 mm (2 inch)) by Mapei Inc.
.4 “ARDEX Liquid Backer Board” (up to 30mm (1¼ inch)) or “ARDEX K15” (up to 50mm (2 inch))by Ardex Engineered Cements.
.5 Servoplan P 200 Plus (concrete substrates, 1mm – 30mm (1/32 inch -1 ¼ inch) or Servoplan BF 850, 5mm-100mm (3/16 inch- 4 inch) – pre-leveler, Servoplan S 444 (3mm-15mm; by Kiesel

.2 Screed mortars:

.1 "Topcem Premix with Planigrout AC,” Accelerated Cure thick bed Screed and additive by Mapei Inc.

.2 "Flextile FS Screed" by Flextile Ltd or "4:1 Dry Pack Mortar and Flextile #43" by Flextile Ltd.
.3 "Laticrete 3701 Mortar Admix" and "Laticrete 226" thick bed mortar by Laticrete.
.4 “ARDEX AM100” by Ardex Engineered Cements
.5 “Servocret RS (fast setting – 1hr), Servocret RS-N (normal setting), non-sag, walls and floors, pumpable by Kiesel

.14 Slip-Resistant Coating:

.1 Provide surface-applied coating designed to provide durable skid resistant finish to tile. Ensure coating does not affect tile aesthetic and finish. Provide in all floor locations unless otherwise indicated on Drawings and schedules.

.2 Basis-of-Design: “Sure Step – Anti-Slip Floor Treatment” by True Traction; www.truetraction.ca (or Equivalent).

2.4 MIXES

.1 Mix mortars and grouts to comply with requirements of applicable ANSI A108 reference standards and manufacturer’s recommendations for accurate proportioning of materials, water or additive content, mixing equipment and mixer speeds, mixing containers, mixing time, pot life and other procedures needed to produce mortars and grouts of uniform quality with optimum performance characteristics.

.2 Do not add water or other materials to dilute mortar or grout additives unless recommended by the admixture manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verify existing conditions and finishes are ready to receive specified tile work. Ensure backings are structurally sound, level, and plumb within required tolerances. Ensure concrete is cured, has no structural cracks, openings and Projects not required to meet design requirements.

.2 Ensure concrete is cured for a minimum of 28 Days and has the following finishes as required to suit designated application methods:

.1 Steel trowel finish if installation includes load bearing waterproof membrane over concrete and thin set applications.

.2 Fine broom or wood float finish for thin set applications.

.3 Screed finish for mortar bed applications.

.4 Notify Consultant in writing of unacceptable substrate conditions. Beginning of installation implies acceptance of existing conditions.

.5 Ensure compatibility of adhesives, waterproofing, reinforcing and fillers with adjacent substrate and component coming in contact with these Products.

.6 Ensure waterproofing and adhesive manufacturers examine substrate conditions, verify conditions are suitable for installation prior to commencement, and review application procedures. If requested, submit written report confirming this.

3.2 PREPARATION

.1 Refer to Section 09 21 16 for provision of substrates.

.2 Ensure surface is dimensionally stable, cured free of contaminants such as oil, sealants and curing compounds.

.3 Scarify concrete substrate with blast track equipment if necessary to completely remove curing compounds or other substances that would interfere with proper bond of setting materials.

.4 Mortar bed application substrate surface variation shall not exceed 6 mm in 3000 mm (1/4" in 10').

.5 Thin set application substrate surface variation shall not exceed 3 mm in 3000 mm (1/8" in 10').

.6 Apply latex cementitious leveling coat to correct substrate irregularity up to 8 mm (5/16") thickness. Above 8 mm (5/16") correct irregularity by mortar bed method.

.7 Review setting out point with the Consultant for each location, verify patterns and edge conditions.

.8 Verify expansion joints have been installed properly. Provide control or expansion joints in widths and depth as located and detailed on the Drawings. Carry existing joints in concrete subfloors through to surface of tile work.

.9 Install expansion joints directly over joints in structural surfaces where tile work abuts restraining surfaces such as perimeter walls, curbs, columns, wall corners and similar components.

.10 Provide control joints in accordance with the following layout guidelines and as indicated:

Environment	Minimum	Maximum	Joint Width
Interior/Shaded	4800 mm	6100 mm	6 mm minimum
Interior/Sunlight	2400 mm	3700 mm	6 mm minimum
Exterior/Normal	2400 mm	3700 mm	10 mm minimum
Exterior/Excessive	2400 mm	3000 mm	13 mm minimum

.1 Slabs-on-Grade:

.1 Over saw cut control joints.
.2 Around columns.
.3 Over perimeter joints.

.2 Suspended Slabs:

.1 Over beam locations.
.2 Around columns.

.11 Verify service fittings, floor drains, rough-ins and similar requirements are completed and are at proper levels to receive ceramic work.

.12 Provide slopes to floor drains using mortar screeds or other leveling bed materials recommended by setting bed manufacturer.

.13 Crack Isolation Membrane

.1 Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness and bonded securely to substrate.

.2 Do not Install tile or setting materials over crack isolation membrane until membrane has cured.

.14 Waterproof Membrane:

.1 Install waterproofing in strict compliance with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness and bonded securely to substrate.

.2 Do not Install tile or setting materials over waterproofing until waterproofing has cured and been tested to determine that it is watertight. Repair and retest if required.

.3 Do not allow traffic on exposed waterproof membrane.

.4 Provide waterproof membrane to following decks, floors, walls, steps and ramps at areas subject to high levels of moisture

3.3 INSTALLATION

.1 Provide tile in accordance with Terrazzo Tile & Marble Association of Canada - Specification Guide 09 30 00; Tile Installation Manual, unless specified otherwise in this Section, and applicable ANSI A108 standards.

.2 Provide minimum of 95% bond coverage by backbuttering or other approved technique for the following installations, in accordance with ANSI A108 Series of tile installation standards:

.1 Tile floors in wet areas.

.2 Tile floors composed of tiles 200 by 200 mm (8” by 8”) or larger.

.3 Tile floors composed of rib-backed tiles.

.3 Grouting: Apply grout in accordance with manufacturer's printed instructions. Minimum of 2/3 of joint depth shall be kept open for grouting and grout shall penetrate joint to bond coat.

.1 Joint Widths: Unless otherwise recommended by the tile manufacturer for specific conditions, Provide grout joint width as follows: 3 mm (1/8”)

3.4 CLEANING AND PROTECTION

.1 On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

.2 Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile floors.

.3 Prohibit foot and wheel traffic from tiled floors for at least seven Days after grouting is completed.

.4 Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces. Correct defective pointing and other unsatisfactory conditions.

.5 Clean adjacent surfaces which have been soiled or otherwise marred, to completely remove evidence of foreign materials.

.6 Replace cracked, discoloured, chipped, and damaged work which cannot be satisfactorily repaired.

END OF SECTION

PART 1 - GENERAL

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL INSTRUCTIONS

.1 Read and conform to:

.1 the General Conditions and the Supplementary Conditions of the Contract;

.2 Division 1 requirements and documents referred to therein.

1.3 SUMMARY

.1 Work Included: Provide acoustic tile ceilings including but not limited to following:

.1 ceiling suspension systems.

.2 lay-in acoustic ceiling panels.

.2 Related Requirements: Specifications throughout the entirety of the Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.4 REFERENCES

.1 Reference Standards: Latest published editions of reference standards listed in this Section in effect as of the closing date and time of the Request for Tenders for the Contract, including any amendments adopted, are applicable unless otherwise indicated.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meetings:

.1 Prior to starting work of this Section, convene a pre-installation meeting at the Project site to review the Project requirements and site conditions with pertinent parties. Conform to requirements of Division 01.

1.6 SUBMITTALS

.1 Product Data: Submit manufacturer's literature and data sheets for each type of material provided under this Section for the Project in accordance with requirements of Division 01. Ensure data sheets provide required information including detailed instructions for installing as well as maintaining, preserving and keeping materials in clean and safe conditions. Provide adequate warning of maintenance practices or cleaning agents detrimental to specified materials.

.2 Safety Data Sheets (SDS): Submit SDS for inclusion in Operation and Maintenance Manual specified in Division 01, for adhesives, sealants and any other material designated by Consultant.

.3 Shop Drawings: Submit Shop Drawings for work of this Section in accordance with Division 01. In addition to minimum requirements, indicate following:

.1 Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

.1 Ceiling suspension system members including joint pattern.
.2 Method of attaching hangers to building structure and termination at walls partitions, bulkheads, lighting fixtures and mechanical fixtures.
.3 Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

.2 Submit Shop Drawings detailed in measurement system (e.g. imperial or metric) to match Drawings.

.4 Samples: Submit samples in accordance with Division 01. Submit following samples in sizes indicated:

.1 Submit 300 mm (12") long samples of suspension system parts, including trim.

.2 Submit 300 mm x 300 mm (12" x 12") samples of acoustic panels.

.5 Certificates:

.1 Submit independent test data and design tables for each type of insert to be employed on this Project for hanger supports.

.2 Submit certification from structural Professional Engineer registered in the Province of Ontario stating that installed suspended ceiling systems are capable of supporting their own weight and weight of lighting, grilles and other mechanical and electrical fixtures required by the mechanical and electrical Divisions of the Specifications and are capable of resisting seismic motions in accordance with requirements specified herein.

.3 Obtain approval of electrical utility Authorities Having Jurisdiction for support of light fixtures, by ceiling grid and supports. Adjust grid, fixing devices and support hangers as required to obtain approval.

.4 Submit written confirmations to Divisions 22, 23 and 26, when requested by the Consultant, that suspended ceiling is capable of supporting additional weight of mechanical and electrical fixtures specified in Division 22, 23 and Division 26.

.6 Maintenance Data: Submit maintenance instructions to the Owner for recommended cleaning materials and methods for panels and trim. Include precautions for use of and composition of cleaning materials detrimental to acoustic materials and trim.

1.7 QUALITY ASSURANCE

.1 Applicator Qualifications: Provide work of this Section executed by competent installers with a minimum of 5 years' experience in the application of Products, systems and assemblies specified herein and with the approval and training of the Product manufacturers.

.2 Source Limitations:

.1 Acoustical Ceiling Panel: Obtain each type through one source from a single manufacturer.

.2 Suspension System: Obtain each type through one source from a single manufacturer.

.3 Mock-ups: Build mock-ups to verify selections made under sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

.1 Build mockup of typical ceiling area as shown on Drawings or directed by Consultant on site.

.2 Approval of mock-ups does not constitute approval of deviations from the Contract Documents contained in mock-ups unless Consultant specifically approves such deviations in writing.

.3 Subject to compliance with requirements specified in this Section, reviewed mock-ups may become part of the completed Work if undisturbed at time of Substantial Performance of the Work.

.4 Licensed Professionals: Employ a structural Professional Engineer carrying a minimum $2,000,000.00 professional liability insurance and registered in the province of Ontario in accordance with requirements of Division 01 to:

.1 design components of the Work of this Section requiring structural performance.

.2 be responsible for full assemblies and connections

.3 be responsible for determining sizes, joint spacing to allow thermal movement and loading of components in accordance with applicable codes and regulations.

.4 be responsible for production and review of Shop Drawings.

.5 inspect work of this Section during fabrication and erection.

.6 stamp and sign each Shop Drawing.

.7 Provide site administration and inspection of this part of the Work.

.8 Submit certificate validating seismic assessment and field review of this part of the Work.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials in original packages, containers and bundles, bearing brand and manufacturer's name and ULC or cUL labels.

.2 Store materials in a covered area, off ground, on flat, smooth, dry surfaces. Protect from moisture. Remove damaged or deteriorated materials from site.

.3 Comply with ceiling panel manufacturer's recommendations regarding temperature and humidity conditions before, during and after ceiling installation.

1.9 PROJECT CONDITIONS

.1 Environmental Requirements: Continuously maintain rooms or areas scheduled to receive acoustical ceilings at not less than 21 deg C (70 deg F), and at occupancy humidity, at least 3 Days prior to installation and 3 Days after work is completed.

.2 Schedule work to eliminate risk of damage to these materials due to adverse environmental conditions in rooms or areas when and after work is installed.

1.10 WARRANTY

.1 The Contractor warrants the work of this Section for period of 3 years from Substantial Performance of the Work against defects and/or deficiencies in accordance with the General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within this warranty period, to the satisfaction of the Consultant and at no expense to the Owner.

1.11 MAINTENANCE

.1 Supply extra materials described below for the Owner's future maintenance use that match Products installed and that are packaged with protective covering for storage and identified with labels describing contents.

.1 Acoustical Tile Ceilings: Full-size panels equal to 2.0 % of quantity installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Products of the following manufacturers (or Equivalent) may be acceptable subject to conformance to requirements of Drawings, schedules and Specifications:

.1 Armstrong World Industries Canada Ltd.

.2 CGC Inc.

.3 CertainTeed Ceilings

.4 Rockfon

2.2 REGULATORY REQUIREMENTS

.1 Surface Burning Characteristics: All ceiling panels to meet fire resistance characteristics equivalent to Class A per ASTM E1264

2.3 DESIGN AND PERFORMANCE REQUIREMENTS

.1 Design suspension system to support lighting fixtures according to Ontario Hydro regulations and submit certification in accordance with Rule 30-302 (1) of the regulations;

.2 Design suspension system to support safely and without distortion entire ceiling system and superimposed loads of:

.1 lighting fixtures

.2 air supply diffusers, boots, fire alarm grilles and exhaust and return air grilles

.3 drapery tracks and drapes

.4 power grid system, where indicated

.3 Prepare panels for sprinkler head penetrations and suspension members of curtain tracks;

.4 Coordinate installation and cooperate with the mechanical and electrical Subcontractors, to accommodate mechanical and electrical items, or any other work required to be incorporated in or coordinated with the ceiling system.

.5 Professional Engineer’s Design and Certification: Employ the services of a Professional Engineer licensed to practice in the Province of Ontario carrying professional liability insurance, and who is experienced in providing engineering services of similar kind, scope and complexity to those contemplated in this Section.

.6 Seismic Design: Provide acoustical panel ceilings designed and installed to withstand the effects of earthquake motions for seismic design category of the Project according to the OBC, CAN/CSA S832 and ASTM E580 and as follows:

.1 Seismic Design Category D, E, F

2.4 MATERIALS

.1 Ceiling Suspension System: Provide suspension system complete with splices, clips, and perimeter moulding, of manufacturer's standard and aluminum types to suit applicable conditions unless special conditions and access areas are shown or specified. In high humidity areas Provide galvanized suspension system.

.1 Standard Exposed Ceiling Suspension System: ASTM C635, 15/16 face, direct-hung system; heavy-duty structural classification.

.1 Finish: Factory finished in non-yellowing, low sheen satin white enamel to Consultant's acceptance to match panels.

.2 Acceptable Products:

.1 "Series "DX Quick Release" by CGC Inc.
.2 "Prelude XL" by Armstrong World Industries
.3 "Chicago Metallic 1200 System" by Rockfon LLC
.4 "Classic Stab System" by CertainTeed Ceilings
.5 or Equivalent to the above

.3 Use with following ceiling panel types: all panel types unless noted otherwise.

.2 Acoustic Ceiling Tiles (ACT):

.1 Acoustic Ceiling Tiles (ACT-1 and ACT-2): CAN/CGSB-92.1-M and ASTM E1264

.1 Classification: Type and Form: Type III, mineral base with painted finish; Form 1, nodular or Form 2 or Type XX.
.2 Colour: White.
.3 Light Reflectance (LR): Not less than 0.85.
.4 Ceiling Attenuation Class (CAC): Not less than 22.
.5 Noise Reduction Coefficient (NRC): Not less than 0.75.
.6 Edge/Joint Detail: Square
.7 Thickness: Not less than 19 mm (3/4 inch)
.8 Modular Size:

.1 ACT-1: 610 mm by 610 mm (24 inches by 24 inches)
.2 ACT-2: 610 mm by 1220 mm (24 inches by 48 inches)

.9 Basis-of-Design Products: "Koral" by ROCKFON® or Equivalent as follows:

.1 "Eclipse™ Acoustical Panels" by CGC/USG Inc.
.2 "Cirrus" by Armstrong Ceilings
.3 "Cashmere" by CertainTeed Canada
.4 or Equivalent

2.5 ACCESSORIES

.1 Hangers: Minimum 0.104" (12 ga) overall thickness galvanized steel wire to zinc coating designation Z275, meeting "Heavy-duty" classification of ASTM C635.

.2 Seismic Stabilizer Bars, Struts and Clips: Manufacturer's standard pre-engineered units designed and tested to accommodate seismic forces for design category specified in this Section.

.3 Main Tees: 3.66 m (12') long, 23.8 mm (15/16") face width double web design, rectangular bulb at top of web, 38 mm (1-1/2") web height. Expansion cut-outs in main tees controlling buckling caused by heat expansion.

.4 Main Tee Splices: Designed to lock lengths of main tees together so that joined lengths of tee function structurally as single unit with tee faces at joint perfectly aligned and presenting tight seam.

.5 Cross Tees: 1220 mm (4') long, 25 mm (1") web height structural cross-section, design same as main tees, designed to connect at main tees forming positive lock without play, loss or gain in grid dimensions with offset over-ride of face flange over main tee flange to Provide flush joint. Provide 38 mm (1-1/2") web height of cross-tee for fire rated assemblies.

.6 Hanger Attachments:

.1 Cast-in-Place Concrete Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as indicated in ASTM C635 and as determined by testing according to ASTM E488 by an independent testing agency.

.1 Acceptable Products: “HHDCA Ceiling Hanger” by Hilti (Canada) Inc. or Equivalent.

.2 Composite Deck Anchors: Ceiling wire fastening assembly, “X-CW Ceiling Wire Assembly" by Hilti or Equivalent.

.3 Attachment to structural steel components: Comply with ASTM C754 unless otherwise indicated

.7 Panel Hold-Down Clips: As recommended by the ceiling tile manufacturer.

.8 Edge Mouldings at Ceiling Perimeters: Materials and finish to match tees.

.9 Fasteners: Galvanized and of size suited to loading conditions.

.10 Supplementary Steel Supports: Steel conforming to Section 05 50 00.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Inspect substrates and previously placed work to determine suitability and completeness. Start of work constitutes an acceptance of existing conditions, and failure of work due to unsatisfactory existing conditions shall be corrected at no cost to Owner. Similarly, if work needs to be removed to correct defects in substrates or previously placed work, both removal and replacement shall be done at no cost to the Owner.

.2 Do not commence installation until all work above suspended ceiling has been completed, inspected and accepted.

.3 Do not start installation until exterior glazing has been completed and exterior openings are closed in. Ensure wet work is completed and dried out to a degree acceptable to panel manufacturer before installation is commenced.

3.2 PREPARATION

.1 Temporary Ceiling Removal:

.1 Coordinate with metal fabricator and the electrical and mechanical trades to assess the complete scope of temporary ceiling removals to allow for metal fabrication and support framing, feeder runs, mechanical equipment and the like by the work of those Sections (note that the extent of ceiling removal has not been shown on architectural plans).

.2 Provide temporary protection, signage and barriers to protect others.

.3 Remove tile, panels and tee bar suspension from area that are required by other trades.

.4 Upon completion of the work of other trades and all required inspections, replace tee-bar and acoustic tile. Where tile or tee-bar are damaged, bent, discoloured, scratched or otherwise appear of lesser quality than surrounding area, replace with new material.

3.3 INSTALLATION

.1 Install ceiling panels and metal suspension system in accordance with applicable requirements of ASTM C636, reviewed Shop Drawings and manufacturer's directions.

.2 Install ceiling suspension and connections components in accordance with requirements of ASTM E580 for seismic design category of the Project.

.3 Install acoustic ceilings using tradesmen skilled in this class of work, in accordance with the manufacturer's instructions and as specified herein. Where manufacturer's directions are at variance with the Contract Documents, notify the Consultant before proceeding with the work.

.4 Neatly and symmetrically Install suspended ceiling to true lines, evenly balanced to pattern indicated on Drawings or as directed.

.5 Centre ceiling system on room axis unless otherwise indicated or directed leaving equal border panels not less than 1/2 a full width.

.6 Recessed items shall replace or be centered on acoustical panels, except where shown otherwise. Consult with the trades and Subcontractors performing the work required by the mechanical and electrical Divisions of the Specifications to co-ordinate work. Provide additional supports where required.

.7 Installation of Hangers:

.1 Install supporting inserts for hangers of suspended ceiling system into concrete slab above.

.2 Do not secure hangers to metal roof deck, ductwork, conduit, piping, equipment or support system for any of these. Attach hangers to the building’s structural members instead.

.3 Secure hangers to construction above per ASTM C636 and the following requirements:

.4 Space hangers for suspended ceilings to support ceiling grids independent of walls, columns, pipes and ducts and as follows:

.1 maximum 1220 mm (4') centres along support grillage,
.2 not more than 150 mm (6") from ends,
.3 within 150 mm (6”) from each corner
.4 maximum of 1220 mm (4’) around fixture perimeters.
.5 Provide an additional hanger at each corner of each opening to receive a recessed lighting fixture and each opening that has been framed by main beam members.
.6 Provide additional hangers at each diffuser, grille and other points of extra loading.

.5 If ductwork or equipment located in ceiling plenum area interferes with hanger spacing, Provide a trapeze or other arrangement reviewed by the Consultant to support main beams at proper spacing.

.8 Installation of Suspended Grid: Install direct-hung grid lay-in acoustic panel ceilings where shown. Install main tees, cross tees, and wall mouldings so bottom flanges are in flat, level plane at finish ceiling elevations.

.1 Lay out and erect grid system to Provide following panel patterns as shown:

.1 2x4 Pattern (610 mm x 1220 mm): Main beam tees spaced 1220 mm (48") oc and cross tees 610 mm (24") oc unless reviewed otherwise.

.2 2x2 Pattern (610 mm x 610 mm):Main beam tees spaced at 1220 mm (48") o.c, primary cross tees spaced at 610 mm (24") o.c and secondary cross tees spaced at 610 mm (24") o.c.

.2 Securely tie members to hangers. Properly lock main tees and cross tees at intersections. Assemble framework to form a rigid and interlocking system.

.9 Installation of Trims and Mouldings:

.1 At locations where ceilings abut walls, columns and other vertical surfaces, Install continuous wall moulding to trim ceiling edges. Install moulding with bottom horizontal leg at elevation required to support acoustic panel and to be flush with bottom flange of grid members, and with vertical leg concealed.

.2 Bolt mouldings to supporting construction at 610 mm (24") on centres and within 150 mm (6") of end of each moulding piece. Provide tight, inconspicuous butt joints in moulding if several pieces are required in any one run.

.3 At recessed-grid system for reveal-edge ceiling tiles, Install "W" shaped wall moulding, of profile specified in this Section, to retain recessed detail at ceiling perimeters.

.4 Fit panels moderately tight between upright legs of members. Cut panels neatly and accurately to fit closely around items piercing the finish ceiling plane. Provide special shapes and sized to Provide a complete installation by cutting panels to fit into less than full size openings.

.5 Secure each panel into grid opening with concealed hold-down clips.

3.4 ADJUSTING AND CLEANING

.1 After interior finishing work has been substantially completed, or when directed by the Consultant, inspect ceiling work. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members.

.2 Comply with the manufacturer's written instructions for cleaning and touchup of minor finish damage.

.3 Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

.4 Upon completion of the Project, finished surfaces shall be clean and free from dirt and other markings and in a good condition acceptable to the Consultant.

END OF SECTION

SEE ADD#16
Q#380

PART 1 - GENERAL

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL INSTRUCTIONS

.1 Read and conform to:

.1 the General Conditions and the Supplementary Conditions of the Contract;

.2 Division 1 requirements and documents referred to therein.

1.3 SUMMARY

.1 Work Included: Provide resilient rubber tile flooring including but not limited to the following:

.1 resilient rubber tile flooring.

.2 preparation of substrate.

.3 moisture reduction barrier.

.4 metal reducing strips and thresholds at junction with adjacent architectural finishes.

.2 Related Requirements: Specifications throughout the entirety of the Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.4 REFERENCES

.1 Reference Standards: Latest published editions of reference standards listed in this Section in effect as of the closing date and time of the Request for Tenders for the Contract, including any amendments adopted, are applicable unless otherwise indicated.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meetings:

.1 Prior to starting work of this Section, convene a pre-installation meeting at the Project site to review the Project requirements and site conditions with pertinent parties. Conform to requirements of Division 01.

1.6 SUBMITTALS

.1 Product Data: Submit manufacturer's literature and data sheets for each type of material provided under this Section for the Project in accordance with requirements of Division 01.

.2 Safety Data Sheets (SDS): Submit SDS for inclusion in Operation and Maintenance Manual specified in Division 01, for adhesives, sealants and any other material designated by Consultant.

.3 Maintenance Instructions: Submit 3 copies of Product maintenance manual to the Consultant prior to completion of the Work. The manual shall contain specific maintenance recommendations and give specific warning of any maintenance practice or materials which may damage or disfigure resilient flooring and bases.

1.7 QUALITY ASSURANCE

.1 Qualifications: Provide the work of this Section, executed by competent installers with a minimum of 5 years' experience in the application of the Products, systems and assemblies specified herein, and with the approval and training of the Product manufacturers. Ensure rubber flooring installers are certified by the material manufacturer with successful proven experience installing similar materials.

.2 Single Source Responsibility: Ensure primary materials provided in this Section are obtained from 1 source by a single manufacturer and secondary materials are obtained from sources recommended by primary materials manufacturers.

.3 Mock-Up: Provide complete room mock-up, minimum 10 m^2 (100 sq ft), complete with integral base showing corner conditions (4 inside corners and 2 outside corners) in locations designated by the Consultant and as required to demonstrate quality of workmanship. Maintain mock-ups during construction in an undisturbed condition as a standard for judging the completed work.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Deliver and store materials undamaged in original wrappings or containers, with manufacturer's labels and seals intact. Store materials in a warm, dry area. Protect from damage due to weather, excessive temperatures, and construction operations.

.2 Deliver materials sufficiently in advance of installation to condition materials to room temperature prior to installation.

.3 Prevent damage to materials during handling and storage. Stack material not over 2 cartons in height, nor in excess of allowable floor loading. Store materials on smooth surfaces only, in an area designated by Consultant.

.4 Protect this work and the work of other trades at all times.

1.9 PROJECT CONDITIONS

.1 Environmental Requirements:

.1 Ensure ambient temperature of room and surface temperature of materials is not less than 18 deg C (65 deg F) for 48 hours before, during and after installation. Maintain minimum temperature as recommended by the Product manufacturer.

.2 Store adhesive on site 48 hours prior to installation. Remove rubber flooring from plastic wrap to facilitate equalization of temperature on site.

.3 Ensure adequate ventilation is provided during installation and curing of materials.

.4 Ensure humidity levels of spaces to receive rubber flooring are maintained at design levels for minimum 24 hours before installation.

.5 Avoid high humidity, cold drafts and abrupt temperature changes.

1.10 MAINTENANCE

.1 Extra Materials: Leave 1 carton of tile for each 93 m^2 (1000 sq ft) or less of each colour of tile installed, for the Owner's future use. Label cartons as to contents and indicate areas where tiles were used.

1.11 WARRANTY

.1 The Contractor warrants the work of this Section against defects and deficiencies in accordance with the General Conditions of the Contract. Promptly correct defects or deficiencies which become apparent within this warranty period, to the satisfaction of the Consultant. Included in this warranty is the Contractor's responsibility for all costs associated with complete system replacement of areas defects or deficiencies (at no expense to the Owner).

.1 The warranty period for the flooring system (flooring material, adhesive and installation) is a period of 8 years starting from Substantial Performance of the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Products of following manufacturers (or Equivalent) may be acceptable subject to conformance to requirements of Drawings, schedules and Specifications:

.1 Rubber Tile Flooring and Base

.1 Johnsonite/Tarkett
.2 Mondo Rubber
.3 Nora Rubber Flooring

.2 Underlayment and accessories

.1 Ardex Engineered Cements
.2 W.W. Henry Co.
.3 Koster American Corporation
.4 Mapei Inc.

2.2 REGULATORY REQUIREMENTS

.1 Provide Product with following flame spread rating and smoke developed rating when tested in accordance with following standards:

.1 Critical Radiant Flux (ASTM E648): > 0.45 watts/cm^2 – Class I

.2 Smoke Developed (ASTM E662): ≤ 450

.3 CAN/ULC-S102.2-M: Maximum Flame Spread: 100.

2.3 DESIGN AND PERFORMANCE REQUIREMENTS

.1 Provide Products free from blisters, cracks, chipped edges and corners, embedded foreign matter or other defects as required to complete flooring installation and to meet design requirements.

.2 Colour Uniformity: Use flooring from consecutive manufacturing process to maintain consistent colour match between adjacent sheets. Replace installed Products in areas that, in the opinion of the Owner of the Consultant, are showing undue colour variation.

2.4 MATERIALS

.1 Rubber Floor Tile (RUB):

.1 Tile Standard: ASTM F1344, Class I-B, Homogeneous Rubber Tile, through mottled.

.2 Wearing Surface: Smooth

.3 Thickness: 3 mm

.4 Size: 610 mm x 610 mm (24” x 24”)

.5 Colours and Patterns: to be selected by Consultant at a later date from manufactures full range.

.6 Acceptable Product: “Massetto” by Mondo or Equivalent.

.2 Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated. Do not use gypsum based materials.

.1 Underlayment: “Ultra/Plan” by Mapei Inc. or approved equivalent by Ardex Engineered Cements (or Equivalent).

.2 Patching Compound:”Plani/Patch” by Mapei Inc. or approved equivalent by Ardex Engineered Cements (or Equivalent).

.3 Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.

.4 Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edges of tiles, and in maximum available lengths to minimize running joints.

.5 Moisture Reduction Barrier: Application of systems for reduction of moisture vapour transmission and alkalinity control for concrete slab required to receive floor covering specified under this Section to be as follows:

.1 Moisture Vapour Emission Rate (MVER) Range: Ensure items provided are capable of treating high moisture vapour transmitting concrete surfaces up to 11.34 kg/93 m^2 (25 lbs/1000 sq ft) in 24 hours; Maximum Relative humidity: 100%; as determined by ASTM F1869 test.

.2 Final Product selection to suit condition encountered at time of installation. Where applicable, Provide manufacturer’s floor leveling systems for use with specified Products.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Site Verification of Conditions:

.1 Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation. Commencement of work implies acceptance of previously completed work.

.2 Substrates shall be clean and dry.

.3 Substrates shall be free of depressions, raised areas, or other defects which would telegraph through the installed resilient material.

.4 Temperature of resilient materials and substrate shall be within specified tolerances.

.5 Moisture condition and adhesive bond tests shall be performed as specified.

.6 For applications on concrete, verify curing, hardening, and sealing compounds have not been used. If there are any, do not proceed until compounds have been removed.

.7 For applications on concrete slabs "on-grade or below grade", verify vapor barrier below slab was installed. If no vapor barrier was installed, do not proceed with work unless written acceptance of such conditions is received and submitted.

.8 Be responsible to report conditions contrary to requirements that would prevent proper installation. Do not commence with work until unsatisfactory conditions have been corrected.

.9 Failure to report unsatisfactory conditions will be construed acceptance and approval of substrate conditions. Commencement of work shall imply acceptance of substrate with regard to conditions of substrate at time of installation.

3.2 PREPARATION

.1 Prepare concrete floors to receive resilient flooring in accordance with requirements of ASTM F710. Consult manufacturer for specific recommendations and prepare substrates according to manufacturer's written instructions to ensure adhesion of floor coverings.

.2 Verify that substrates are dry and free of curing compounds, sealers, and hardeners.

.3 Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, paint, dirt, silicone, or any other foreign matter detrimental to flooring application using mechanical methods recommended by manufacturer. Do not use solvents.

.4 Pre-Installation Testing:

.1 Acidity/Alkalinity and Adhesion Testing:

.1 Conduct pH test to ensure alkali salt residue is within limitations acceptable to manufacturer and to avoid adhesive failure, discoloration, shrinkage and softening of floor covering.

.2 If pH results are higher than acceptable to manufacturer, neutralize floor prior to beginning of installation. Neutralize floor by sanding, vacuuming and by application of water and mild muriatic acid as recommended by manufacturer. Retest to ensure pH levels have been neutralized.

.3 Proceed with installation only after substrates pass testing.

.2 Moisture Testing:

.1 Relative Humidity Test: Perform relative humidity test in accordance with requirements of ASTM F2170 using in situ probes and measure internal relative humidity of slab.

.1 Ensure concrete slab and air space above floor slab are at service temperature and that relative humidity of area is similar to Project’s final conditions for 48 hours prior to measuring concrete relative humidity.

.2 Conduct minimum of 3 tests for first 1,000 sq.ft and one additional test for each 1,000 sq.ft. Conduct one test near center and others around perimeter of area.

.3 Proceed with installation only after substrates have a maximum 75% relative humidity measurement.

.4 Provide results to Consultant in writing prior to commencement of installation.

.5 Do not proceed with installation until moisture problems have been corrected.

.5 Moisture Barrier Application:

.1 Apply moisture reduction barrier at following locations:

.1 Basement slabs and Slabs-on-grades (regardless of pre-installation moisture testing results)

.2 Suspended slabs where slab moisture contents are above those recommended by floor covering manufacturers at time of installation after performing pre-installation testing.

.2 Prior to applying moisture barrier, mechanically prepare concrete substrate using dustless approved method to ICRI requirements to CSP (Concrete Surface Profile) #2 (Diamond Cup Ground) or #3 (Shotblasted).

.3 Apply moisture barrier in accordance with the manufacturer's recommendations across the entire surface being treated including up to and around the perimeter of restrained surfaces such as walls and columns.

.4 Do not proceed with work until unsatisfactory conditions have been resolved.

.6 Remove sub-floor ridges and bumps. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate. Prohibit traffic until filler has cured.

.7 Vacuum, prime and seal substrate to the resilient rubber flooring manufacturer's recommendations.

.8 Underlayment:

.1 Fill depressions, dished areas, low spots, voids, gaps, cracks, joints, holes and other substrate defects with underlayment, flat, even and flush with adjacent substrate. Remove projections and repair other defects to tolerances acceptable to the manufacturer.

.2 Floor fills, toppings and underlayment shall have minimum compressive strength of 24 MPa (3500 psi). Do not Install underlayment, leveler, patching and skim coat over expansion joints.

.3 Provide underlayment to achieve a flat substrate to within the following tolerances:

.1 3 mm (1/8") total maximum deviation + and - along a 3000 mm (10') straight edge applied omni-directionally over entire floor area.

.4 Provide a flat, smooth 600 mm (24") wide underlayment strip at the junction of resilient flooring with other finish flooring materials for a flush transition at the meeting edge. Feather strip edges to conceal its perimeter.

.5 Vacuum subfloors immediately prior to installation.

3.3 INSTALLATION

.1 Comply with the manufacturer's written instructions for installing floor tile and flash coved corners and base.

.2 Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

.1 Lay tiles in pattern indicated.

.3 Match floor tiles for colour and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.

.1 Lay tiles in pattern of colours and sizes indicated.

.4 Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

.5 Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

.6 Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.

.7 Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in installation areas. Maintain overall continuity of colour and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.

.8 Adhere floor tiles to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 PROTECTION AND CLEANING

.1 Comply with manufacturer's written instructions for cleaning and protection of floor coverings.

.2 Perform the following operations immediately after completing floor covering installation:

.1 Remove factory applied wax, adhesive and other blemishes from floor covering surfaces.

.2 Sweep and vacuum floor coverings thoroughly.

.3 Damp-mop floor coverings to remove marks and soil.

.3 Protect floor coverings from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

.4 Provide and maintain necessary protection of bases. Replace damaged resilient bases with new materials at no additional cost.

.5 Cover floor coverings until Substantial Performance of the Work. Prohibit traffic on floor for 48 hours after installation.

3.5 DEMONSTRATION AND TRAINING

.1 Engage manufacturer to demonstrate cleaning and maintenance procedures to the Owner in accordance with requirements of Division 01.

END OF SECTION

SEE ADD#16
Q#380

PART 1 - GENERAL

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL INSTRUCTIONS

.1 Read and conform to:

.1 the General Conditions and the Supplementary Conditions of the Contract.

.2 Division 1 requirements and documents referred to therein.

1.3 SUMMARY

.1 Work Included: Provide resilient base including but not limited to the following:

.1 surface fillers, primer and adhesive.

.2 resilient toe bases at resilient floor areas.

.3 resilient toeless bases at carpeted areas.

.4 resilient stair accessories.

.5 resilient molding accessories

.2 Related Requirements: Specifications throughout the entirety of the Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.4 REFERENCES

.1 Reference Standards: Latest published editions of reference standards listed in this Section in effect as of the closing date and time of the Request for Tenders for the Contract, including any amendments adopted, are applicable unless otherwise indicated.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meetings:

.1 Prior to starting the work of this Section, convene a pre-installation meeting at the Project site to review the Project requirements and site conditions with pertinent parties. Conform to requirements of Division 01.

1.6 SUBMITTALS

.1 Product Data: Submit manufacturer's literature and data sheets for each type of material provided under this Section for the Project in accordance with requirements of Division 01. Ensure data sheets provide required information including detailed instructions for installing as well as maintaining, preserving and keeping materials in clean and safe conditions. Provide adequate warning of maintenance practices or cleaning agents detrimental to specified materials.

.2 Safety Data Sheets (SDS): Submit SDS for inclusion in Operation and Maintenance Manual specified in Division 01, for adhesives, sealants and any other material designated by Consultant.

.3 Shop Drawings: Submit Shop Drawings for the work of this Section in accordance with Division 01.

.1 Ensure Shop Drawings indicate material characteristics, dimensions, details of construction, joint layouts including movement joints, connections and relationship with adjacent construction.

.4 Samples: Submit samples in accordance with Division 01.

.1 Submit duplicate 610 mm (2'- 0") long sample of each type of resilient bases.

1.7 QUALITY ASSURANCE

.1 Manufacturer's Qualifications: Manufacturer shall have 5 years' experience in the successful manufacture and fabrication of flooring bases of the types and quality shown and specified herein. Submit proof of experience upon request

.2 Applicator Qualifications: Provide work of this Section executed by competent installers with a minimum of 5 years' experience in the application of Products, systems and assemblies specified herein, including 2 years in heat welding of seams and with the approval and training of the Product manufacturers. Upon request, provide proof of manufacturer's certificate to the Consultant prior to commencement of installation.

.3 Single Source Responsibility: Ensure primary materials provided in this Section are obtained from 1 source by a single manufacturer and secondary materials are obtained from sources recommended by primary materials manufacturers.

.4 Mock-Up:

.1 Build mockups to verify selections made to demonstrate aesthetic effects and set quality standards for materials and execution.

.2 Install minimum 12'-0" (3600 mm) long sections of each type of resilient base (2 inside and 2 outside corners) as directed at the site by Consultant. Do not proceed with resilient base work until quality control Mock-Up has been reviewed and accepted by Consultant.

.3 Reviewed and accepted quality control Mock-Up to be retained and serve as minimum acceptable standard for the resilient base work. Incorporate quality control Mock-Up into finished resilient base work if accepted by Consultant.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials in good condition to the Site in the manufacturer's original unopened containers that bears the name and brand of the manufacturer, Project identification, shipping and handling instructions.

.2 Store on site in designated space at minimum temperature of 20 deg C (68 deg F) for period of 48 hours immediately prior to, during and after installation. Store goods in rolls only.

1.9 PROJECT CONDITIONS

.1 Provide each flooring Product in accordance with manufacturer's recommended tolerances for:

.1 Substrate moisture content.

.2 Temperature and ventilation.

.3 Maintain relative humidity at application to % recommended by manufacturer when tested in accordance with ASTM F2170.

.2 Environmental Requirements: Air temperature and structural base temperature at base installation shall be above 20 deg C (68 deg F) for 72 hours before, during and 48 hours after installation. Allow base materials and application adhesives to acclimatize to these temperatures for 48 hours.

1.10 WARRANTY

.1 The Contractor warrants resilient bases for a period of 3 years from the date of Substantial Performance of The Work against defects and/or deficiencies in accordance with the General Conditions of the Contract.

.2 Promptly correct any defects or deficiencies which become apparent within this warranty period, to the satisfaction of the Consultant and at no expense to the Owner. Defects include but are not limited to: failure in adhesive bond and extensive colour fading.

1.11 MAINTENANCE

.1 Extra Materials: Supply to the Owner at the completion of the job 6000 mm (20'-0") of coil stock of each type of resilient base in colours specified for future repairs, boxed in original containers and clearly labeled. Extra stock shall be the same production run as the installed Products. Store extra stock in location as directed later by the Consultant.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Products of following manufacturers (or Equivalent) may be acceptable subject to conformance to requirements of the Drawings, schedules and Specifications:

.1 Flexco

.2 Johnsonite Division of Duramax Inc.

.3 Roppe.

2.2 REGULATORY REQUIREMENTS

.1 Flooring materials shall be low VOC emitting materials when tested by a qualified testing agency.

.2 Surface burning characteristics: Provide Product with the following flame spread rating and smoke developed rating when tested in accordance with the following standards:

.1 Critical Radiant Flux (ASTM E648 or NFPA 253): > 0.45 watts/cm^2 – Class I

.2 Smoke Developed (ASTM E662): ≤ 450

.3 CAN/ULC-S102.2-M: Maximum Flame Spread: 100.

2.3 DESIGN AND PERFORMANCE REQUIREMENTS

.1 Provide rubber stair treads as specified herein complete with preparation of substrate, and other accessories to complete installation to meet design requirements.

.2 Provide materials free from blisters, cracks, chipped edges and embedded foreign matter or other defects.

.3 Comply with applicable regulations regarding VOC content of adhesives.

.4 Colour Uniformity: Use treads from consecutive manufacturing process to maintain consistent colour match between adjacent installation. Replace installed Products in areas that, in the opinion of the Owner or the Consultant, are showing undue colour variation.

2.4 MATERIALS

.1 Rubber Toe Base (RB-1) (at resilient floor areas): ASTM F1861, PVC free, Type TS (rubber, vulcanized thermoset) or TP (thermoplastic rubber), Group 1 (solid, homogeneous); smooth surface with the following characteristics:

.1 Styles: Cove (base with toe)

.2 Thickness: Minimum 3.2 mm (0.125”) thick

.3 Height: 100 mm (4") unless otherwise indicated on Drawings.

.4 Lengths: Coils in manufacturer's standard length.

.5 Corners: Job-formed using adhesive, cove former fillet radius reinforcing strips, welding rod and accessories as recommended by the resilient base manufacturer.

.6 Colours: To be selected by the Consultant at a later date from the manufacturer's full range including designer colours.

.7 Acceptable Products:

.1 “Rubber Wall Base” by Johnsonite (or Equivalnet).
.2 “Marathon Rubber Cove Base” by American Biltrite (Canada) Ltd. (or Equivalnet).
.3 “Pinnacle Rubber Wall Base” by Roppe (or Equivalnet).
.4 “Wallflowers Rubber Wall Base” by Flexco (or Equivalnet).

.2 Rubber Toeless Base (RB-2) (at carpeted areas): ASTM F1861, PVC free, Type TS (rubber, vulcanized thermoset) or TP (thermoplastic rubber), Group 1 (solid, homogeneous); smooth surface with following characteristics:

.1 Styles: Straight (flat or toeless)

.2 Thickness: Minimum 3.2 mm (0.125”) thick

.3 Height: 100 mm (4")

.4 Lengths: Coils in manufacturer's standard length.

.5 Corners: Job-formed using adhesive, cove former fillet radius reinforcing strips, welding rod and accessories as recommended by resilient base manufacturer.

.6 Colours: To be selected by Consultant at a later date from manufacturer's full range including designer colours.

.7 Acceptable Products:

.1 “Rubber Toeless Wall Base” by Johnsonite (or Equivalnet).
.2 “Marathon Rubber Toeless Base” by American Biltrite (Canada) Ltd. (or Equivalnet).
.3 “Pinnacle Rubber Wall Base” by Roppe (or Equivalnet).

.3 Molding Accessories and Transitions (TRANSITION 3)

.1 Description: Provide resilient caps for cove resilient flooring, reducer strips for resilient flooring, joiners for tile and carpet and transition strips as noted on the Drawings and Schedules or where metal transitions are not indicated.

.2 Profile and Dimensions: As recommended by the manufacturer.

.3 Colours and Patterns: As selected by the Consultant from a full range of industry colours.

.4 Acceptable Manufacturer: Johnsonite or Equivalent.

2.5 ACCESSORIES

.1 Surface fillers and primers: Types and brands approved, acceptable to the resilient base manufacturers for applicable conditions. Use non-shrinking latex compound.

.2 Resilient base adhesives: Best quality, waterproof, clear setting type and brands as recommended by the resilient base manufacturer and meeting VOC limits stipulated herein.

.3 Stair-Tread Nose Filler: Two-part epoxy compound recommended by the resilient stair-tread manufacturer to fill nosing substrates that do not conform to tread contours.

.4 Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edges of flooring, and in maximum available lengths to minimize running joints.

.5 Joint Sealant: Provide CAN/CGSB-19.24-M, multi-component modified urethane base chemical curing sealing material compatible with adjacent materials finish and as recommended by resilient base manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Site Verification of Conditions:

.1 Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation. Commencement of work implies acceptance of previously completed work.

.2 Ensure concrete floors are fully cured. Verify concrete floor dryness by using test methods recommended by flooring manufacturer.

.3 Verify curing, hardening or other admixtures have been used and if used ensure these compounds have been removed.

.4 Installation of flooring shall be considered an acceptance of surfaces to be covered. If repair of surfaces is required after commencement of flooring work it shall be included as part of the Work specified herein.

3.2 PREPARATION

.1 Substrates shall be:

.1 dry and clean;

.2 free of cracks, ridges, depressions, raised areas or other defects which would telegraph through and interfere with adhesion and installation of flooring;

.3 temperature of resilient flooring and substrate shall be within specified tolerances;

.2 Perform moisture and adhesive bond test.

.3 Perform adhesive bond test in each major area, minimum 1 per 93 m^2 (1000 sq ft), prior to installation. Examine after 72 hours to determine whether bond is solid and no moisture is present. Do not proceed with work until results of bond test are acceptable.

.4 Concrete shall have dampness no greater than that recommended by the flooring and adhesive manufacturers when tested with moisture meter. Where floors exhibit negative alkalinity, carbonization or dusting conform to manufacturers' recommendations for removal of these elements that are detrimental to the work.

.5 Be responsible to report conditions contrary to requirements that would prevent proper installation. Do not commence work until unsatisfactory conditions have been corrected.

.6 Failure to report unsatisfactory conditions will be construed acceptance and approval of substrate conditions. Commencement of the work of this Section shall imply acceptance of substrate with regard to conditions of substrate at time of installation.

.7 Prepare horizontal concrete substrates according to ASTM F 710.

.8 Pre-Installation Testing:

.1 Acidity and Alkalinity Test:

.1 Conduct pH test to ensure alkali salt residue is within limitations acceptable to manufacturer and to avoid adhesive failure, discoloration, shrinkage and softening of floor covering.

.2 If pH results are higher than acceptable to manufacturer, neutralize floor prior to beginning of installation. Neutralize floor by sanding, vacuuming and by application of water and mild muriatic acid as recommended by manufacturer. Retest to ensure pH levels have been neutralized.

.2 Relative Humidity Test:

.1 Perform relative humidity test in accordance with requirements of ASTM F2170 using in situ probes and measure internal relative humidity of slab. Ensure concrete slab and air space above floor slab are at service temperature and that relative humidity of area is similar to the Project's final conditions for 48 hours prior to measuring concrete relative humidity.

.2 Conduct a minimum of 3 tests for first 1,000 sq.ft and one additional test for each 1,000 sq.ft. Conduct one test near center and others around perimeter of area.

.3 Ensure relative humidity probe test results do not exceed 75% unless recommended otherwise by flooring manufacturer(s) in writing. Do not proceed with installation until moisture problems have been corrected. Provide results to the Consultant prior to commencement of installation.

3.3 INSTALLATION

.1 Resilient Bases:

.1 Resilient base work shall be performed by experienced and competent workers in strict accordance with manufacturers' written instructions for material concerned.

.2 Fill cracks or irregularities with crack filler approved by resilient base manufacturer. Provide a solid backing over entire area behind resilient base.

.3 Immediately before installation, sweep and vacuum clean substrates to be covered by resilient Products

.4 Apply primer in strict accordance with manufacturer's written instructions. Permit primer to dry.

.5 Apply adhesive evenly and continuously with an approved notchtooth spreader at the recommended rate for full base adhesion and contact. Mechanical spreader not approved. Do not apply adhesive in a manner which promotes induced waviness in resilient base. Do

not spread more adhesive than can be covered before initial set takes place. Use waterproof adhesive throughout.

.6 Mix and spread adhesive evenly, in quantities which can be covered by resilient base within the adhesive's working time. If the adhesive over-dries, completely remove it using solvents compatible with adhesive and re-apply adhesive. Do not soil walls, bases, fitments, finish carpentry work or adjacent surfaces with adhesive. Promptly remove all excess and spillage of adhesive.

.7 Unroll coils of resilient base. Place resilient base flat to loosen coil set.

.8 Set wall base in adhesive tightly against wall and floor surfaces. Use lengths as long as practicable and not less than 500 mm (20") long.

.9 Install resilient bases to walls, columns and fitments as indicated on the Drawings, during final stages of completion of work, when ceilings and permanent partitions are finished, when prime paint coats are applied and when surface conditions are suitable for installation.

.10 Set resilient base in adhesive to produce a positive, permanent bond without gaps, tight against vertical and floor surfaces for a uniform fit.

.11 Install resilient base straight and level with maximum height variation of 1:1000, having vertical, tight and flush "hairline" butt joints with no two joints closer than 2' - 0" (610mm) apart.

.12 Roll resilient base with clean, polished 5 lbs.(2.27 kg) roller, against vertical and floor surfaces to ensure full bonding to surfaces.

.13 Ensure that installation of resilient base is tight, firm, and free of bubbling and separation of any kind from surfaces. Remove defective installation as directed by the Consultant and Install new resilient base as specified herein.

.14 Resilient base work shall be handed over to the Owner free of blemishes and in perfect condition.

.15 Job-Formed Corners:

.1 Accurately scribe and fit resilient base to metal frames and other obstructions.

.2 Outside Corners: Use straight pieces of maximum lengths possible. External corners shall be wrapped around corners as sharp as possible by scoring the back. Form without producing discoloration (whitening) at bends. Shave back of base at points where bends occur and remove strips perpendicular to length of base that are only deep enough to produce a snug fit without removing more than half the wall base thickness.

.3 Inside Corners: Provide mitred internal corners. Use straight pieces of maximum lengths possible. Shave back of base where necessary to produce a snug fit to substrate.

.2 Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.4 CLEANING

.1 Remove excess adhesive from floor, base and wall surfaces without damage.

.2 Clean, seal and wax floor and base surface to flooring manufacturer's instructions.

.3 Sweep and vacuum horizontal surfaces thoroughly.

.4 Damp-mop horizontal surfaces to remove marks and soil.

3.5 PROTECTION

.1 Protect installed flooring as recommended by flooring manufacturer against damage from rolling loads, other trades or placement of fixtures and equipment.

.2 Prohibit traffic on floor for 48 hours after installation.

END OF SECTION

PART 1 - GENERAL

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL INSTRUCTIONS

.1 Read and conform to:

.1 the General Conditions and the Supplementary Conditions of the Contract.

.2 Division 01 requirements and documents referred to therein.

1.3 SUMMARY

.1 Work Included: *Provide* static dissipative resilient flooring including but not limited to following:

.1 substrate preparation.

.2 static dissipative resilient flooring.

.3 moisture reduction barrier.

.4 reducing strips and thresholds at junction with adjacent architectural finishes.

.2 Related Requirements: Specifications throughout the entirety of Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.4 REFERENCES

.1 Reference Standards: Latest published editions of reference standards listed in this Section in effect as of the closing date and time of the Request for Tenders for the Contract, including any amendments adopted, are applicable unless otherwise indicated.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meetings:

.1 Prior to starting work of this Section, convene a pre-installation meeting at Project site to review Project requirements and site conditions with pertinent parties. Conform to requirements of Division 01.

.2 In particular address the following items:

.1 Prior to commencing work of this Section arrange for manufacturer's technical representative to review with Contractor and Consultant, procedures to be adopted and conditions under which work shall be performed. Inspect surfaces to determine adequacy of existing and proposed conditions.

.2 Ensure Division 3 requirements for concrete are compatible with requirements of this Section. Ensure following meet acceptable criteria to ensure proper performance floor covering work:

.3 floor flatness and floor levelness requirements for static dissipative resilient flooring installation and their acceptability by flooring manufacturer;

.4 surface texture of finished floor required for static dissipative resilient flooring installation;

.5 acceptable approaches to remediation of high moisture and high pH floors;

.6 adhesive application and floor covering installation.

.7 Co-operate fully with other Subcontractors on the Work and promptly proceed with work of this Section as rapidly as job conditions permit.

.8 Co-operate with other Sections for application of all miscellaneous specialties.

.9 Supply items to be built-in in ample time to be incorporated into work of other Subcontractors, together with measurements and other information required for location of it.

.10 Ensure work which may create dust does not proceed during work related to painting and final finishing.

1.6 SUBMITTALS

.1 Product Data: Submit manufacturer's literature and data sheets for each type of material provided under this Section for *Project* in accordance with requirements of Division 01. Ensure data sheets provide required information including detailed instructions for installing as well as maintaining, preserving and keeping materials in clean and safe conditions. Provide adequate warning of maintenance practices or cleaning agents detrimental to specified materials.

.2 Safety Data Sheets (SDS): Submit SDS for inclusion in Operation and Maintenance Manual specified in Division 01, for adhesives, sealants and any other material designated by Consultant.

.3 Shop Drawings:

.1 Submit *Shop Drawings* for work of this Section in accordance with Division 01. Submit *Shop Drawings* for all areas showing the following:

.1 seam layout for seams between rolls;

.2 coving details, treatment at walls and floor drains;

.3 treatment where flooring meets dissimilar materials and all other special conditions.

.2 Obtain reviewed *Shop Drawings* from *Consultant* prior to commencement of resilient flooring application.

.4 Site Quality Control Submittals: Submit a diagram of area showing locations and results of each of the following tests as required by pre-installation testing:

.1 Acidity and alkalinity test

.2 Relative humidity test

.5 Samples:

.1 Submit samples in accordance with Division 01.

.2 Submit duplicate 300 mm x 300 mm (12" x 12") sample pieces of sheet material, 300 mm (12") long integral base. Where applicable nosing, feature strips, treads, edge strips and applicable accessories.

.3 Submit samples for welding rod, each type of seam specified, to indicate quality of joint treatment, and each type of flooring accessory.

.4 Submit sample of internal and external corner of coved base having fused seams as specified.

.6 Operating and Maintenance Instructions Manual: Provide maintenance data for resilient flooring for incorporation into maintenance manual specified in Division 01.

1.7 QUALITY ASSURANCE

.1 Qualifications:

.1 Manufacturers: Provide Products for Work of this Section by manufacturer with minimum 10 years' experience in the manufacture of such materials.

.2 Installers: Provide work of this Section executed by competent installers with minimum 5 years' experience in the application of Products, systems and assemblies specified and with approval and training of the Product manufacturers.

.2 Single Source Responsibility: Ensure primary materials provided in this Section are obtained from 1 source by a single manufacturer and secondary materials are obtained from sources recommended by primary materials manufacturers.

.3 *Mock-Ups*:

.1 Lay a typical interior flooring area of approximately 10 m² (100 sq ft) in a permanent location within the building to be designated by *Consultant*. Include [2 steps,] [integral base,] each threshold condition, fused joint treatment and perimeter joint sealant.

.2 Sample flooring area, once accepted, shall become a permanent part of *Project* and shall be the standard of workmanship against which the balance of static dissipative resilient sheet flooring work will be judged.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials in good condition to site in manufacturer's original unopened containers that bears name and brand of manufacturer, *Project* identification, shipping and handling instructions.

.2 Store on site in designated space at minimum temperature of 20 deg C (68 deg F) for period of 48 hours immediately prior to, during and after installation. Store sheet goods on ends of rolls only.

1.9 PROJECT CONDITIONS

.1 Environmental Requirements: Air temperature and structural base temperature at flooring installation shall be above 20 deg C (68 deg F) for 72 hours before, during and 48 hours after installation. Allow flooring materials and application adhesives to acclimatize to these temperatures for 48 hours.

.2 Do not allow traffic on floor for following duration of time (after installation): 24 hours for walking traffic; 48 hours for light static loads; and 72 hours for heavy traffic or static loads.

1.10 MAINTENANCE

.1 Extra Materials: *Supply* to *Owner* at completion of job, 3% gross area as spare flooring of each colour, packaged in original cartons. Maintenance materials shall be same production run as installed materials.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Products of following manufacturers may be acceptable subject to conformance to requirements of Drawings, Schedules and Specifications:

.1 Flexco

.2 Forbo Industries

.3 Roppe.

.2 Comparable *Products* from manufacturers listed herein will be considered provided they meet the requirements of this *Specification*, offering functionally, aesthetically equivalent products in *Consultant's* opinion and subject to *Consultant's* review.

2.2 REGULATORY REQUIREMENTS

.1 Provide Product with following flame spread rating and smoke developed rating when tested in accordance with following standards:

.1 Critical Radiant Flux (ASTM E648): > 0.45 watts/cm2 – Class I

.2 Smoke Developed (ASTM E662): ≤ 450

.3 CAN/ULC-S102/S102.2-M: Maximum Flame Spread: 100.

.2 Electrical Resistance: EC: 2.5 x 10^4 – 10^6 ohms surface to ground; SD 1 x 10^6 - 10^8 ohms surface to ground; when tested according to NFPA 99, ASTM F150, EOS/ESD S7.1.

.3 Static Load Limit: 970 pounds per square inch when tested in accordance with ASTM F 970-00, Standard Test Method for Static Load Limit.

.4 Slip Resistance: EC/SD floor covering shall meet or exceed ADA recommendations of 0.6 for flat surfaces when tested in accordance with ASTM D2047.

.5 Castor Resistance: EN 425: Suitable for Office Chair Castors.

.6 Ensure that floor finishes specified in this Section do not exceed a maximum of 300 for flame spread rating and a maximum 300 for smoke developed classification when tested in accordance with CAN/ULC S102.2, unless otherwise indicated.

.7 In exit stairways, vestibules to exit stairs, lobbies, and service spaces / service rooms, ensure that floor finishes specified in this Section do not exceed a maximum of 25 for flame spread rating and a maximum 50 for smoke developed classification when tested in accordance with CAN/ULC S102.2.

2.3 DESIGN AND PERFORMANCE REQUIREMENTS:

.1 Provide Products free from blisters, cracks, chipped edges and corners, embedded foreign matter or other defects. Ensure materials contain no PVC.

2.4 MATERIALS

.1 Static Dissipative Resilient Flooring (SHV-SD): ASTM F1913, non-backed, non-layered, homogenous vinyl composition composed of polyvinyl chloride resin, stabilizers, fillers and pigments for use on approved slab on grade and suspended floors, maximum 3 colours and *Product* design selected by *Consultant* from manufacturer's full range:

.1 Tile:

.1 Size: 304 mm x 304 mm (12 inch x 12 inch)

.2 Thickness: 2.00 mm (0.08") thick

.3 Acceptable Products:

.1 Colorex EC/SD by Forbo Industries.
.2 Roppe ESD by Roppe.
.3 Flexco ESD Vinyl flooring by Flexco.

.2 Primers and Adhesives: Waterproof, of types recommended by resilient homogenous flooring manufacturer for specific material on applicable substrate, above, on or below grade.

.3 Sub-Floor Filler: Fast setting, white premix latex requiring water only to produce cementitious paste to manufacturer's recommendations.

.4 Metal Edge Strips: Aluminum extruded, smooth, mill finish and polished with lip to extend under floor finish, shoulder flush with top of adjacent floor finish.

.5 Moisture Reduction Barrier: Application of systems for reduction of moisture vapour transmission and alkalinity control for concrete slab required to receive floor covering specified under this Section to be as follows:

.1 Moisture Vapour Emission Rate (MVER) Range: Ensure items provided are capable of treating high moisture vapour transmitting concrete surfaces up to 11.34 kg/93 m^2 (25 lbs/1000 sq ft) in 24 hours; Maximum Relative humidity: 100%; as determined by ASTM F1869 test.

.2 Final *Product* selection to suit condition encountered at time of installation. Where applicable, Provide manufacturer's floor leveling systems for use with specified Products.

.3 *Provide* 1 of following:

.1 "Planiseal Series – Moisture Barrier Systems" by MAPEI Inc.;

.2 "Ardex Moisture Control Systems" by Ardex Engineered Cements;

.3 "Koester VAP I - 2000" by Koester USA Moisture Control System.

.4 Approved proprietary equivalent moisture control system recommended in writing by floor covering manufacturer and approved by *Consultant* in order to authenticate floor covering warranties.

.6 Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated. Do not use gypsum-based materials. Refer to Section 03 54 16.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Site Verification of Conditions:

.1 Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation. Commencement of work implies acceptance of previously completed work.

.2 Ensure concrete floors are fully cured. Verify concrete floor dryness by using test methods recommended by flooring manufacturer.

.3 Verify curing, hardening or other admixtures have been used and if used ensure these compounds have been removed.

.4 Installation of flooring shall be considered an acceptance of surfaces to be covered. If repair of surfaces is required after commencement of flooring work it shall be included as part of the work specified herein.

.5 Substrates shall be:

.1 dry and clean;

.2 free of depressions, raised areas or other defects which would telegraph through installed flooring;

.3 temperature of resilient flooring and substrate shall be within specified tolerances;

.4 perform moisture and adhesive bond test.

.5 Perform adhesive bond test in each major area, minimum 1 per 93 m^2 (1000 sq ft), prior to installation. Examine after 72 hours to determine whether bond is solid and no moisture is present. Do not proceed with work until results of bond test are acceptable.

.6 Concrete shall have dampness no greater than recommended by flooring and adhesive manufacturers when tested with moisture meter. Where floors exhibit negative alkalinity, carbonization or dusting conform to manufacturers' recommendations for removal of these elements detrimental to work.

.7 Be responsible for reporting conditions contrary to requirements that would prevent proper installation. Do not commence with *Work* until unsatisfactory conditions have been corrected.

.8 Failure to report unsatisfactory conditions will be construed acceptance and approval of substrate conditions. Commencement of *Work* shall imply acceptance of substrate with regard to conditions of substrate at time of installation.

.9 Pre-Installation Testing:

.1 Acidity and Alkalinity Test:

.1 Conduct pH test to ensure alkali salt residue is within limitations acceptable to manufacturer and to avoid adhesive failure, discoloration, shrinkage and softening of floor covering.

.2 If pH results are higher than acceptable to manufacturer, neutralize floor prior to beginning of installation. Neutralize floor by sanding, vacuuming and by application of water and mild muriatic acid as recommended by manufacturer. Retest to ensure pH levels have been neutralized.

.2 Relative Humidity Test:

.1 Perform relative humidity test in accordance with requirements of ASTM F2170 using in situ probes and measure internal relative humidity of slab. Ensure concrete slab and air space above floor slab are at service temperature and that relative humidity of area is similar to Project's final conditions for 48 hours prior to measuring concrete relative humidity.

.2 Conduct minimum of 3 tests for first 1,000 sq.ft and one additional test for each 1,000 sq.ft. Conduct one test near center and others around perimeter of area.

.3 Ensure relative humidity probe test results do not exceed 75% unless recommended otherwise by flooring manufacturer(s) in writing. Do not proceed with installation until moisture problems have been corrected. *Provide* results to *Consultant* prior to commencement of installation.

3.2 PREPARATION

.1 Prepare concrete floors to receive resilient sheet flooring in accordance with requirements of ASTM F710. Consult individual manufacturer for their specific recommendations and follow them as required.

.2 For existing floors conduct non-chemical methods of removal such as abrasive cleaning or blast cleaning, including methods described in ASTM D4259 on existing concrete slabs with deleterious residues.

.3 Moisture Barrier:

.1 Apply moisture reduction barrier at following locations:

.1 Basement slabs and Slabs-on-grades (regardless of pre-installation moisture testing results)

.2 Suspended slabs where slab moisture contents are above those recommended by floor covering manufacturers at time of installation after performing pre-installation testing.

.2 Prior to applying moisture barrier, mechanically prepare concrete substrate using dustless approved method to ICRI requirements to CSP (Concrete Surface Profile) #2 (Diamond Cup Ground) or #3 (Shotblasted).

.3 Apply moisture barrier in accordance with manufacturer's recommendations across entire surface being treated including up to and around perimeter of restrained surfaces such as walls and columns.

.4 Do not proceed with work until unsatisfactory conditions have been resolved.

.4 Clean floor free of paint, oil, dirt or any other foreign matter detrimental to sheet flooring application.

.5 Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes and other defects with sub-floor filler.

.6 Clean floor and apply filler; trowel and float to leave smooth, flat hard surface. Prohibit traffic until filler has cured.

.7 Vacuum, prime and seal substrate to static dissipative resilient flooring manufacturer's recommendations.

3.3 INSTALLATION

.1 *Install* flooring in accordance with manufacturer's installation procedures and as specified herein. Mix and apply adhesives to manufacturer's recommendations.

.2 *Install* flooring wall to wall before installation of floor set cabinets, casework, furniture, equipment and fixed partitions.

.3 Apply adhesive uniformly using recommended trowel. Do no spread more adhesive than can be covered by flooring before initial set takes place.

.4 Lay static dissipative resilient sheet flooring using heat seam and welding rod process. Prepare heat welded seams with special tool for this purpose and heat weld with vinyl welding rod in seams. Use method and sequence or work in conformance with approved *Shop Drawings* and in conformance with manufacturer's recommendations. Finish seams flush and free from voids, recesses and raised areas. Lay flooring (with seams parallel to building lines) to produce a minimum number of seams. Border widths minimum 1/3 width of full material. Lay static dissipative sheet flooring true, level and with even tight joints. Fit borders accurately as required.

.5 Run sheets parallel to length or width of room as approved. Double cut sheet joints and continuously seal.

.6 As installation progresses, roll flooring with 45 kg (100 lb) roller to ensure full adhesion. Keep edges of sheet flooring at seams devoid of extra adhesive.

.7 Cut flooring neatly around fixed objects. *Provide* borders around permanent fixtures.

.8 *Install* floor markings where indicated. Fit joints tightly.

.9 *Install* flooring in pan type floor access covers. Maintain floor pattern.

.10 Continue flooring over areas which will be under built-in furniture.

.11 Continue flooring through areas to receive movable type partitions without interrupting floor pattern.

.12 Terminate flooring at centreline of door in openings where adjacent floor finish or colour is dissimilar.

.13 *Install* metal edge strips at unprotected or exposed edges where flooring terminates.

.14 Tile

.1 Ensure permanent HVAC is on operation and set at a minimum of 68o F (20o C) at least one week prior to installation. Acclimate material to jobsite conditions for a minimum of 48 hrs. prior to installation.

.2 Conduct moisture tests on all concrete slabs regardless of age or grade level. Concrete moisture vapor emissions shall not exceed 3.0 lbs per 1000 sq. ft. in 24 hrs; Measure the relative humidity in the center of the concrete slab in accordance with ASTM F2170. Relative humidity shall not exceed 75%.

.3 Conduct pH test to ensure it does not exceed a pH of 10.

.4 Use adhesive, patching and leveling compounds as recommended by manufacturer. Conduct adhesive mat bond test to ensure proper working time of adhesive.

.5 *Install* tiles on approved substrates, *Install* tile in alternating directions (quarter turned). Install tiles into wet adhesive and roll immediately with a 100 lb. roller. Always check for proper adhesive transfer. Ensure complete wet transfer of adhesive to tile backing.

.6 Do not allow heavy traffic or rolling loads for a minimum of 72 hours following the installation.

.15 Resilient Base

.1 *Install* resilient bases to walls and fitments as indicated on the *Drawings* and Room Finish Schedule, during final stages of completion of work, when ceilings and permanent partitions are finished, when prime paint coats are applied and when surface conditions are suitable for installation.

.16 Set resilient base in adhesive to produce a positive, permanent bond without gaps, tight against vertical and floor surfaces for a uniform fit.

.17 *Install* resilient base straight and level with maximum height variation of 1:1000, having vertical, tight and flush "hairline" butt joints with no two joints closer than 2' - 0" (610mm) apart. *Provide* mitred internal corners. External corners shall be wrapped around corners as sharp as possible by scoring the back.

3.4 CLEANING

.1 Remove excess adhesive from floor, base and wall surfaces without damage.

.2 Clean and seal floor and base surface to flooring manufacturer's instructions.

.3 Conform to manufacturers' maintenance instructions for complete routine maintenance.

3.5 PROTECTION

.1 Protect installed flooring as recommended by flooring manufacturer against damage from rolling loads, other trades or placement of fixtures and equipment.

.2 Prohibit traffic on floor for 48 hours after installation.

3.6 DEMONSTRATION AND TRAINING

.1 Engage manufacturer to demonstrate cleaning and maintenance procedures to Owner in accordance with requirements of Division 01.

END OF SECTION

SEE ADD#15
Q#364

SEE ADD#16
Q#380

PART 1 - GENERAL

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL INSTRUCTIONS

.1 Read and conform to:

.1 the General Conditions and the Supplementary Conditions of the Contract;

.2 Division 1 requirements and documents referred to therein.

1.3 SUMMARY

.1 Work Included: Provide athletic flooring including but not limited to the following:

.1 underlayment.

.2 athletic flooring.

.3 resilient base.

.4 reducing strips.

.5 moisture reduction barrier.

.2 Related Requirements: Specifications throughout the entirety of the Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.4 REFERENCES

.1 Reference Standards: Latest published editions of reference standards listed in this Section in effect as of the closing date and time of the Request for Tenders for the Contract, including any amendments adopted, are applicable unless otherwise indicated.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meetings:

.1 Prior to starting work of this Section, convene a pre-installation meeting at the Project site to review Project requirements and site conditions with pertinent parties. Conform to requirements of Section 01 30 00.

1.6 SUBMITTALS

.1 Product Data: Submit manufacturer's literature and data sheets for each type of material provided under this Section for the Project in accordance with requirements of Section 01 30 00. Ensure data sheets provide required information including detailed instructions for installing as well as maintaining, preserving and keeping materials in clean and safe conditions. Provide adequate warning of maintenance practices or cleaning agents detrimental to specified materials.

.2 Safety Data Sheets (SDS): Submit SDS for inclusion in Operation and Maintenance Manual specified in Section 01 70 00, for adhesives, sealants and any other material designated by Consultant.

.3 Shop Drawings:

.1 Submit Shop Drawings for the work of this Section in accordance with Section 01 30 00. Submit Shop Drawings for all areas showing the following:

.1 seam layout for seams between rolls;
.2 coving details, treatment at walls and floor drains;
.3 treatment where flooring meets dissimilar materials and all other special conditions.

.2 Obtain reviewed Shop Drawings from the Consultant prior to commencement of resilient flooring application.

.4 Site Quality Control Submittals: Submit a diagram of the area showing locations and results of each of the following tests as required by pre-installation testing:

.1 Calcium chloride test

.2 Acidity and alkalinity test

.3 Relative humidity test

.5 Samples: Submit samples in accordance with Section 01 30 00. Submit the following samples in sizes indicated:

.1 Athletic flooring 300 mm (12") square.

.2 Resilient base 300 mm (12") long.

.3 Resilient caps 300 mm (12") long.

.4 Reducing strips 300 mm (12") long.

.6 Maintenance Instructions: Submit 3 copies of the Product maintenance manual to the Consultant prior to completion of the Work. The manual shall contain specific maintenance recommendations and give specific warnings of any maintenance practices or materials which may damage or disfigure athletic flooring and bases.

1.7 QUALITY ASSURANCE

.1 Qualifications: Provide the work of this Section executed by competent installers with a minimum of 5 years' experience in the application of the Products, systems and assemblies specified herein and with the approval and training of the Product manufacturers.

.2 Colour Uniformity: Sheet flooring used shall be from consecutive manufacturing process to maintain consistent colour match between adjacent sheets. Installed areas showing undue colour variation, in the opinion of the Owner, shall be replaced.

.3 Single Source Responsibility: Ensure primary materials provided in this Section are obtained from 1 source by a single manufacturer and secondary materials are obtained from sources recommended by primary materials manufacturers.

.4 Mock-ups: Provide complete room Mock-up, minimum 10 m2 (100 sq ft) complete with integral base showing corner conditions (4 inside corners and 2 outside corners) in locations designated by Consultant and as required to demonstrate quality of workmanship. Maintain Mock-ups during construction in an undisturbed condition as a standard for judging the completed work.

1.8 MAINTENANCE

.1 Extra Materials: Leave 1 carton of tile for each 93 m^2 (1000 sq ft) or less of each colour of flooring type installed for Owner's future use or 2% of total quality installed. Label cartons or rolls as to contents and indicate areas where tiles were used.

1.9 DELIVERY, STORAGE AND HANDLING

.1 Deliver and store materials undamaged in original wrappings or containers, with manufacturer's labels and seals intact. Store materials in warm and dry area. Store linoleum rolls upright.

.2 Deliver materials in original packaging clearly labelled with Project information, flooring materials, location and other pertinent information.

.3 Prevent damage to materials during handling and storage. Do not stack flooring materials over 2 cartons in height or in excess of allowable floor loading. Store materials on smooth surfaces only, in area designated by Consultant.

.4 Protect this work and work of other trades from damage at all times.

1.10 PROJECT CONDITIONS

.1 Environmental Requirements:

.1 Ensure ambient temperature of room and surface temperature of materials is not less than 18 deg C (65 deg F) for 48 hours before, during and after installation. Maintain minimum temperature as recommended the Product manufacturer.

.2 Ensure humidity levels of spaces to receive linoleum are maintained at design levels for a minimum 24 hours before installation.

.3 Avoid high humidity, cold drafts and abrupt temperature changes.

1.11 WARRANTY

.1 The Contractor warrants the work of this Section for a period of 10 years from Substanital Performance of the Work against defects and deficiencies in accordance with the General Conditions of the Contract. Promptly correct defects or deficiencies which become apparent within this warranty period, to the satisfaction of the Consultant. Included as part of the Contractor’s warranty obligations is the Contractor’s responsibility for all costs associated with the complete system replacement of areas by any defects and deficiencies (at no expense to the Owner). Defects include but are not limited to: material shrinkage, cracking, splitting and defective workmanship including but not limited to failure in adhesive bond, bubbling, blistering, delamination and seam failure

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Products of following manufacturers (or Equivalent) may be acceptable subject to conformance to requirements of Drawings, schedules and Specifications:

.1 Athletic Flooring:

.1 Flexco;
.2 Mondo America Inc.
.3 Compass Flooring;
.4 Gym-Con;
.5 Roppe Corporation;
.6 Edgewood Athletics;

.2 Comparable Products from manufacturers offering functionally, aesthetically equivalent Products in Consultant’s opinion and subject to Consultant’s review, listed herein will be considered provided they meet the requirements of this Specification.

2.2 DESCRIPTION

.1 Regulatory Requirements:

.1 Provide Product with following flame spread rating and smoke developed rating when tested in accordance with following standards:

.1 Critical Radiant Flux (ASTM E648): > 0.45 watts/cm^2 – Class I
.2 Smoke Developed (ASTM E662): ≤ 450
.3 Maximum Flame Spread (CAN/ULC-S102.2-M): ≤ 100.

.2 Design and Performance Requirements:

.1 Provide Products free from blisters, cracks, chipped edges and corners, embedded foreign matter or other defects.

.2 Static Load Capacity: ASTMF970, Exceeds 10.54 kg/cm² (150 psi).

2.3 MATERIALS

.1 Sports Flooring (SPF-1):

.1 Top Layer: 6 mm thick prefabricated resilient athletic flooring, calendered and vulcanized, with a base of natural and synthetic rubbers, stabilizing agents and pigmentation.

.1 Basis-of-Design: “MondoArmor” by Mondo Inc. or Equivalent;

.2 Underlayment: resilient shock absorbing underlayment; 12 mm prefabricated synthetic rubber honeycomb (elongated hexagon-shaped) base, calendered and vulcanized, with special isoprenic rubbers, mineral fillers, stabilizing agents and pigmentation, designed and engineered for heavy impact resistance.

.1 Basis-of-Design: “Baselast EX” by Mondo Inc. or Equivalent;

.3 Adhere top layer to resilient shock absorbing underlayment on-site with polyurethane adhesive.

.4 Size: Manufacturer's standard-size square tile, not less than 610 mm (24 inches) square. Sheet Products may be used in lieu of tile subject to conformance with performance and aesthetic requirements of specifications.

.5 Total Thickness: Not less than 18 mm with minimum 6 mm top layer.

.6 Colour and Pattern: As selected by Consultant from manufacturer's full range

.7 Acceptable Products: “MondoArmor Strength” by Mondo Inc. or Equivalent.

2.4 ACCESSORIES

.1 Border Tiles: Interlocking, beveled-edge tiles, of same material as floor tile, with bevels that transition from thickness of floor tile to surface below it, with straight outside edges, and for use where floor covering corners and edges do not abut vertical surfaces.

.2 Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated. Do not use gypsum based materials.

.1 Underlayment: “Ultra/Plan” by Mapei Inc. or approved equivalent by Ardex Engineered Cements (or Equivalent).

.2 Patching Compound:”Plani/Patch” by Mapei Inc. or approved equivalent by Ardex Engineered Cements (or Equivalent).

.3 Sub-Floor Filler for smoothing, patching, filling cracks, holes, voids and depressions: Fast setting cementitious patching compound requiring water only to produce cementitious paste to manufacturer's recommendations. Provide" Plani/Patch" by Mapei Inc. or Equivalent by Ardex Engineered Cements (or Equivalent).

.4 Moisture Reduction Barrier: Application of systems for reduction of moisture vapour transmission and alkalinity control for concrete slab required to receive floor covering specified under this Section to be as follows:

.1 Moisture Vapour Emission Rate (MVER) Range: Ensure items provided are capable of treating high moisture vapour transmitting concrete surfaces up to 11.34 kg/93 m^2 (25 lbs/1000 sq ft) in 24 hours; maximum relative humidity: 100%; as determined by ASTM F1869 test.

.2 Final Product selection to suit the conditions encountered at the time of installation. Where applicable, Provide the manufacturer's floor leveling systems for use with specified Products.

.3 Provide 1 of the following:

.1 "Planiseal Series – Moisture Barrier Systems" by MAPEI Inc.;
.2 "Ardex Moisture Control Systems" by Ardex Engineered Cements;
.3 "Koester VAP I - 2000" by Koester USA Moisture Control System.
.4 Approved proprietary Equivalent moisture control system recommended in writing by floor covering manufacturer and approved by the Consultant in order to authenticate floor covering warranties.

.5 Reducing Strips: Provide rubber reducing strips as manufactured by The Johnsonite Rubber Co. or Roppe or Flexco (or Equivalent). Provide materials in thicknesses to suit adjacent flooring.

.6 Primers and Adhesives: Low-VOC, waterproof of types recommended by rubber flooring manufacturer and compatible with applied curing material for specific material on applicable substrate, above, on or below grade.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Site Verification of Conditions: Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify the Consultant in writing of any conditions which would be detrimental to the installation. Commencement of work implies acceptance of previously completed work. Comply with the manufacturer's recommendations including the following:

.1 Substrates conditions (clean, dry, free of depressions, raised areas or other defects which would telegraph through the installed resilient material).

.2 Temperature of resilient materials and substrate.

.3 Moisture conditions and adhesive bond tests.

.4 Confirmation that curing, hardening, and sealing compounds have not been used on concrete. Remove such compounds before proceeding

.5 Confirmation that vapor barrier below slab has been installed for applications on concrete slabs-on-grade or below grade. Do not proceed with work unless written confirmation of such conditions is received and submitted.

.2 Pre-installation Testing:

.1 Calcium Chloride Test:

.1 Perform calcium chloride test in accordance with requirements of ASTM F1869 immediately prior to installation of linoleum flooring for moisture on concrete floors around perimeter of areas, at columns, and where moisture may be anticipated.

.2 Conduct 1 test for every 93 m² (1000 sq ft) of flooring. Moisture emission from concrete floor shall not exceed 1.5 kg/93 m² (3.5 lbs/1000 sq ft) in 24 hours. Do not proceed with installation until moisture problems have been corrected. Provide results to the Consultant in writing prior to commencement of the installation.

.2 Relative Humidity Test:

.1 Perform relative humidity test in accordance with requirements of ASTM F2170 using in situ probes and measure internal relative humidity of slab. Ensure concrete slab and air space above floor slab are at service temperature and that relative humidity of area is similar to the Project's final conditions for 48 hours prior to measuring concrete relative humidity.

.2 Conduct minimum of 3 tests for first 1,000 sq.ft and one additional test for each 1,000 sq.ft. Conduct one test near the center and others around the perimeter of area.

.3 Ensure relative humidity probe test results do not exceed 75% unless recommended otherwise by the flooring manufacturer(s) in writing. Do not proceed with installation until moisture problems have been corrected. Provide results to th eConsultant prior to commencement of installation.

.3 Acidity and Alkalinity Test:

.1 Conduct pH test in accordance with ASTM F710 to ensure alkali salt residue is within limitations acceptable to manufacturer and to avoid adhesive failure, discoloration, shrinkage and softening of floor covering.

.2 If pH results are higher than acceptable to manufacturer, neutralize floor prior to the beginning of installation. Neutralize floor by sanding, vacuuming and by application of water and mild muriatic acid as recommended by manufacturer. Retest to ensure pH levels have been neutralized.

.3 Provide acidity and alkalinity test at same frequency and at each location in which calcium chloride and relative humidity testing is performed. Do not proceed with installation until acidity problems have been corrected. Provide results to the Consultant prior to commencement of installation.

3.2 PREPARATION

.1 Clean athletic flooring substrates free of loose and adhered material perfectly clean and in accordance with athletic the flooring manufacturer's instructions.

.2 Ensure concrete substrates are dry after performing tests as specified herein before using methods recommended by athletic flooring and adhesive manufacturers, and that they exhibit no alkalinity, carbonization, dusting or scaling.

.3 Remove subfloor ridges and bumps to make substrate flush with adjacent subfloor.

.4 Moisture Barrier:

.1 Apply moisture reduction barrier at following locations:

.1 Basement slabs and Slabs-on-grades (regardless of pre-installation moisture testing results)

.2 Suspended slabs where slab moisture contents are above those recommended by floor covering manufacturers at time of installation after performing pre-installation testing.

.2 Prior to applying moisture barrier, mechanically prepare concrete substrate using dustless approved method to ICRI requirements to CSP (Concrete Surface Profile) #2 (Diamond Cup Ground) or #3 (Shotblasted).

.3 Apply moisture barrier in accordance with manufacturer's recommendations across entire surface being treated including up to and around perimeter of restrained surfaces such as walls and columns.

.4 Do not proceed with work until unsatisfactory conditions have been resolved.

.5 Fill depressions, dished areas, low spots, voids, gaps, cracks, joints, holes and other substrate defects with underlayment, flat, even and flush with adjacent substrate.

.6 Provide cementitious underlayment to achieve a flat substrate to within 3 mm (1/8") total maximum deviation along 3000 mm (10') straight edge applied omni-directionally over entire floor area.

.7 Provide a flat, smooth 600 mm (24") wide underlayment strip at junction of athletic flooring with other finish flooring materials for a flush transition at the meeting edge. Feather strip edges to conceal perimeters.

3.3 INSTALLATION

.1 Install flooring as recommended by the material manufacturer.

.2 Locate junctions of dissimilar flooring between rooms (i.e. same material but different colour, or different material) at door opening centrelines.

.3 Do not Provide athletic flooring beneath permanently concealed portions of the Work of Section 06 40 00 unless indicated otherwise.

.4 Loose lay tiles over area to be covered in staggered pattern and with tile pattern running as directed by the Consultant. Make cuts to fit tile at perimeter and at penetrations.

.5 Apply adhesive and embed tiles. Do not pressure fit tiles. Remove excess adhesive.

.6 Install flooring flush with floor plates, cleanout covers and other fitments in floor.

.7 Roll floor diagonally to expel entrapped air.

.8 Weigh down tile seams and corners if recommended by manufacturer until adhesive has set.

3.4 CLEANING

.1 Remove adhesive from surface of flooring as work progresses.

.2 Protect newly laid flooring from construction traffic for a period of 7 Days to allow flooring to bond firmly. Do not wash newly laid floor covering for minimum of 7 Days after installation to allow adhesive to set and dry. Afterwards, thoroughly clean surfaces in accordance with manufacturer's directions using cleaners as recommended by material manufacturer.

.3 Provide and maintain necessary protection of finished athletic flooring and bases. Replace damaged athletic flooring and bases with new materials at no additional cost.

END OF SECTION

SEE ADD#15
Q#366

PART 1 - GENERAL

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL INSTRUCTIONS

.1 Read and conform to:

.1 the General Conditions and the Supplementary Conditions of the Contract;

.2 Division 1 requirements and documents referred to therein.

1.3 SUMMARY

.1 Work Included: Provide seamless resin flooring including but not limited to the following:

.1 Solvent-free, two-component epoxy coating system.

.2 Fluid-Applied Flooring – Thin Coat System

.3 Fluid-Applied Flooring – Self-Leveling, Chemical-Resistant

.4 Fluid-Applied Flooring – Chemical-Resistant

.5 Auxiliary materials required for a complete installation.

.2 Related Requirements: Specifications throughout the entirety of the Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.4 REFERENCES

.1 Reference Standards: Latest published editions of reference standards listed in this Section in effect as of the closing date and time of the Request for Tenders for the Contract, including any amendments adopted, are applicable unless otherwise indicated.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meetings:

.1 Prior to starting the work of this Section, convene a pre-installation meeting at the Project site to review the Project requirements and site conditions with pertinent parties. Conform to requirements of Section 01 30 00.

1.6 SUBMITTALS

.1 Product Data: Submit manufacturer's literature and data sheets for each type of material provided under this Section for the Project in accordance with requirements of Section 01 30 00. Ensure data sheets provide required information including detailed instructions for installing as well as maintaining, preserving and keeping materials in clean and safe conditions. Provide adequate warnings of maintenance practices or cleaning agents detrimental to specified materials.

.2 Safety Data Sheets (SDS): Submit SDS for inclusion in Operation and Maintenance Manual specified in Section 01 70 00, for adhesives, sealants and any other material designated by Consultant.

.3 Shop Drawings: Submit Shop Drawings for the work of this Section in accordance with Division 01.

.1 Ensure Shop Drawings indicate material characteristics, dimensions, details of construction, joint layouts including movement joints, connections and relationship with adjacent construction.

.4 Samples: Submit 300 mm x 300 mm (12" x 12") sample of flooring for approval. Submit additional samples until approval is obtained. Make changes in aggregate mix as required to secure correct colour and texture. Label sample(s) with Project name and number, applicator, names of material and manufacturer, area where material will be applied, date of sample, colour, gloss, texture and aggregate mix proportion.

.5 Site Quality Control Submittals: Submit a diagram of the area showing the locations and results of each of the following tests as required by pre-installation testing:

.1 Calcium chloride test

.2 Acidity and alkalinity test

.3 Relative humidity test

1.7 QUALITY ASSURANCE

.1 Qualifications:

.1 Manufacturers: Provide Products for the work of this Section by a manufacturer with a minimum 10 years' experience in the manufacture of such materials.

.2 Installers: Provide work of this Section executed by competent installers with a minimum 5 years' experience in the application of the Products, systems and assemblies specified herein and with the approval and training of the Product manufacturers.

.3 Inspection and Testing Company: Retain services of an independent inspection and testing company acceptable to the Consultant to perform testing on concrete substrates to identify moisture levels in slabs. The independent inspection and testing company will be required to submit the results of tests performed to the Consultant for verification.

.2 Single Source Responsibility: Ensure primary materials provided in this Section are obtained from 1 source by a single manufacturer and secondary materials are obtained from sources recommended by primary materials manufacturers.

.3 Mock-ups: At site, in area designated by Consultant, erect sample floor area 1 m2 (10 sq ft) by required thickness as per Specifications for each type of flooring, including moisture barrier and waterproofing membrane where applicable, primer and necessary number of coats to obtain specified finish, showing colour range, bond and quality of work. Show colour range, sheen level, bond and final quality of work. Ensure Mock-up erected illustrates minimum 2 outside corners and 2 inside corner of integral cove base.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials to site in original, unopened containers with manufacturer's labels and seals intact. Labels shall identify manufacturer's name, brand name of Product, grade and type, application directions and shelf life and/or expiry date of Product.

.2 Store materials in a dry area between 10°C (50°F) and 30°C (86°F), away from direct sunlight and fire hazards.

.3 Handle and store materials in accordance with manufacturer's printed directions.

.4 Store flammable materials in safe, approved containers to eliminate fire hazards and remove from site at end of each work shift.

.5 Do not use materials that have been stored for period of time exceeding maximum recommended shelf life of materials.

1.9 PROJECT CONDITIONS

.1 Environmental Requirements:

.1 Verify concrete slab is smooth, sound, clean, free of any compounds or curing agents detrimental to topping and any materials used to correct contour of concrete slab shall be compatible with epoxy topping system.

.2 Do not apply flooring over substrate materials that contain over 3% moisture. Obtain approval of flooring manufacturer of moisture content of subfloors before proceeding with application.

.3 Maintain well-lit and well-ventilated area.

.4 Comply with the flooring manufacturer's directions for maintenance of substrate temperatures, ventilation and other conditions required to execute and protect work.

1.10 WARRANTY

.1 The Contractor warrants the work of this Section for a period of 2 years from Substantial Performance of the Work against defects and/or deficiencies in accordance with the General Conditions of the Contract.

.1 Promptly correct any defects or deficiencies which become apparent within this warranty period, to the satisfaction of the Consultant and at no expense to the Owner. Defects include but are not limited to: discolouration, fading, pinholes, cracking, peeling and leaking. Damage due to the structural failure of base, water seepage or abnormal abuse is excepted.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Products of following manufacturers (or Equivalent) may be acceptable subject to conformance to requirements of Drawings, schedules and Specifications:

.1 Mapei Inc.

.2 NEOGARD®

.3 Niagara Protective Coatings;

.4 PurEpoxy.

.5 Sherwin Williams High Performance Flooring

.6 Sika Canada Inc.

.2 Substitution Limitations: No further substitutions are acceptable.

2.2 DESIGN AND PERFORMANCE REQUIREMENTS

.1 Provide resinous flooring products manufactured and tested in accordance with ASTM C722, except modified as follows:

.2 Troweled-applied liquid flooring systems.

.1 Epoxy-Based Systems:

.1 Thickness: as specified.
.2 Minimum compressive strength: 40 MPa (6000 psi) at 7 days; ASTM C579.
.3 Minimum tensile strength: 10 MPa (1500 psi) at 7 days; ASTM C307.
.4 Minimum flexural strength: 17 MPa (2500 psi) at 7 days; ASTM C580.
.5 Shrinkage: maximum of 0.5%; ASTM C531.
.6 Water absorption: maximum of 1.0%; ASTM C413.
.7 Static coefficient of friction: minimum 0.5; ASTM D2047.
.8 Dynamic coefficient of friction: minimum 0.42; ANSI A326.3 when tested using the BOT 3000 Digital Tribometer
.9 Chemical Resistance (immersion): ASTM C267.
.10 Chemical Resistance (spot): ASTM D1308.
.11 Fungi Growth (ASTM G21): Minimum Class 1 Rating.
.12 Mould Growth (ASTM D3273): Minimum Class 10 Rating.
.13 Pull-off Strength: 100% substrate failure in accordance with ASTM D4541 or ACI 503R.

.2 Urethane Systems Requirements:

.1 Thickness: as specified.
.2 Minimum compressive strength: 40 MPa (6000 psi) at 7 days; ASTM C579.
.3 Minimum tensile strength: 7 MPa (1000 psi) at 7 days; ASTM C307.
.4 Minimum flexural strength: 14 MPa (2000 psi) at 7 days; ASTM C580.
.5 Shrinkage: maximum of 0.5%; ASTM C531.
.6 Water absorption: maximum of 1.0%; ASTM C413.
.7 Static coefficient of friction: minimum 0.5; ASTM D2047.
.8 Dynamic coefficient of friction: minimum 0.42; ANSI A326.3 when tested using the BOT 3000 Digital Tribometer
.9 Chemical Resistance (immersion): ASTM C267.
.10 Chemical Resistance (spot): ASTM D1308.
.11 Fungi Growth (ASTM G21): Minimum Class 1 Rating.
.12 Mould Growth (ASTM D3273): Minimum Class 10 Rating.
.13 Pull-off Strength: 100% substrate failure in accordance with ASTM D4541 or ACI 503R.

.3 Broadcast and Slurry Broadcast Liquid Flooring Systems.

.1 Epoxy-Based Systems Requirements:

.1 Thickness: as specified.
.2 Minimum tensile strength: 10 MPa (1500 psi) at 7 days; ASTM D638.
.3 Minimum flexural strength: 14 MPa (2000 psi) at 7 days; ASTM D790.
.4 Water absorption: maximum of 1.0%; ASTM C413.
.5 Static coefficient of friction: minimum 0.5; ASTM D2047.
.6 Chemical Resistance (spot): ASTM D1308.
.7 Fungi Growth (ASTM G21): Minimum Class 1 Rating.
.8 Mould Growth (ASTM D3273): Minimum Class 10 Rating.

.2 Urethane Systems Requirements:

.1 Thickness: as specified.
.2 Minimum tensile strength: 7 MPa (1000 psi) at 7 days; ASTM D638.
.3 Minimum flexural strength: 10 MPa (1500 psi) at 7 days; ASTM D790.
.4 Water absorption: maximum of 1.0%; ASTM C413.
.5 Static coefficient of friction: minimum 0.5; ASTM D2047.
.6 Chemical Resistance (spot): ASTM D1308.
.7 Fungi Growth (ASTM G21): Minimum Class 1 Rating.
.8 Mould Growth (ASTM D3273): Minimum Class 10 Rating.

.9 Pull-off Strength: 100% substrate failure in accordance with ASTM D4541 or ACI 503R.

.4 Self-leveling flooring systems.

.1 Epoxy-Based Systems Requirements:

.1 Thickness: as specified.
.2 Minimum tensile strength: 10 MPa (1500 psi) at 7 days; ASTM D638.
.3 Minimum flexural strength: 14 MPa (2000 psi) at 7 days; ASTM D790.
.4 Maximum shrinkage: 0.5%; ASTM C531.
.5 Maximum water absorption: 1.0%; ASTM C413.
.6 Minimum coefficient of friction: 0.5; ASTM D2047.
.7 Chemical Resistance (spot): ASTM D1308.
.8 Fungi Growth (ASTM G21): Minimum Class 1 Rating.
.9 Mould Growth (ASTM D3273): Minimum Class 10 Rating.
.10 Pull-off Strength: 100% substrate failure in accordance with ASTM D4541 or ACI 503R.

.2 Urethane Systems Requirements:

.1 Thickness: as specified.
.2 Minimum tensile strength: 7 MPa (1000 psi) at 7 days; ASTM D638.
.3 Minimum flexural strength: 10 MPa (1500 psi) at 7 days; ASTM D790.
.4 Maximum shrinkage: 0.5%; ASTM C531.
.5 Maximum water absorption: 1.0%; ASTM C413.
.6 Minimum coefficient of friction: 0.5; ASTM D2047.
.7 Chemical Resistance (spot): ASTM D1308.
.8 Fungi Growth (ASTM G21): Minimum Class 1 Rating.
.9 Mould Growth (ASTM D3273): Minimum Class 10 Rating.
.10 Pull-off Strength: 100% substrate failure in accordance with ASTM D4541 or ACI 503R.

.5 Reaction to fire:

.1 Ensure that floor finishes specified in this Section do not exceed a maximum of 300 for flame spread rating and a maximum 300 for smoke developed classification when tested in accordance with CAN/ULC S102.2, unless otherwise indicated.

.2 Critical Radiant Flux: 0.22 W/sq. cm or greater per NFPA 253.

.3 Flammability: Self-extinguishing in accordance with ASTM D635.

2.3 EPOXY FLOORING SYSTEM (SR-1)

.1 Components: Two-part system consisting of Part A (Clear) and Part B (Clear to amber).

.1 VOC Content: 75.4 g/L.

.2 Solids Content:

.1 By Volume: 100%

.2 By Weight: 100%

.3 Density:

.1 Part A: 1.05 - 1.10 kg/L (Clear), 1.10 - 1.15 kg/L (Colors)

.2 Part B: 0.9 - 1.0 kg/L

.4 Viscosity @ 25°C (77°F):

.1 Part A: 1200-1400 cP (Clear), 1400-1600 cP (Colors)

.2 Part B: 150-350 cP

.5 Mechanical Properties:

.1 Bond Resistance: > 300 PSI (substrate rupture) per ASTM D4541

.2 Hardness (Shore D): 85-90 per ASTM D2240

.3 Tensile Strength: 5500 PSI per ASTM D638

.4 Compressive Strength: 14000 PSI per ASTM D695

.5 Abrasion Resistance: 0.10 g per ASTM D4060 (CS17, 1000 cycles, 1000 g)

.6 Elongation: 6.7% per ASTM D638

.6 Thermal and Environmental Properties:

.1 Service Temperature: -4°F to 122°F (-20°C to 50°C)

.2 Resistance to Mold: Rated 10 (ASTM D3273)

.3 Resistance to Fungi: Rated 0 (ASTM G21)

.7 Cove base: integral type, height as indicated on Drawings.

.8 Acceptable System: “PE-100”by PurEpoxy. No substitutions.

.9 Colour: As selected by Consultant from manufacturer’s full range including solid colour, flakes systems and metallic systems.

2.4 EPOXY FLOORING – THIN-COAT (SR-2)

.1 System Description: two component, solid colour, high solids, low viscosity, self-priming, smooth, glossy epoxy finish and integral cove base.

.2 System Description: Chemical-resistant, low viscosity, self-priming, smooth, flooring system for use over properly prepared concrete substrates.

.1 System Type: Epoxy-based.

.2 Overall System Thickness: Not less than 0.76 mils (30 mils)

.3 Cove base: integral type, height as indicated on Drawings.

.4 Primer: as recommended by manufacturer.

.5 Color and Pattern: As selected by Consultant from manufacturer's full range at a later date.

.6 Sheen: semi-gloss, unless otherwise indicated.

.7 Wearing Surface: Manufacturer’s standard wearing surface meeting slip-resistance performance specified herein.

.3 Basis-of-Design System: “Sikafloor® 261” by Sika Canada Inc.

.4 Acceptable Equivalent Systems:

.1 “Durex® Epotel GSC” by Durabond Technical Coatings

.2 “Mapefloor I 302 SL” by Mapei Corp

.3 “CG32” or “CG65” or “CG 125” or “CG 250 Troweled” by NEOGARD®

.4 “General Polymers 3579” (Clear) “General Polymers 3746” (Opaque/colours) “General Polymers 4687” (Opaque/colours), by Sherwin Williams High Performance Flooring.

2.5 FLUID-APPLIED FLOORING – SELF-LEVELLING (SR-3)

.1 System Description: Chemical-resistant, self-leveling, resin-based, monolithic flooring system for use over properly prepared concrete substrates.

.1 System Type: Urethane-cement based.

.2 System Classification (ASTM C722): Self-levelling (SL)

.1 Minimum compressive strength: 50 MPa (7250 psi) at 7 days; ASTM C579.
.2 Minimum tensile strength: 12 MPa (1740 psi) at 7 days; ASTM C307.
.3 Minimum flexural strength: 20 MPa (2900 psi) at 7 days; ASTM C580.
.4 Maximum shrinkage: 0.5%; ASTM C531.
.5 Maximum water absorption: 1.0%; ASTM C413.
.6 Minimum coefficient of friction: 0.5; ASTM D2047.
.7 Chemical Resistance (spot): ASTM D1308.
.8 Fungi Growth (ASTM G21): Minimum Class 1 Rating.
.9 Mould Growth (ASTM D3273): Minimum Class 10 Rating.
.10 Pull-off Strength: 100% substrate failure in accordance with ASTM D4541 or ACI 503R.
.11 Overall System Thickness: 3 mm (1/8 inch)
.12 Primer: as recommended by manufacturer.
.13 Body/Grout Coats: urethane cement resin complete with manufacturer's standard aggregates.
.14 Color and Pattern: As selected by Consultant from manufacturer's full range at a later date
.15 Sheen: semi-gloss, unless otherwise indicated.
.16 Wearing Surface: Manufacturer’s standard wearing surface meeting slip-resistance performance specified herein.

.2 Basis-of-Design System:

.1 Base coat: “TREMfloor SL” by Tremco or approved equivalent.

.2 Topcoat: TREMfloor FC or approved equivalent.

2.6 ROLLER APPLIED EPOXY FLOORING – CHEMICAL RESISTANT (SR-4)

.1 2-component, solvent and silicone-free, multi coat, roller/squeegee applied, seamless flooring system with low gloss and slip resistance:

.2 System Description:

.1 Prime coat: manufacturer’s standard epoxy-based coat.

.2 Wear coat: manufacturer’s standard epoxy-based coat.

.3 Top Coat: manufacturer’s standard epoxy-based coat.

.4 Overall System Thickness: 0.58 mm (23 mils). Provide manufacturer’s standard self-levelling system to ensure installation is smooth and level.

.5 Color and Pattern: As selected by Consultant from manufacturer's full range at a later date

.6 Sheen: to be selected by Consultant at a later date.

.7 Wearing Surface: Manufacturer’s standard wearing surface meeting slip-resistance performance specified herein.

.3 Acceptable Systems:

.1 “Sikafloor® Fastflor CR®” by Sika Canada Inc.

.2 “MasterTop 1216” by BASF Canada Inc.

.3 “CG 32” by NEOGARD®

.4 “Resuflor 3579 Primer” and Resuflor 3741” by Sherwin Williams High Performance Flooring.

2.7 ACCESSORIES

.1 Primer: 100% solids, type recommended by manufacturer for substrate and body coats indicated.

.2 Waterproofing Membrane: type recommended by manufacturer for substrate and primer and body coats indicated. Provide in all locations with a drain.

.3 Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated. Do not use gypsum based materials.

.1 Underlayment: “Ultra/Plan” by Mapei Inc. or approved equivalent by Ardex Engineered Cements (or Equivalent).

.2 Patching Compound:”Plani/Patch” by Mapei Inc. or approved equivalent by Ardex Engineered Cements (or Equivalent).

.4 Divider Strips: white alloy zinc, 'L' shape; thickness as required to suit floor thickness,

.5 Cove Strips: As recommended by flooring manufacturer.

.6 Slip Resistant Additive (SRA): Manufacturer’s standard material for use with or as a component part of coating on horizontal surfaces to Provide slip resistance.

.7 Joint Sealant and backers: CAN/CGSB-19.24-M, Type 1, Class B, multi-component modified urethane base chemical curing material compatible with floor finish and as recommended by flooring manufacturer.

.1 Provide preformed, closed cell, compressible joint backer strips Compatible with sealant, primer, flooring and substrate. Minimum 20 shore 'A' hardness; tensile strength: between 140 kPa and 200 kPa. Sizes and shapes to suit various conditions, diameter 25% greater than joint width.

.8 Moisture Reduction Barrier: Application of systems for reduction of moisture vapour transmission and alkalinity control for concrete slab required to receive floor covering specified under this Section to be as follows:

.1 Moisture Vapour Emission Rate (MVER) Range: Ensure items provided are capable of treating high moisture vapour transmitting concrete surfaces up to 11.34 kg/93 m2 (25 lbs/1000 sq ft) in 24 hours; Maximum Relative humidity: 100%; as determined by ASTM F1869 test.

.2 Final Product selection to suit condition encountered at time of installation. Where applicable, Provide manufacturer’s floor leveling systems for use with specified Products.

.3 Provide 1 of following:

.1 "Planiseal Series – Moisture Barrier Systems" by MAPEI Inc.;
.2 "Ardex Moisture Control Systems" by Ardex Engineered Cements;
.3 "Koester VAP I - 2000" by Koester USA Moisture Control System.
.4 Approved proprietary Equivalent moisture control system recommended in writing by floor covering manufacturer and approved by the Consultant in order to authenticate floor covering warranties.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Site Verification of Conditions: Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify the Consultant in writing of any conditions which would be detrimental to the installation. Commencement of work implies acceptance of previously completed work.

.2 Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with seamless resin flooring.

.1 Old Concrete:

.1 Clean surface using BLASTRAC, sand blasting, or diamond grinding with 30 grit or coarser.
.2 Remove oils and fats prior to application.

.2 New Concrete:

.1 Allow curing for at least 30 days.
.2 Perform surface preparation using BLASTRAC, sand blasting, or diamond grinding with 30 grit or coarser.
.3 Apply a primer to reduce out-gassing and promote adhesion.

.3 Pre-installation Testing: Inspect and test concrete surfaces and immediately advise to Consultant in writing of unsatisfactory conditions which may affect performance or appearance of finished surfaces.

.1 Tensile Bond Strength Test: Ensure concrete surface have minimum 1.5 MPa (210 psi) tensile bond strength when tested in accordance with ASTM C1583 prior to flooring application.

.2 Acidity/Alkalinity and Adhesion Testing:

.1 Conduct pH test to ensure alkali salt residue is within limitations acceptable to manufacturer and to avoid adhesive failure, discoloration, shrinkage and softening of floor covering.
.2 If pH results are higher than acceptable to manufacturer, neutralize floor prior to beginning of installation. Neutralize floor by sanding, vacuuming and by application of water and mild muriatic acid as recommended by manufacturer. Retest to ensure pH levels have been neutralized.
.3 Proceed with installation only after substrates pass testing.

.3 Moisture Testing:

.1 Calcium Chloride Test: Perform calcium chloride test in accordance with requirements of ASTM F1869 immediately prior to installation of resilient flooring for moisture on concrete floors around perimeter of areas, at columns, and where moisture may be anticipated.

.1 Perform 1 test for every 93 m² (1000 sq ft) of flooring.
.2 Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 1.5 kg/93 m² (3.5 lbs/1000 sq ft) in 24 hours.
.3 Provide results to Consultant in writing prior to commencement of installation.
.4 Do not proceed with installation until moisture problems have been corrected.

.2 Relative Humidity Test: Perform relative humidity test in accordance with requirements of ASTM F2170 using in situ probes and measure internal relative humidity of slab.

.1 Ensure concrete slab and air space above floor slab are at service temperature and that relative humidity of area is similar to Project's final conditions for 48 hours prior to measuring concrete relative humidity.

.2 Conduct minimum of 3 tests for first 1,000 sq.ft and one additional test for each 1,000 sq.ft. Conduct one test near center and others around perimeter of area.

.3 Proceed with installation only after substrates have a maximum 75% relative humidity measurement.

.4 Provide results to Consultant in writing prior to commencement of installation.

.5 Do not proceed with installation until moisture problems have been corrected.

.4 Moisture Barrier Application:

.1 Apply moisture reduction barrier at following locations:

.1 Basement slabs and Slabs-on-grades (regardless of pre-installation moisture testing results)

.2 Suspended slabs where slab moisture contents are above those recommended by floor covering manufacturers at time of installation after performing pre-installation testing.

.2 Apply moisture barrier in accordance with manufacturer's recommendations across entire surface being treated including up to and around perimeter of restrained surfaces such as walls and columns.

.3 Do not proceed with work until unsatisfactory conditions have been resolved.

.5 Remove sub-floor ridges and bumps. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate. Prohibit traffic until filler has cured.

.6 Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through seamless resin flooring according to manufacturer's written instructions.

.7 Vacuum, prime and seal substrate to flooring manufacturer's recommendations.

3.2 PREPARATION

.1 Comply with ASTM C811 requirements unless manufacturer's written instructions are more stringent.

.2 Clean subfloor free of laitance, oil, grease and other foreign matter detrimental to flooring application. Ensure concrete substrate surface is sound, with deteriorated concrete removed, cleaned, and replaced to suit design requirements. Ensure cleaned surfaces are dust free, sound and unbruised. Blow clean control joints, sawcuts and cracks with compressed air and grout with material compatible with floor coating materials.

.3 Repair, joint spalling, surface spalling, and cracks prior to placement seamless flooring. Seal joints and when required repair cracks with epoxy injection method.

.4 Use surface preparation equipment or mechanical methods recommended by system manufacturer. Prepare concrete floors over entire area with steel shot blasting or other method recommended by manufacturer.

.5 Remove uneven joints, rough areas and projections off surfaces. Ensure surface is hard, sound and roughened to irregular surface with weak concrete removed and surface holes and voids exposed. Equip dry blasting machine with vacuum to minimize dust.

.6 Ensure shot blasting exposes cracks in concrete surface. For cracks less than 1.5 mm (1/16") employ crack reinforcing tape in accordance manufacturer's recommendations. Repair cracks, holes or other deficiencies in accordance with manufacturer's recommendations.

.7 Ensure masonry backing surfaces for cove bases are free of voids and irregularities. Fill recessed joints with recommended epoxy plaster.

.8 Obtain the Consultant's approval of prepared substrate prior to installation of flooring.

.9 Mix components and prepare materials according to flooring manufacturer's written instructions.

3.3 INSTALLATION

.1 Apply components of seamless resin flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated with integral cove bases, uninterrupted except at divider strips, sawn joints or other types of joints required.

.2 Apply flooring with care to ensure no laps, pin holes, voids, crawls, skips or other marks or irregularities are visible, and to Provide uniform appearance.

.3 Thickness:

.1 Primer: 10 mils (150 ft²/gal)

.4 Finish Coat:

.1 Solid Color: 16 mils (100 ft²/gal)

.2 Flakes System: 13 mils (120 ft²/gal)

.3 Metallic System: 40 mils (40 ft²/gal)

.5 Site Tolerances: Finish seamless flooring surfaces to produce plumb and level floor, or straight where sloped to drains, within tolerance of 3 mm in 3 m (1/8" in 10').

3.4 FIELD QUALITY CONTROL

.1 Inspection:

.1 The Owner may engage an independent inspection and testing company to inspect the work of this Section. Give at least 2 weeks notice of starting work to inspection and testing company and allow inspector free access.

.2 Tests may include thickness, compressive strength and chemical resistance as specified in requirements of this Specification.

.3 If test results show applied materials do not comply with the requirements specified herein, pay for testing, remove noncomplying materials, prepare surfaces coated with unacceptable materials, and reapply flooring materials to comply with requirements.

.2 Manufacturer's Field Services: Ensure flooring manufacturer representative's presence at pre-construction site meeting and on site Day flooring application is commenced and periodically thereafter, to ensure work is properly performed.

3.5 CLEANING

.1 Touch up and refinish minor defects in work. Refinish entire coated surface areas where finish is damaged or otherwise unacceptable.

.2 Remove promptly as work progresses spilled or splattered coating materials from adjacent surfaces. Clean floors on completion of work. Do not mar surfaces while removing splatters.

3.6 PROTECTION

.1 Protect completed work from traffic for at least 1 week to allow proper curing of floor finish. Protect work from any trades using area after completion of installation.

.2 Protect adjacent surfaces from damage resulting from work of this Section. If necessary, cover or mask adjacent surfaces to those receiving flooring including fixtures and equipment.

.3 Replace materials soiled by coatings during application and storage, and from which stains cannot be completely removed at no extra cost.

.4 Erect barriers to prevent entry and presence of workers not performing work of this Section during application of flooring and for 48 hours following completion of application.

.5 Post "No Smoking" signs while work is in progress and curing. Ensure spark-proof electrical equipment is used in areas where flammable materials are being applied. Prevent use of open flames or equipment that may cause sparks during this phase of work.

END OF SECTION

SEE ADD#16
Q#380

PART 1 - GENERAL

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL INSTRUCTIONS

.1 Read and conform to:

.1 the General Conditions and the Supplementary Conditions of the Contract.

.2 Division 01 requirements and documents referred to therein.

1.3 SUMMARY

.1 Work Included: Provide carpet tile including but not limited to the following:

.1 carpet tile.

.2 resilient accessories.

.3 metal edge strips.

.4 moisture reduction barrier.

.2 Related Requirements: Specifications throughout the entirety of the Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.4 REFERENCES

.1 Reference Standards: Latest published editions of reference standards listed in this Section in effect as of the closing date and time of the Request for Tenders for the Contract, including any amendments adopted, are applicable unless otherwise indicated.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meetings:

.1 Prior to starting work of this Section, convene a pre-installation meeting at the Project site to review the Project requirements and site conditions with pertinent parties. Conform to requirements of Division 01.

1.6 SUBMITTALS

.1 Product Data: Submit manufacturer's literature and data sheets for each type of material provided under this Section for the Project in accordance with requirements of Division 01. Ensure data sheets provide required information including detailed instructions for installing as well as maintaining, preserving and keeping materials in clean and safe conditions. Provide adequate warning of maintenance practices or cleaning agents detrimental to specified materials.

.2 Safety Data Sheets (SDS): Submit SDS for inclusion in Operation and Maintenance Manual specified in Division 01, for adhesives, sealants and any other material designated by consultant.

.3 Shop Drawings: Submit Shop Drawings and layout Drawings in accordance with Division 01. Ensure Shop Drawings indicate material characteristics, seam layouts, direction of run, details of construction, connections and relationship with adjacent construction. Do not Install carpet tile until layout Drawings are approved.

.4 Samples:

.1 Submit 2 representative samples of each material specified herein indicating visual characteristics and finish. Include range samples if variation of finish is anticipated. As a minimum submit:

.1 450 mm x 450 mm (18" x 18") sample of each carpet tile specified.
.2 300 mm (12”) long sample of each exposed edge stripping and accessory item.

.2 The Consultant may take random samples of carpet tiles as installation progresses for comparison with approved samples. If, in opinion of the Consultant, such samples fail to meet the standards of approved samples, remove tiles and replace with approved tiles as required at no cost to the Owner.

.5 Maintenance Data: Submit maintenance instructions in triplicate for insertion into maintenance manuals in accordance with Division 01. Ensure instructions give specific warnings of maintenance or cleaning practices or materials which may damage carpeting.

1.7 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Materials: Supply the following quantity of maintenance material in accordance with Division 01:

.1 Deliver to the Consultant and store where directed 5% of each colours selected suitably labelled in boxes. Identify Product name, colour, quantity and locations where used in the Project (room name and numbers).

.2 Retain waste cuttings over 1m^2 (10 sq ft) and hand over to the Owner.

1.8 QUALITY ASSURANCE

.1 Applicator Qualifications: Provide the work of this Section executed by competent installers with a minimum 5 years experience in the application of the Products, systems and assemblies specified here and with the approval and training of the Product manufacturers.

.2 Mock-Up: In area designated by Consultant, provide sample installation of each colour of at least 9 m2 (100 sq ft) showing colour matching. Make changes as required until approved. When approved, sample area shall represent minimum acceptable standard for work. Remove sample installation when directed unless sample area can be satisfactorily incorporated into work.

1.9 DELIVERY, STORAGE AND HANDLING

.1 Delivery and Acceptance Requirements: Deliver cartons of carpet tile to site clearly tagged to show installation location.

.2 Storage and Handling Requirements:

.1 Comply with CRI - Carpet Installation Standard 2011. Store adhesive, carpet tapes and similar items in heated area maintained at minimum temperature of 10 deg C (50 deg F) or at such temperature as recommended by the Product manufacturer.

.2 Handling: Comply with the adhesive and carpet tile manufacturer's directions for use of adhesive. Observe open time limits for adhesives and place lids on open cans when not

being used. Under no circumstances contaminate or thin adhesives with water or solvents, unless specifically directed by manufacturer in writing.

1.10 PROJECT CONDITIONS

.1 Ambient Conditions:

.1 Provide ventilation system in the area to be carpeted to ensure adequate (min 1 air change each hour) extraction of VOC's and other contaminants. In occupied buildings, the existing ventilation system may not be used for this purpose.

1.11 WARRANTY

.1 The Contractor warrants the work of this Section for period of 5 years from Substantial Performance of the Work against defects and/or deficiencies in accordance with the General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within this warranty period, to he satisfaction of the Consultant and at no additional expense to the Owner. Defects include but are not limited to: buckling, opening of seams, bond failure, extensive colour fading and loss of more than 10% of pile fibre in any area.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Products of following manufacturers (or Equivalent) may be acceptable subject to conformance to requirements of Drawings, schedules and Specifications:

.1 Carpet Tile (CPTT):

.1 Interface Carpet
.2 Mohawk Group
.3 Shaw Contract Group

.2 Substitution Limitations: This Specification is based on interface Products. Comparable Products from manufacturers listed herein offering functionally, aesthetically equivalent Products in Consultant’s opinion and subject to the Consultant’s review will be considered provided they meet the requirements of this Specification.

2.2 REGULATORY REQUIREMENTS

.1 Fire Performance Characteristics: Provide carpet certified by ULC or WHPS, having identical properties to those tested for following fire performance characteristics, in accordance with requirements test method indicated below. Identify carpet with appropriate markings of applicable testing and inspecting organization.

.1 Critical Radiant Flux (ASTM E648): > 0.45 watts/cm2 – Class I

.2 Smoke Developed (ASTM E662): ≤ 450

.3 Fire-test response characteristics: conforming to CAN/ULC-S101-M and CAN/CGSB-4.162-M.

2.3 MATERIALS

.1 Carpet Tile (CPTT): Provide 300 mm x 914 mm (12inch X 36 inch) “Expedition Style – Seismic Wave ” by Mohawk Group Collection or equivalent complete with manufacturer’s proprietary soil protection treatment meeting characteristics specified herein with following characteristics:

.1 Construction: Tufted Textured Loop or multi-level pattern loop

.2 Fiber: Duracolor® Tricor Premium Nylon

.3 Dye method: 100% solution dyed

.4 Backing: manufacturer’s standard treatment.

.5 Protective treatments: manufacturer’s standard treatment.

.6 Pattern repeat: none

.7 Colour: to be selected by Consultant at a later date from manufacturer’s full range.

.8 Laying Patterns: As indicated on reviewed Shop Drawings.

.2 Miscellaneous Accessories:

.1 Adhesive, Seam Sealer, Seam Tape: Non-solvent based, water-resistant, non-toxic type as recommended by the carpet manufacturers for their carpet.

.2 Tools: Paint roller and tray, seam roller, steel measuring tape, chalk line (use white chalk) and carpet knife.

.3 Thresholds: Aluminum, screw-down type as recommended by carpet manufacturer, colours selected by the Consultant from manufacturers' standard range. Provide necessary carpet thresholds, adapters, cove caps, edge guards, edge strips and stair nosings (if applicable) as required to suit design requirements.

.3 Moisture Reduction Barrier: Application of systems for reduction of moisture vapour transmission and alkalinity control for concrete slab required to receive floor covering specified under this Section to be as follows:

.1 Moisture Vapour Emission Rate (MVER) Range: Ensure items provided are capable of treating high moisture vapour transmitting concrete surfaces up to 11.34 kg/93 m^2 (25 lbs/1000 sq ft) in 24 hours; Maximum Relative humidity: 100%; as determined by ASTM F1869 test.

.2 Final Product selection to suit condition encountered at time of installation. Where applicable, Provide the manufacturer’s floor leveling systems for use with specified Products.

.3 Provide 1 of following:

.1 "Planiseal Series – Moisture Barrier Systems" by MAPEI Inc.;
.2 "Ardex Moisture Control Systems" by Ardex Engineered Cements;
.3 "Koester VAP I - 2000" by Koester USA Moisture Control System.
.4 Approved proprietary Equivalent moisture control system recommended in writing by floor covering manufacturer and approved by Consultant in order to authenticate floor covering warranties.

.4 Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated. Do not use gypsum based materials.

.1 Underlayment: “Ultra/Plan” by Mapei Inc. or approved equivalent by Ardex Engineered Cements (or Equivalent).

.2 Patching Compound:"Plani/Patch" by Mapei Inc. or approved equivalent by Ardex Engineered Cements (or Equivalent).

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Site Verification of Conditions: Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify the Consultant in writing of any conditions which would be detrimental to the installation. Commencement of work implies acceptance of previously completed work.

3.2 PREPARATION

.1 Ensure floor is clean and free of cracks and protrusions. Remove dirt, paint, debris, grease, oil and loose toppings or finishes. Grind smooth ridges and high spots in concrete surfaces to be carpeted. Ensure moisture content of concrete slabs meet the carpet tile manufacturer's recommendations.

.2 Pre-Installation Testing:

.1 Acidity and Alkalinity Test:

.1 Conduct pH test to ensure alkali salt residue is within limitations acceptable to manufacturer and to avoid adhesive failure, discoloration, shrinkage and softening of floor covering.

.2 If pH results are higher than acceptable to manufacturer, neutralize floor prior to beginning of installation. Neutralize floor by sanding, vacuuming and by application of water and mild muriatic acid as recommended by manufacturer. Retest to ensure pH levels have been neutralized.

.2 Relative Humidity Test:

.1 Perform relative humidity test in accordance with requirements of ASTM F2170 using in situ probes and measure internal relative humidity of slab. Ensure concrete slab and air space above floor slab are at service temperature and that relative humidity of area is similar to the Project's final conditions for 48 hours prior to measuring concrete relative humidity.

.2 Conduct minimum of 3 tests for first 1,000 sq.ft and one additional test for each 1,000 sq.ft. Conduct one test near center and others around perimeter of area.

.3 Ensure relative humidity probe test results do not exceed 75% unless recommended otherwise by flooring manufacturer(s) in writing. Do not proceed with installation until moisture problems have been corrected. Provide results to the Consultant prior to commencement of installation.

.3 Fill gaps or cracks more than 2 mm (1/16") wide and minor depressions with latex compound. Grind protrusions smooth.

.4 Vacuum clean floors prior to installation.

.5 Moisture Barrier:

.1 Apply moisture reduction barrier at following locations:

.1 Basement slabs and Slabs-on-grades (regardless of pre-installation moisture testing results)

.2 Suspended slabs where slab moisture contents are above those recommended by floor covering manufacturers at time of installation after performing pre-installation testing.

.2 Prior to applying moisture barrier, mechanically prepare concrete substrate using dustless approved method to ICRI requirements to CSP (Concrete Surface Profile) #2 (Diamond Cup Ground) or #3 (Shotblasted).

.3 Apply moisture barrier in accordance with the manufacturer's recommendations across entire surface being treated including up to and around perimeter of restrained surfaces such as walls and columns.

.4 Do not proceed with the work of this Section until unsatisfactory conditions have been resolved.

3.3 INSTALLATION

.1 Comply with CRI Carpet Installation Standard 2011. Refer to the Drawings for areas where carpet tile is to be installed. Install work of this Section after other trades have completed their work and just prior to completion of the Work, unless otherwise instructed by the Consultant.

.2 Do not commence work in areas where illumination is not characteristic of final illumination

.3 Commencement of work: Refer to the Drawings and Room Finish Schedule for areas where carpet is to be installed. Install work of this Section after other trades have completed their work and just prior to completion of the Work, unless otherwise instructed by the Consultant.

.4 Measuring: Determine centre of room using standard tile-laying methods. Resulting quadrants should meet at right angles. Offsetting centre chalk line may become necessary to insure that perimeter tiles will be at least half-size or larger.

.5 Pile Direction: Install carpet tiles to achieve monolithic appearance with arrows on back pointing in same direction.

.6 Laying Out: To prevent movement of tiles during initial stages and to insure straight lines and square corners, create an anchor line by laying strips of adhesive alongside each centre chalk line. Lay tiles accurately and firmly along centre lines in selected quadrant. Additional tiles within quadrant should be installed by "stair-step" technique. In some cases, due to partitions, "starting" point is centre of the room. Carpet tiles are to be installed up to partitions, not under partition.

.7 Checking Tightness: Measure areas to ensure tight installation. Measure over 11 tiles to attain cumulative space "gained" over 10 joints. The gain must not be greater than 6 mm (1/4").

.8 Alignment: As tiles are butted against each other, frequently check at joints to ensure proper alignment. Do not Install tiles that seem out of true more than 1.5 mm (1/32").

.9 Control Grid: To prevent tiles from shifting in larger areas, about every 6 m (20') to 9 m (30') both in length and width directions, anchor row of tiles. Use texturing paint roller to apply narrow strip of adhesive under "control" tiles.

.10 Joints: Take care when butting 1 tile against another. Avoid excessive pressure on joining tiles as it may cause tiles to "peak" or "buckle". Brush back face pile should and "tip" tile into place, to avoid pile being caught in joint.

.11 Perimeter Tiles: Lay last whole tile closest to wall and perimeter cuts on adhesive. Accurately cut and tightly fit perimeter tiles against vertical fixed surface such as walls. In event of open perimeter design, Provide fixed reducer strip anchored to floor as necessary to lock tile area in place.

.12 Cutting: Cut tiles from back, using template for fitting around columns or at room perimeter. Only activate electrical floor outlets after carpet installation. Surface-mark affected tiles with tape.

.13 Trimming and Gluing: Install carpet using full adhesive method (glue down) unless otherwise noted on the Drawings. Whenever tile is cut or trimmed, always adhere to floor.

3.4 CLEANING

.1 Immediately following installation, inspection and approval of work by the Consultant, vacuum clean carpet using pile lifter and remove debris.

.2 Waste Management Requirements:

.1 Comply with Government of Ontario Waste Management requirements. Accumulate surplus tile and waste daily and remove such materials to suitable recycling facility at completion of work.

3.5 PROTECTION

.1 Restriction of Traffic:

.1 Restrict traffic during installation. Upon completion of installation, do not allow traffic or movement of furniture onto carpet surface until installed area has been anchored at perimeter.

.2 Cover entire carpeted area with plastic covering held in place by masking tape at seams and stay-tacking around perimeter, if required by the Consultant.

.3 Do not remove carpet protection until directed by the Consultant.

.4 Hand over work free of blemishes and in perfect condition.

END OF SECTION

PART 1 - GENERAL

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL INSTRUCTIONS

.1 Read and conform to:

.1 the General Conditions and the Supplementary Conditions of the Contract.

.2 Division 01 requirements and documents referred to therein.

1.3 SUMMARY

.1 Work Included: Provide fabric-wrapped acoustical panels including but not limited to following:

.1 fabric wrapped acoustic wall panels.

.2 Related Requirements: Specifications throughout the entirety of the Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.4 REFERENCES

.1 Reference Standards: Latest published editions of reference standards listed in this Section in effect as of the closing date and time of the Request for Tenders for the Contract, including any amendments adopted, are applicable unless otherwise indicated.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meetings:

.1 Prior to starting work of this Section, convene a pre-installation meeting at the Project site to review the Project requirements and site conditions with pertinent parties. Conform to requirements of Division 01.

1.6 SUBMITTALS

.1 Product Data: Submit manufacturer's literature and data sheets for each type of material provided under this Section for the Project in accordance with requirements of Division 01. Ensure data sheets provide required information including detailed instructions for installing as well as maintaining, preserving and keeping materials in clean and safe conditions. Provide adequate warning of maintenance practices or cleaning agents detrimental to specified materials.

.2 Safety Data Sheets (SDS): Submit SDS for inclusion in Operation and Maintenance Manual specified in Division 01, for adhesives, sealants and any other material designated by Consultant.

.3 Shop Drawings: Submit Shop Drawings of the Work of this Section in accordance with Division 01. In addition to minimum requirements indicate the following:

.1 Include plans, sections and large scale details, and indicate components and methods of assembly, materials and their characteristics, fastenings, finishes, and other fabrication information required for work of this section. Indicate assembly joint lines.

.2 Submit coordination Drawings indicating locations of concealed grounds, cutouts, plates, and other required fabrications.

.3 Show relation to adjoining construction, details of outside and inside corners and door openings.

.4 materials, thicknesses and finishes.

.5 methods of setting, sealing, securing, field connections and anchorage.

.4 Samples: Submit samples in accordance with Division 01. Submit following samples in the sizes indicated:

.1 direct fastening system members minimum 300 mm (12") long

.2 suspension system members minimum 300 mm (12") long.

.3 panels minimum 300 mm (12") square and of specified thickness

.5 Test and Evaluation Reports: Prior to submitting Shop Drawings for the Work of this Section, submit the following:

.1 Fire-test-response characteristics: Manufacturer's test results and certificates illustrating installed wood wall panel systems meet fire-resistance ratings required for this Project.

.2 Acoustic Performance: Independent test data and certificate confirming system meets or exceeds specified STC, NRC and CAC ratings.

.6 Certificates:

.1 Obtain certificate from the Professional Engineer responsible for the design which includes seismic assessment and field review of this part of the Work, validating that work substantially complies with requirements of the OBC and that requisite field reviews have been completed.

.7 Maintenance Instructions: Submit maintenance instructions in accordance with Division 01. Submit maintenance instructions that specify warnings of any maintenance practice or materials which may damage or disfigure the Work of this Section.

1.7 MAINTENANCE MATERIAL SUBMITTALS.

.1 Extra Materials: Supply 2% surplus panel fabric from same production run as installed panels.

1.8 QUALITY ASSURANCE

.1 Applicator Qualifications: Provide the work of this Section executed by competent installers with a minimum of 5 years' experience in the application of the Products, systems and assemblies specified herein and with the approval and training of Product manufacturers.

.2 Single Source Responsibility: Ensure primary materials provided in this Section are obtained from 1 source by a single manufacturer and secondary materials are obtained from sources recommended by primary materials manufacturers.

.3 Mock-Ups: Provide Mock-ups in locations designated by Consultant and as required to demonstrate quality of workmanship. Maintain Mock-ups during construction in an undisturbed condition as a standard for judging the completed work. Conform to requirements of Division 01. Ensure Mock-ups are accepted prior to start of system application. Do not alter, move or destroy mock-up until work is completed and approved by Consultant.

1.9 WARRANTY

.1 The Contractor warrants the work of this Section for a period of 2 years from Substantial Performance of the Work against defects and deficiencies in accordance with the General Conditions of the Contract. Promptly correct defects or deficiencies which become apparent within this warranty period, to the satisfaction of the Consultant and at no additional expense to the Owner. Defects include but are not limited to: buckling, opening of seams, bond failure and extensive colour fading.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Products of following manufacturers (or Equivalent) may be acceptable subject to conformance to requirements of the Drawings, schedules and Specifications:

.1 Acoustical Wall Panels:

.1 Decoustics
.2 GWP Wallworks Group
.3 Wall Technology, Inc.
.4 Akustus
.5 EzoBord c/o Arysonics

.2 Panel Fabric:

.1 Carnegie

2.2 DESIGN AND PERFORMANCE REQUIREMENTS

.1 Design suspension system to support safely and without distortion, superimposed loads of:

.1 Lighting fixtures;

.2 Air Supply diffusers, boots, fire alarm grilles and exhaust and return air grilles;

.2 Design suspension system to support lighting fixtures according to regulations of local utility company and submit certification accordingly.

.3 Prepare panels for sprinkler head penetrations and suspension members of curtain tracks.

.4 Fire Performance Characteristics:

.1 Ensure materials listed in this Section are rated as Class A, when tested in accordance with ASTM E 1264, CAN/ULC S102 and for following characteristics:

.1 Flame Spread Rating: ≤ 25 on any surface exposed by cutting through in any direction
.2 Smoke Developed Index: ≤ 450

.2 Ensure materials provided for the Work of this Section have approved Product listing from organization acceptable to the Authorities Having Jurisdiction such as ULC, cUL or ITS.

.5 Acoustical Performance: Ensure assemblies are capable of providing specified NRC, STC and CAC ratings specified herein when tested in accordance with ASTM C423, ASTM E90 and ASTM E1414 respectively.

2.3 MANUFACTURED UNITS

.1 Acoustical Wall Panels (AWP-1): Not Used.

.2 Acoustical Wall Panels (AWP-2): Provide acoustical wall panels “Acoustical Wall Panel - AP” by Decoustics or Equivalent with following characteristics:

.1 Edges: Square

.2 Corners: Standard

.3 Core: 38 mm (1-1/2")

.4 NRC: Not less than 0.95

.5 Fabric Facing: Provide 100% fire-retardant “Meteor - Xorel” by Carnegie Fabrics (or Equivalent) in colour selected by the Consultant from manufacturer's full range.

.6 Mounting System: Provide concealed mechanical fastening clip-on wall mounting system complete with metal closures and trims specified herein as recommended by system manufacturer.

.7 Colours: Allow 3 colours to be selected by Consultant at a later date from manufacturer's full range.

2.4 AUXILIARY MATERIALS

.1 Furring Channels: Coordinate with Section 09 21 16. Provide 33 mils (0.0329” – 0.0836mm – 20ga) thick galvanized sheet steel furring channels (Z-clips). Zinc coating: Z275 (G90) in accordance with ASTM A653/653M. Screw channels: 67 mm (2-5/8") wide x 22 mm (7/8") deep.

.2 Supplementary Steel Supports and Reinforcing: In accordance with the requirements of Section 09 21 16.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Site Verification of Conditions:

.1 Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation. Commencement of work implies acceptance of previously completed work.

.2 Inspect surfaces into which work of this Section is dependent for irregularities detrimental to installation and performance of work of this Section. Confirm that conditions are satisfactory prior to proceeding. Notify the Consultant in writing of conditions which would be detrimental to the installation. Commencement of work implies acceptance of previously completed work.

3.2 INSTALLATION

.1 Do not start installation until exterior glazing has been completed and exterior openings are closed in. Ensure wet work is completed and dried out to a degree acceptable to panel manufacturer before installation commences. Maintain uniform temperatures of at least 21 deg C (72 deg F) for 72 hours prior to commencement of the Work and maintain temperature until 72 hours after completion.

.2 Wall Panels:

.1 Install acoustical wall panels in locations indicated with vertical surfaces and edges plumb, top edges level and in alignment with other panels, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.

.2 Secure wall panels with concealed mechanical fastening mounting system in accordance with manufacturer's recommendations.

.3 Finish panel surface to match the Consultant's approved sample.

3.3 CLEANING

.1 After interior finishing work has been substantially completed or when directed by the Consultant, inspect wall panel work. Replace broken, chipped or damaged work. Reset loose units or units out of place and touch up marred surfaces with matching finishes. Upon completion of the Project, ensure finished surfaces are clean and free from dirt and other markings; in good condition subject to acceptance of the Consultant.

3.4 SITE QUALITY CONTROL

.1 Manufacturer's Services: Arrange for Product manufacturer's technical representative to:

.1 meet and discuss installation procedures and unique conditions at the Place of the Work.

.2 inspect substrate surfaces and recommend solutions to accommodate adverse conditions.

.3 periodically visit and inspect installation and report unsatisfactory conditions to Contractor.

.4 attend final inspection and to submit written certification Products, systems and assemblies have been installed in accordance with manufacturer's requirements.

3.5 DEMONSTRATION AND TRAINING

.1 Engage a factory-authorized service representative to train maintenance personnel to replace and maintain acoustical wall panels in accordance with requirements of Division 01.

END OF SECTION

PART 1 - GENERAL

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL INSTRUCTIONS

.1 Read and conform to:

.1 the General Conditions and the Supplementary Conditions of the Contract.

.2 Division 01 requirements and documents referred to therein.

1.3 SUMMARY

.1 Work Included: Provide painting including but not limited to the following:

.1 Painting of all interior exposed elements noted on the Drawings and exterior exposed elements noted on the Drawings. Do not paint excluded components indicated herein. Where an item or surface is not specifically mentioned on the Drawings, Provide same finish as similar adjacent materials or surfaces.

.2 Work Excluded:

.1 Do not paint pre-finished metal siding, fascia and soffit, coping cap flashing and similar components. Refer to dedicated trade Sections of the Specifications for special finishes specified therein and their effects on the work prescribed by this Section.

.2 Do not paint chrome, stainless steel, vinyl, plastic laminate and aluminum surfaces throughout unless specified otherwise.

.3 Do not paint internal surfaces of steel tanks and stacks.

.4 Do not paint sprayed fire-resistant materials.

.5 Do not paint equipment furnished completely prime and finish painted by manufacturer unless required to have field painting over factory finish to have one common corporate colour as identified in the Drawings.

.6 Do not paint over ULC, FM or other labels or equipment identification plates required by OBC or standards referenced therein.

.3 Related Requirements: Specifications throughout the entirety of the Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.4 REFERENCES

.1 Definitions used in this Section:

.1 Exposed: This refers to items visible in completed Work. In case of closets, cabinets and drawers, it includes their interiors.

.2 Surface Preparation: This refers to a means of cleaning or treating of surfaces that are to be painted to ensure the best possible bond between the surface and the painting applied. Surface preparation methods include but are not limited to:

.1 Ensure preparation and workmanship conforms to MPI Painting Manual requirements

.2 Removal of surface contaminants that will affect performance of painting including but not limited to: oil, grease, salts, dust, dirt, rust, rust scale, mill scale, and old coatings where applicable.
.3 Removal of surface imperfections including without limitations: weld spatter, sharp edges, burrs, silvers, laminations, pits, porosities and crevices.
.4 Preparation of surfaces to Provide anchor profile or surface profile to improve mechanical bonding of coating to prepared surface by increasing surface area.

.2 Reference Standards: Latest published editions of reference standards listed in this Section in effect as of the closing date and time of the Request for Tenders for the Contract, including any amendments adopted, are applicable unless otherwise indicated.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meetings:

.1 Prior to starting the work of this Section, convene a pre-installation meeting at the Project site to review the Project requirements and site conditions with pertinent parties. Conform to requirements of Division 01.

1.6 SUBMITTALS

.1 Product Data: Submit manufacturer's literature and data sheets for each type of material provided under this Section for the Project in accordance with requirements of Division 01. Ensure data sheets provide required information including detailed instructions for installing as well as maintaining, preserving and keeping materials in clean and safe conditions. Provide adequate warning of maintenance practices or cleaning agents detrimental to specified materials.

.1 Maintain a copy of the MPI's "Architectural Painting Specification Manual" latest edition on site during the performance of painting work.

.2 Safety Data Sheets (SDS): Submit SDS for inclusion in Operation and Maintenance Manual specified in Division 01, for adhesives, sealants and any other material designated by Consultant.

.3 Proposed Materials: Submit in writing a list of proposed materials prepared by paint manufacturer for approval, at least 60 Days before materials are required. Ensure list bears manufacturer's official certification that materials listed meet or exceed requirements specified herein.

.4 Qualification Data: Submit qualification data for independent paint inspection and testing agency retained for this Project illustrating agency's personnel credentials and experience on Projects of similar size and scope.

.5 Progress Reports:

.1 Arrange for the independent inspection and testing company's representative to visit the Site at intervals during Surface Preparation and paint coating application to ensure proper specified Surface Preparation is being performed, specified Product are being used, appropriate number of coats are being applied and specified finishing procedures are being carried out. Painting inspector shall prepare job progress reports at regular intervals. Submit copy of reports to Consultant.

.2 Upon completion of work, submit written reports and Inspection Company's confirmation that materials and application methods conform to manufacturers' requirements.

.6 Samples: Submit following samples of each color and material to be applied, with texture to simulate actual conditions, on representative samples of the actual substrate in sizes indicated.

.1 Brushouts: minimum 200 mm x 250 mm (8" x 10") of each colour required at least 30 Days prior to commencement of painting.

Substrate	Sample, Base Material
Concrete Masonry	Face of typical unit
Gypsum Board	Face of typical unit
Metal	Steel Plate
Woodwork	Wood (Submit sample panels of stain and varnish finish on each species of wood specified, minimum 300 mm (12") square and of specified thickness.)

.7 Product List: Conform to the requirements of Division 01 and submit a Schedule of Finishes listing the manufacturer's Product name and colour for each paint system. Upon completion, submit records of Products used. List Products in relation to finish systems and include the following:

.1 Product Name, Type and Use

.2 Manufacturer’s Product Number

.3 Colour Numbers

.4 MPI Environmentally Friendly Classification System Rating

.5 VOC Level (g/L)

.6 Manufacturer’s Safety Data Sheets (SDS)

1.7 QUALITY ASSURANCE

.1 Qualifications: Provide the work of this Section executed by competent installers with membership in good standing in OPCA and/or PDCA having a minimum of 5 years’ experience in the application of the Products, systems and assemblies specified herein and with the approval and training of Product manufacturers.

.2 Single Source Responsibility:

.1 Ensure primary materials provided in this Section are obtained from 1 source by a single manufacturer and secondary materials are obtained from sources recommended by primary materials manufacturers.

.2 Provide paint and finishing materials for each procedure listed in Drawings from Products of a single manufacturer.

.3 Use single brand of paint chosen throughout the work of this Section, except where specified otherwise herein.

.3 Mock-Up: At site, with Painting Inspector present, Consultant will locate testing area to establish standard of workmanship, texture, gloss and coverage.

.1 Prepare surfaces and apply treatment to galvanized components for Consultant’s review. Do no painting until samples have been approved. Approved panels become standard of comparison for painting work on site.

.2 Apply 300 mm x 300 mm (12" x 12") samples of each finish on each type of surface to be coated with correct material, number of coats, colour, texture and degree of gloss required or apply full size test samples in areas designated by Consultant. Provide additional samples, if required, to obtain approval.

.3 Correct and refinish work which does not meet quality levels established by reviewed finishes at no expense to Owner. Reviewed full size sample panels may become integral part of finished work if undisturbed at time of Substantial Performance of the Work

1.8 DELIVERY, STORAGE AND HANDLING

.1 Review Product literature, MSDS, related safety data, proper disposal requirements and inform trades involved in the work of this Section.

.2 Deliver and store materials on site in the manufacturer's sealed and labeled containers. Imprint containers with batch numbers and colour identification.

.3 Store containers of paint, thinner and other volatile materials in well ventilated places where they will not be exposed to excessive heat or direct rays of the sun. Keep tightly closed when not in use. Remove used cloths from building at the end of every working shift and when not in use. Take precautions against spontaneous combustion by drenching with water or placing in air-tight covered metal containers.

.4 Prevent fire or explosion caused by improper storage of paints, solvents, rags, and similar items. Store hazardous materials in location and in manner approved by local fire authority.

.5 Post "No Smoking" signs in areas of storage and mixing. Strictly enforce this requirement. Provide and maintain CO_2 fire extinguishers of minimum 9 kg (20 lb) capacity. Repair damage to storage area or surrounding area at no cost to Owner.

.6 Protect finished areas subject to contact during drying by posting "Wet Paint" signs and barring from traffic where necessary.

.7 Leave storage areas clean and free from evidence of occupancy.

.8 Collect waste paint by type and Provide for delivery to recycling or collection facility. Recycle empty paint cans.

1.9 PROJECT CONDITIONS

.1 Paint and finish work items in clean, dust-free, properly ventilated and adequately lit areas (minimum 100 lx (9.3 ft candles).

.2 Maintain minimum interior temperature of 18 deg C (65 deg F) during application and drying of paint and maintain until building occupancy occurs.

.3 Do not undertake interior painting on surfaces where condensation has or will form due to presence of high humidity and lack of proper ventilation. Do not undertake painting unless substrate is a minimum of 3 deg C (5 deg F) above the dew point and rising.

.4 Substrate Moisture Content: Perform tests with electronic moisture meter to ensure compliance with manufacturer's recommendations. Unless otherwise recommended by substrate manufacturer, maximum moisture content for following materials is as follows:

.1 Concrete and Concrete Unit Masonry: Maximum 12 - 14% for solvent coatings and as recommended by manufacturer for each water based system.

.2 Gypsum Based Board: Maximum 12 - 14%.

.3 Wood: Maximum 15%.

.5 Temperature and Ventilation:

.1 Do not Provide paint under ambient and surface temperatures less than 15 deg C (59 deg F) in any instance for 24 hours before and during installation; and 7 Days after installation.

.2 Provide ventilation to remove odours, evaporating solvents and moisture. Maintain adequate ventilation at all times to control excessive humidity.

.3 Ensure adequate temporary ventilation is provided under Div 01 for protection of workers from toxic fumes.

1.10 WARRANTY

.1 The Contractor warrants the work of this Section for period of 2 years from Substantial Performance of the Work against defects and deficiencies in accordance with the General Conditions of the Contract.

.2 Promptly correct defects or deficiencies which become apparent within this warranty period, to the satisfaction of the Consultant and at no expense to the Owner. Defects include but are not limited to: material shrinkage, cracking, splitting, bubbling, blistering and delamination resulting from defective materials or poor workmanship.

1.11 MAINTENANCE

.1 Supply of Touch-up Paint: Supply to the Owner 1-4 litre can (1-1 gal) of each different type and colour of paint used on this Project.

.2 Paint shall be boxed and in sealed, unopened cans in undamaged condition, with name of manufacturer, contents, type and colour clearly indicated on a label securely adhered to can. Submit cans to Owner in accordance with requirements of Division 01.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Products of following manufacturers (or Equivalent) may be acceptable subject to conformance to requirements of Drawings, schedules and Specifications:

.1 Benjamin-Moore

.2 PPG - Pittsburgh Paints

.3 Sherwin Williams

.2 Substitution Limitations:

.1 Limit material selection to the Products selected from the manufacturers listed herein that comply with MPI systems indicated below and listed in the "MPI Approved Products List" and indicated by code numbers referred to in the Master Painter Institute Architectural Specification Manual, latest edition. Provide listed prime and finish coat materials unless otherwise recommended in writing by the paint manufacturer for each specific substrate.

.2 Only comparable Products from manufacturers listed herein will be considered provided they meet the requirements of this Specification, offering functionally, aesthetically equivalent Products in Consultant’s opinion and subject to Consultant’s review.

.3 Colour matching is not acceptable. Paint materials without manufacturer's label will not be allowed.

2.2 REGULATORY REQUIREMENTS

.1 Conform to the *Occupational Health and Safety Act* (Ontario), Regulation 851 and other requirements of local Authorities Having Jurisdiction for storage, mixing, application and disposal of paint and related waste materials.

.2 For temporary scaffolding, ladders and other construction accessories, conform to the Occupational Health and Safety Act (Ontario), Regulation 851, and other requirements of Authorities Having Jurisdiction, as amended.

.3 Fire Hazard Classification: As determined by ULC testing in accordance with CAN/ULC S102/S102.2 shall not exceed following:

.1 Flame Spread: 0.

.2 Fuel Contributed: 15.

.3 Smoke Developed: 10.

.4 Provide coatings from specified MPI designations which are in accordance with Canadian Volatile Organic Compound (VOC) Concentration Limits for Architectural Coatings Regulations.

.5 Comply with toxic trace limitations stipulated by Authorities Having Jurisdiction in accordance with requirements of CAN/CGSB-1.500.

2.3 DESIGN AND PERFORMANCE REQUIREMENTS

.1 Acceptable materials, workmanship and all items affecting the Work of this Section are to be in accordance with the MPI's "Architectural Painting Specification Manual", latest edition, and "Maintenance and Repainting Specification Manual", latest edition. Painting work to be in accordance with MPI Premium Grade finish requirements.

.2 Only materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, and similar coating materials.) listed in the MPI Approved Product List are acceptable for use on this Project.

.3 Provide other materials such as linseed oil, shellac, thinners and solvents, of the highest quality Product of an MPI listed manufacturer and compatible with paint materials being used as required.

.4 Provide paint materials with good flowing and brushing properties and dry or cure free of blemishes, sags, air entrapment, and other similar effects.

.5 Where required, ensure paints and coatings meet flame spread and smoke developed ratings designated by OBC requirements and Authorities Having Jurisdiction.

.6 Paint applied on materials which from time to time will become hot, such as convector covers and similar items, to be approved by paint manufacturer for particular condition.

.7 Paint materials will be rated under Environmental Notation System (ENS) with acceptable VOC ranges as listed in the MPI Approved Product List under "E" ranges. Use only materials having a minimum MPI "Environmentally Friendly "E2" or "E3" rating based on VOC (EPA Method 24) content levels

.8 As far as practical, factory mix paint for immediate application without thinning or alteration at site. Do not alter or thin any paint without manufacturer's written approval.

.9 All accent walls to have a level 5 finish before painting begins. Refer to Section 09 21 16, Gypsum Board.

.10 The Consultant reserves right to refuse paint or finishing material if in Consultant's opinion materials are not suitable or adequate for proposed use.

2.4 MATERIALS

.1 Topcoat and Intermediate Coat Thickness:

.1 Latex & Acrylics (Interior): 0.03 mm (1.2 mils) DFT/coat.

.2 Epoxies (Interior): 0.076 mm (3 mils) DFT/coat.

.3 Urethanes (Interior and Exterior): 0.076 mm (3 mils) DFT/coat.

.2 Gloss and Sheen Ratings: The following gloss terms used herein shall have the following values in accordance with ASTM D523 based on the MPI recommended gloss reflectance guidelines:

Gloss Term	Gloss Level	Gloss Value
Flat or Matte	G1	0 to 5 units at 60 degrees and max 10 units at 85 degrees
Velvet	G2	0 to 10 units at 60 degrees and max 10 to 35 units at 85 degrees
Eggshell	G3	5 to 25 units at 60 degrees and 10 to 35 units at 85 degrees
Satin	G4	20 to 35 units at 60 degrees and min 35 units at 85 degrees
Semi-Gloss	G5	35 to 70 units at 60 degrees
Gloss	G6	70 to 85 units at 60 degrees

.3 Gloss Values:

.1 As later selected by the Consultant:

.1 Walls: egg shell or satin.
.2 Trim and doors: Semi-gloss.
.3 Ceilings: Flat

.4 Colours: Consultant will select colours at a later date. Refer to Drawings.

.1 Colours of Latex Paint (PT):

.1 Maximum of 5 colours, of which no more than 4 colours will be dark accent colours. No more than 4 colours will be used per room for walls and ceilings, with a different colour for painted doors and frames. Deep tint accent colours may be used on doors and similar panels scheduled for painting.
.2 Reveals, coves and bulkheads and valances may have colour different than main colour in room.
.3 Final colours selected will not necessarily be colours found on standard colour charts of manufacturer whose Products have been accepted for use.

.2 Colour of Epoxy Paint (PT-E): The Consultant will select maximum 5 colours for epoxy paint from manufacturer's standard colour range.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Surface Conditions:

.1 Do work only when surfaces and conditions are satisfactory for production of quality work. Report to the Consultant in writing any surfaces which are found to be unsatisfactory. Commencement of the work implies acceptance of substrate surfaces.

.2 Ensure temperature of surfaces to be finished is between 10 deg C and 20 deg C (50 deg F and 68 deg F) and surfaces are dry and free of dirt, grease or other contaminants that may affect applied finish.

.3 Verify moisture content of surfaces with electronic moisture metre. Do not proceed without written directions if moisture reading is higher than 12 - 15%.

.4 Conform to manufacturer's requirements and those listed below for following substrates:

.1 Steel substrates: Do not apply coatings over moisture or when surface temperature is not at least 3 deg C (5 deg F) above dew point and rising.
.2 Wood substrates: Do not stain or paint if moisture reading is higher than 12%. Inspect work to ensure surfaces are smooth, free from machine marks and that nailheads have been countersunk.
.3 Cast-in-place concrete substrates: Allow to cure for 60 to 90 Days before proceeding with priming.
.4 Concrete: Inspect and accept or reject filled-in surface blow holes.
.5 New masonry substrates: Allow to cure for 30 to 90 Days. Ensure moisture content is below 12% and test for alkalinity and neutralize (pH 6.5 - 7.5) before proceeding with priming.
.6 Gypsum board substrates: Inspect to ensure joints are completely filled and sanded smooth. Inspect surfaces for following defects and ensure corrective measures have been taken prior to commencing painting work:

.1 "nail popping".
.2 screw heads not recessed and taped.
.3 breaks in surface or other imperfections.

3.2 PREPARATION

.1 Verify that each substrate is dry and not frozen and free from tool and sandpaper marks, dust, rust, insects, grease and other foreign matter liable to impair finished work.

.2 Prepare defective surfaces to obtain a satisfactory substrate and in accordance with paint manufacturer's instructions.

.3 Prior to painting, sweep areas dust-free.

.4 Clean soiled surfaces to be painted.

.5 Protection:

.1 Provide scaffolding, staging, platforms and ladders, as required for execution of work. Erect scaffolding to avoid interference with work of other trades. Comply with Occupational Health and Safety Act (Ontario) and other Authorities Having Jurisdiction.

.2 Provide drop cloths or adequate plastic sheets to protect floors in areas assigned for storage and mixing of paints.

.3 Protect work of other Sections being performed by trades against paint splattering and Make Good at own expense any such damage.

.4 Remove finish hardware, electrical switch and outlet covers, receptacle plates, fittings and fastenings, to protect from paint splatter. Mask items not removable. Use sufficient drop cloths and protective coverings for full protection of floors, furnishings, mechanical, electrical and special equipment, all other components of building which do not require painting or to be removed, from paint spotting and other soiling. Re-Install items when paint is dry. Clean any components that are paint spotted or soiled.

.5 Keep waste rags in covered metal drums containing water and remove from building at end of each Day.

.6 Prohibit traffic, where possible, from areas where painting is being carried out and until paint is cured. Post “wet paint” or other warning signage during and on completion of work. Provide also warning signs at all points of entry to areas where painting is applied.

.7 When handling solvent coating materials, wear approved vapour/particulate respirator as protection from vapours. Dust respirators do not provide protection from vapours.

.6 Surface Preparation: Comply with MPI RSP 1, MPI RSP 4, SSPC SP1, 2, or 3 as applicable for surface cleaning.

.1 Prepare surfaces in accordance with SSPC or MPI standards. Change rags frequently to avoid contaminant spread.

.2 Ferrous Metal: Clean to SSPC-SP1/2/3. Remove rust, prime bare metal.

.3 Structural Steel/Miscellaneous Steel: Remove contaminants to SSPC-SP7 or SSPC-WJ4 LPWC.

.4 Decorative Metals: Remove scale, rust to SSPC-SP6.

.5 Galvanized Steel: Allow unweathered steel to weather, clean to SSPC-SP16. No acetic acid use.

.6 Weathered Galvanized Steel: Clean to SSPC-SP16.

.7 Pre-Treated Galvanized Steel: Follow manufacturer's preparation guidelines.

.8 Woodwork: Determine species, grain, moisture content. Sand and clean for finish application.

.9 Plastic (PVC): Solvent clean to SSPC-SP1, sand lightly.

.10 Previously Finished Surfaces: Clean, strip defective paint, flatten gloss, prepare for new finishes.

.11 Concrete Surfaces: Verify moisture content, etch if necessary, rinse and dry. Prepare floors as per manufacturer.

.12 Gypsum Board: Inspect for defects, clean, sand, prime as necessary.

3.3 MIXING

.1 Mix and prepare paint materials in accordance with manufacturer’s directions for particular material and coat to be applied. If reducing is required, do so in accordance with recommendations of manufacturer for particular material and coat.

.2 Mix primer-sealer with a certain amount of colour coat in proportions recommended by manufacturer of material actually used. Tint undercoats and each finish coat with correct type colours, for identification of each succeeding coat.

.3 Clean containers used for storage, mixing and application of materials free of foreign materials and residue.

3.4 APPLICATION

.1 Paint interior and exterior Exposed elements as noted on the Drawings and as required to complete design requirements. Do not paint excluded components indicated herein. Where an item or surface is not specifically mentioned in the schedules, Provide the same finish as similar adjacent materials or surfaces. If colour or finish is not designated on the Drawings, the Consultant will select from standard colors or finishes available.

.2 Provide finish uniform in sheen, colour and texture, free from streaks, shiners and brush or roller marks or other defects.

.3 Apply materials in accordance with manufacturer's directions and Specifications paying particular attention to appropriate time frame after cleaning when environmental conditions encourage flash-rusting, rusting, contamination or manufacturer's paint Specifications require earlier applications. Apply subsequent coatings in accordance with manufacturer’s recommended recoat “windows”. Do not use adulterants. Do any reduction of coating’s viscosity in accordance with the manufacturer’s directions.

.4 Use up paints within the period of shelf life recommended by the paint manufacturer.

.5 Successive coatings to be harmonious chemical compositions and materials of same manufacturer.

.6 Thoroughly mix materials before application. Apply materials evenly, under adequate illumination, free from sags, runs and other defects. Do cutting-in neatly and ensure paint is applied wet edge to wet edge.

.7 Sand and dust between each coat to provide an anchor for next coat and to remove defects visible from a distance up to 1000 mm (39").

.8 Ensure each coat is dry and hard as per manufacturers’ recommendations for recoats before a following coat is applied.

.9 Continue through paint finish behind wall-mounted items (e.g. markerboards and tack boards).

.10 Finishes and number of coats specified hereinafter in Drawings are intended as minimum requirements guide only. Refer to the manufacturer’s recommendations for exact instructions for thickness of coating to obtain optimum coverage and appearance. Some materials and colours may require additional coats and deeper colours may require use of manufacturers’ special tinted primers.

.11 Apply additional paint coats, beyond number of coats specified for any surface, to completely cover and hide substrate and to produce a solid, uniform appearance.

.12 Allow each coat of paint to cure and become dry and hard before application of succeeding coats (unless manufacturer's directions require otherwise).

.13 Before finishing paint coats are applied, inspect and touch-up shop coats of primers previously applied by other trades or fabricators.

.14 Provide paint coating thicknesses indicated, measured as minimum dry film thicknesses.

.15 Obtain colour chart giving colour schemes and gloss value for various areas from the Consultant. Colour chart shall give final selection of colours and surface textures of finishes and whether finishes are transparent (natural) or opaque (paint).

.16 Spraying is not allowed without written permission.

.17 Paint entire plane of areas exhibiting incomplete or unsatisfactory coverage and of areas which have been cut and patched. Patched appearance is not acceptable.

.18 Finish paint factory primed surfaces. Do not paint baked paint surface, chrome plated, stainless steel, aluminum or other surfaces finished with final finish in factory.

.19 Advise the Consultant when each applied paint coat can be inspected. Do not recoat without inspection. Tint each coat slightly to differentiate between applied coats.

.20 Apply final coats on smooth surfaces by roller or brush. Hand brush wood trim surfaces.

.21 Sand smooth paint and varnish undercoats prior to recoating.

.22 Apply primer coat soon after Surface Preparation is completed to prevent contamination of substrate.

.23 Woodwork:

.1 Prime woodwork designated for painting as soon as possible after delivery to site and before installation. Prime cut surfaces, whether exposed or not (i.e. all 6 edges of wood doors) before installation. Prime cut surfaces of woodwork to receive transparent finish with 1 coat of transparent finish reduced 25%.

.2 Fill open grain woods with filler tinted to match wood and work well into grain. Wipe excess from surface before filler sets.

.3 Apply primer-sealer coats by brush or roller. Permit to dry in accordance with manufacturer’s recommendations before applying succeeding coats. Touch up suction spots and sand between coats with No. 120 sandpaper.

.4 Apply final coats on smooth surfaces by roller or brush. Hand brush wood trim surfaces.

.24 Ferrous Metal Surfaces: Apply primer coat to unprimed ferrous metal surfaces. Where sandblast preparation is specified, apply specified primer immediately after blast cleaning.

3.5 EXISTING SPACES

.1 Refinish existing surfaces of rooms or areas which have been damaged, altered or otherwise affected by work. Also finish "new" work occurring thereon unless otherwise specified. Use same procedure as for new work but primer (or filler, stain and sealer in case of varnish finish) may be omitted. Prepare existing surfaces as specified herein. Ensure finish matches previous finish.

.2 Paint or repaint rooms or areas where noted on Drawings and/or as indicated on Drawings.

.3 Repaint surfaces entirely between changes of plane.

.4 Extend painting to a suitable boundary to avoid a “patched” effect. Sand, wire-brush, or scrape such existing finished surfaces to remove loose paint and to reduce gloss. Also clean existing films of dirt, grease or wax. If metallic surfaces are rusted, remove loose scale to Provide a firm surface. Patch and sand cracks and other imperfections.

.5 Provide paint to interior existing spaces effected by alterations [and shelled-in spaces] in accordance with following:

.1 Paint walls to the nearest inside and outside corners for the full wall height.

.2 Paint columns floor to ceiling.

.3 Paint full ceilings to the nearest wall or bulkhead.

.4 Unless indicated otherwise match the existing colour.

.5 Example Locations:

.1 pressed steel frames.
.2 hollow metal doors.
.3 access doors and frames.
.4 hose cabinets.
.5 miscellaneous exposed interior metal work.

3.6 MECHANICAL AND ELECTRICAL SERVICES

.1 Read Division 21, 22, 23 and Division 26 for their requirements and further instruction on painting mechanical and electrical work and perform such work under the supervision of the respective Subcontractors responsible for performing the work prescribed by the mechanical and electrical Divisions of the Specifications.

.2 Finish paint primed mechanical equipment: heaters, convectors, radiators, wall fin perimeter induction units, fan coil units and similar items.

.3 Prime and paint exposed, unfinished electrical raceways, fittings, outlet boxes, junction boxes, pull boxes and similar items.

.4 Keep sprinkler heads free of paint.

.5 Take steps to protect gauges, identification plates and similar items from being painted over or paint splattered.

.6 Remove grilles, covers, access panels for mechanical and electrical systems from installed location and paint separately, if these items are not factory finished

.7 Paint work to match surfaces they are seen against unless directed otherwise.

.8 Paint interior surfaces of air ducts visible through grilles and louvres, with 1 coat of flat black metal paint to limit of sight line.

3.7 CLEANING

.1 Clean adjacent surfaces which have been painted, soiled or otherwise marred.

.2 Remove masking and other protection provided under this Section.

.3 During the work of this Section cover finished floors, walls, ceilings and other work in the vicinity and protect such work from paint and damage.

.4 Painting work will not be considered complete until spatters, drippings, smears and overspray have been cleaned and removed to the satisfaction of the Consultant.

.5 Make Good any damage to structure building surfaces or furnishings resulting from painting operations at no cost to the Owner.

.6 Disposal of Paint Waste:

.1 Be responsible for removal and disposal of material and waste generated by this Section.

.2 Paint, stain and wood preservative finishes and related materials (such as thinners and solvents) are regarded as hazardous Products and are subject to regulations of Authorities Having Jurisdiction regarding their disposal. Obtain information on these controls from the applicable Provincial government departments having jurisdiction.

.3 Separate and recycle waste materials. Where paint recycling is available, collect waste paint by type and provide for delivery to recycling or collection facility. Materials that cannot be reused must be treated as hazardous waste and disposed of in an appropriate manner.

.4 Place materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.

.5 To reduce amount of contaminants entering waterways, sanitary/storm drain systems or into the ground adhere to following procedures:

.1 Retain cleaning water for water-based materials to allow sediments to be filtered out. In no case clean equipment using free draining water.
.2 Retain cleaners, thinners, solvents and excess paint and place in designated containers and ensure proper disposal.
.3 Return solvent and oil soaked rags used during painting operations for contaminant recovery, proper disposal, or appropriate cleaning and laundering.
.4 Dispose of contaminants in an approved legal manner in accordance with hazardous waste regulations.
.5 Dry empty paint cans prior to disposal or recycling (where available).
.6 Close and seal tightly partly used cans of materials including sealant and adhesive containers and store protected in well ventilated fire-safe area at moderate temperature.

.6 Set aside and protect surplus and uncontaminated finish materials not required by the Owner and deliver or arrange collection for verifiable re-use or re-manufacturing.

3.8 INTERIOR PAINT SCHEDULE

.1 **Standard Performance Finishes (PT) - for public areas including lobbies, corridors, waiting areas, not subject to high abuse (Refer to Drawings for specific locations)**

.1 Substrate: Concrete Vertical Surfaces (including undersides of mezzanines and stairs etc.) - Latex (Over Alkali-resistant Primer) (INT 3.1A as amended):

.1 Primer: 1 coat alkali-resistant primer (MPI #3)

.1 "Loxon Concrete & Masonry Primer, <100 g/L" by Sherwin Williams (or Equivalent)
.2 "Perma-Crete Alkali Resistant Primer" by PPG - Pittsburgh Paint (or Equivalent)
.3 "Ultra Spec 500 Interior Primer" by Benjamin Moore (or Equivalent)

.2 Top Coats: 2 coats latex Interior, Institutional Low Odor/VOC (MPI #143, MPI #144, #145)

.1 Zero VOC Latex Paint:

.1 "ProMar 200 Zero VOC, 0 g/L" by Sherwin Williams (or Equivalent)
.2 "Pure Performance Interior Latex Zero VOC 9-line" by PPG - Pittsburgh Paint (or Equivalent)
.3 "Ultra Spec 500 Interior Finish" by Benjamin Moore (or Equivalent)

.2 Zero VOC and Silica-free Latex Paint (Garbage Rooms only):

.1 "Harmony Interior Latex — Odor Eliminating Technology, 0 g/L" by Sherwin Williams; no substitutions (or Equivalent)

.2 Substrate: Concrete Masonry Units - Institutional Low Odour/VOC Latex Finish (INT 4.2E as amended):

.1 Primer: 1 coat latex interior block filler (MPI #4):

.1 "PrepRite Block Filler, 45 g/L" by Sherwin Williams (or Equivalent)
.2 "Speedhide Hi Fill Acrylic Block Filler" by PPG - Pittsburgh Paint (or Equivalent)
.3 “Ultra Spec Masonry Block Filler K571”by Benjamin Moore (or Equivalent)

.2 Top Coats: 2 coats latex Interior, Institutional Low Odor/VOC (MPI #143, MPI #144, #145)

.1 Zero VOC Latex Paint:

.1 "ProMar 200 Zero VOC, 0 g/L" by Sherwin Williams (or Equivalent)
.2 "Pure Performance Interior Latex Zero VOC 9-line" by PPG - Pittsburgh Paint (or Equivalent)
.3 "Ultra Spec 500 Interior Finish" by Benjamin Moore (or Equivalent)

.2 Zero VOC and Silica-free Latex Paint (Garbage Rooms only):

.1 "Harmony Interior Latex — Odor Eliminating Technology, 0 g/L" by Sherwin Williams; no substitutions. (or Equivalent)

.3 Substrate: Gypsum Board and Plaster Ceilings and Soffits - Institutional Low Odour/VOC Latex Finish (gypsum wallboards, textured plasters, etc.) (INT 9.2M as amended)

.1 Primer: 1 coat multi-purpose latex interior primer sealer (MPI #149)

.1 Zero VOC Latex Primer:

.1 "ProMar 200 Zero VOC Interior Latex Primer, 0 g/L" by Sherwin Williams (or Equivalent)
.2 "Pure Performance Interior Latex Primer 9-900" by PPG - Pittsburgh Paint (or Equivalent)
.3 "Ultra Spec 500 Waterborne Interior Primer Sealer" by Benjamin Moore (or Equivalent)

.2 Zero VOC and Silica-free Latex Primer (garbage rooms only):

.1 "Harmony Interior Latex Primer — Odor Eliminating Technology, 0 g/L" by Sherwin Williams; no substitutions. (or Equivalent)

.2 Top Coats: 2 coats latex Interior, Institutional Low Odor/VOC (MPI #143, MPI #144, #145)

.1 Zero VOC Latex Paint:

.1 "ProMar 200 Zero VOC, 0 g/L" by Sherwin Williams (or Equivalent)
.2 "Pure Performance Interior Latex Zero VOC 9-line" by PPG - Pittsburgh Paint (or Equivalent)
.3 "Ultra Spec 500 Interior Finish" by Benjamin Moore (or Equivalent)

.2 Zero VOC and Silica-free Latex Paint (garbage rooms only):

.1 "Harmony Interior Latex — Odor Eliminating Technology, 0 g/L" by Sherwin Williams; no substitutions. (or Equivalent)

.4 Substrate: Gypsum Board Walls - Institutional Low Odour/VOC Latex Finish (gypsum and fiberglass faced wallboards, textured plasters, etc.) (INT 9.2M as amended)

.1 Primer: 1 coat multi-purpose latex interior primer sealer (MPI #149)

.1 Zero VOC Latex Primer:

.1 "ProMar 200 Zero VOC Interior Latex Primer, 0 g/L" by Sherwin Williams (or Equivalent)
.2 "Pure Performance Interior Latex Primer 9-900" by PPG - Pittsburgh Paint (or Equivalent)

.3 "K534 Ultra Spec 500 Waterborne Interior Primer Sealer" by Benjamin Moore (or Equivalent)

.2 Zero VOC and Silica-free Latex Primer (garbage rooms only):

.1 "Harmony Interior Latex Primer — Odor Eliminating Technology, 0 g/L" by Sherwin Williams; no substitutions. (or Equivalent)

.2 Top Coats: 2 coats latex Interior, Institutional Low Odor/VOC (MPI #143, MPI #144, #145)

.1 Zero VOC Latex Paint:

.1 "ProMar 200 Zero VOC, 0 g/L" by Sherwin Williams (or Equivalent)
.2 "Pure Performance Interior Latex Zero VOC 9-line" by PPG - Pittsburgh Paint (or Equivalent)
.3 "Ultra Spec 500 Interior Finish" by Benjamin Moore (or Equivalent)

.2 Zero VOC and Silica-free Latex Paint (garbage rooms only):

.1 "Harmony Interior Latex — Odor Eliminating Technology, 0 g/L" by Sherwin Williams; no substitutions. (or Equivalent)

.5 Substrate: Fiberglass Mat Faced Gypsum Board Walls (Moisture resistant gypsum board, abuse resistant gypsum board, impact resistant gypsum board) (Non-MPI System)

.1 Primer: 1 coat high build surfacer (Minimum DFT: as recommended by manufacturer but not less than 10 mils)

.1 "Builders Solution, <50 g/L" by Sherwin Williams (or Equivalent)
.2 "Speedhide Maxbuild High Build Drywall Surfacer" by PPG - Pittsburgh Paint (or Equivalent)

.2 Sealing Coat: As recommended by Paint manufacturer.
.3 Top Coats: 2 coats latex Interior, Institutional Low Odor/VOC (MPI #143, MPI #144, #145)

.1 Zero VOC Latex Paint:

.1 "ProMar 200 Zero VOC, 0 g/L" by Sherwin Williams (or Equivalent)
.2 "Pure Performance Interior Latex Zero VOC 9-line" by PPG - Pittsburgh Paint (or Equivalent)
.3 "Ultra Spec 500 Interior Finish" by Benjamin Moore (or Equivalent)

.6 Substrate: Painted Wood (Doors, Frames, Trims, Rails etc.) – latex finish (INT 6.3V as amended)

.1 Primer: 1 coat multi-purpose latex interior primer sealer (MPI #39)

.1 "Multi-Purpose Latex Primer" by Sherwin Williams (or Equivalent)
.2 "Seal Grip Acrylic Universal Primer" by PPG - Pittsburgh Paint (or Equivalent)
.3 “Fresh Start High-Hiding All-Purpose Primer K046” by Benjamin Moore (or Equivalent)

.2 Top Coats: 2 coats acrylic Interior, Institutional Low Odor/VOC (MPI #147)

.1 "Pro Industrial Zero VOC Acrylic, 0 g/L" by Sherwin Williams (or Equivalent)
.2 "Pure Performance Interior Latex Zero VOC" by PPG - Pittsburgh Paint (or Equivalent)

.3 "Ultra Spec 500 Waterborne Interior Finish" by Benjamin Moore (or Equivalent)

.7 Substrate: Stained Wood (Trims, Rails etc.) – polyurethane varnish (INT 6.3E as amended)

.1 Stain: 1 coat interior wood stain (semi-transparent) (MPI #90)

.1 "Minwax Wood Finish Stain, <250 g/L" by Sherwin Williams (or Equivalent)
.2 "Olympic Low VOC Oil Wood Stain" by PPG - Pittsburgh Paint (or Equivalent)
.3 Equivalent by Benjamin Moore

.2 Top Coats: 2 coats clear moisture cure polyurethane varnish (MPI #56, #57):

.1 "Minwax Waterbased Polyurethane Varnish, <275 g/L" by Sherwin Williams (or Equivalent)
.2 "Olympic Oil Based Polyurethane" by PPG - Pittsburgh Paint (or Equivalent)

.8 Substrate: Ferrous Metals

.1 Doors, Frames, Miscellaneous Metals etc.) - Water Based Light Industrial Coating (INT 5.1B or INT 5.18 as amended)

.1 Primer: 1 coat rust inhibitive primer (MPI #107)

.1 "Pro Industrial Pro-Cryl Universal Primer, <100 g/L" by Sherwin Williams (or Equivalent)
.2 "Pitt-Tech Plus DTM Acrylic Primer" by PPG - Pittsburgh Paint (or Equivalent)
.3 “Ultra Spec HP D.T.M. Primer FP04” by Benjamin Moore (or Equivalent)

.2 Top Coats: 2 coats acrylic Interior, Institutional Low Odor/VOC (MPI #147, MPI #153):

.1 "Pro Industrial Zero VOC Acrylic, 0 g/L" by Sherwin Williams (or Equivalent)
.2 "Pure Performance Interior Latex Zero VOC" by PPG - Pittsburgh Paint (or Equivalent)
.3 " K540 Ultra Spec 500 Waterborne Interior Finish" by Benjamin Moore (or Equivalent)

.2 Handrails (INT 5.1K as amended)

.1 Primer: 1 coat rust inhibitive primer (MPI #107)

.1 "Pro Industrial Pro-Cryl Universal Primer, <100 g/L" by Sherwin Williams (or Equivalent)
.2 "Pitt-Tech Plus DTM Acrylic Primer" by PPG - Pittsburgh Paint (or Equivalent)
.3 "Super Spec High Performance Acrylic Metal Primer" by Benjamin Moore (or Equivalent)

.2 Top Coats: 2 coats water-based epoxy (MPI #115)

.1 "Pro Industrial Zero VOC Waterbased Epoxy, 0 g/L" by Sherwin Williams (or Equivalent)
.2 "Cornado 1138 Line" by Benjamin Moore (or Equivalent)

.9 Substrate: Galvanized Metal

.1 Doors, Frames, Miscellaneous Metals etc. (INT 5.3N or 5.3K as amended)

.1 Primer: 1 coat water-based galvanized primer (MPI #134)

.1 "Pro Industrial Pro-Cryl Universal Primer, <100 g/L" by Sherwin Williams (or Equivalent)
.2 "Pitt-Tech Plus DTM Acrylic Primer" by PPG - Pittsburgh Paint (or Equivalent)
.3 “Ultra Spec HP D.T.M. Primer FP04” by Benjamin Moore (or Equivalent)

.2 Top Coats: 2 coats acrylic Interior, Institutional Low Odor/VOC (MPI #147, MPI #153)

.1 "Pro Industrial Zero VOC Acrylic, 0 g/L" by Sherwin Williams (or Equivalent)
.2 "Pitt-Tech Plus DTM Acrylic" by PPG - Pittsburgh Paint (or Equivalent)
.3 "K540 Ultra Spec 500 Waterborne Interior Finish" by Benjamin Moore (or Equivalent)

.2 Handrails (INT 5.1K as amended)

.1 Primer: 1 coat rust inhibitive primer (MPI #107)

.1 "Pro Industrial Pro-Cryl Universal Primer, <100 g/L" by Sherwin Williams (or Equivalent)
.2 "Pitt-Tech Plus DTM Acrylic Primer" by PPG - Pittsburgh Paint (or Equivalent)
.3 "Super Spec High Performance Acrylic Metal Primer" by Benjamin Moore (or Equivalent)

.2 Top Coats: 2 coats water-based epoxy (MPI #115)

.1 "Pro Industrial Zero VOC Waterbased Epoxy, 0 g/L" by Sherwin Williams (or Equivalent)
.2 “Pitt Glaze Acrylic Epoxy” (NOT MPI APPROVED) by PPG - Pittsburgh Paint (or Equivalent)
.3 "Cornado 1138 Line" by Benjamin Moore (or Equivalent)

.10 Substrate: Aluminum

.1 Primer: 1 coat quick dry primer (MPI #76, MPI #95, MPI #107)

.1 "Pro Industrial Pro-Cryl Universal Primer, <100 g/L" by Sherwin Williams (or Equivalent)
.2 "Pitt-Tech Plus DTM Acrylic Primer" by PPG - Pittsburgh Paint (or Equivalent)
.3 "KP04 Super Spec High Performance Acrylic Metal Primer" by Benjamin Moore (or Equivalent)

.2 Top Coats: 2 coats acrylic Interior, Institutional Low Odor/VOC (MPI #147, MPI #153)

.1 "Pro Industrial Zero VOC Acrylic, 0 g/L" by Sherwin Williams (or Equivalent)
.2 "Pitt-Tech Plus DTM Acrylic" by PPG - Pittsburgh Paint (or Equivalent)
.3 "K540 Ultra Spec 500 Waterborne Interior Finish" by Benjamin Moore (or Equivalent)

.2 **High Performance Finishes (PT-E) (Refer to Drawings for specific locations).**

.1 Substrate: Concrete Vertical Surfaces (including undersides of mezzanines and stairs etc.) - Epoxy Modified Latex (INT 3.1G as amended):

.1 Primer: As recommended by top coat manufacturer.
.2 Top Coats: 2 coats water-based epoxy (MPI #115)

.1 "Pro Industrial Zero VOC Waterborne Epoxy, 0 g/L" by Sherwin Williams (or Equivalent)
.2 Corotech Acrylic Epoxy V450 by Benjamin Moore (or Equivalent)

.2 Substrate: Concrete Masonry Units – Epoxy modified latex (INT 4.2J as amended)

.1 Primer: 1 coat latex interior block filler (MPI #4):

.1 "PrepRite Block Filler, 45 g/L" by Sherwin Williams (or Equivalent)
.2 "Speedhide Hi Fill Acrylic Block Filler" by PPG - Pittsburgh Paint (or Equivalent)
.3 ”Ultra Spec Masonry Block Filler K571” by Benjamin Moore (or Equivalent)

.2 Top Coats: 2 coats water-based epoxy (MPI #115)

.1 "Pro Industrial Zero VOC Waterborne Epoxy, 0 g/L" by Sherwin Williams (or Equivalent)
.2 “Pitt Glaze Acrylic Epoxy” (NOT MPI APPROVED) by PPG - Pittsburgh Paint (or Equivalent)
.3 "Cornado 1138 Line" by Benjamin Moore (or Equivalent)

.3 Substrate: Gypsum Board and Plaster Ceilings and Soffits **below 6096 mm (20’ – 0”)** (gypsum and fiberglass faced wallboards, textured plasters, etc.) - Institutional Low Odour/VOC Latex Finish (INT 9.2M as amended)

.1 Primer: 1 coat multi-purpose latex interior primer sealer (MPI #149)

.1 Zero VOC Latex Primer:

.1 "ProMar 200 Zero VOC Interior Latex Primer, 0 g/L" by Sherwin Williams (or Equivalent)
.2 "Pure Performance Interior Latex Primer 9-900" by PPG - Pittsburgh Paint (or Equivalent)
.3 "K534 Ultra Spec 500 Waterborne Interior Primer Sealer" by Benjamin Moore (or Equivalent)

.2 Top Coats: 2 coats latex Interior, Institutional Low Odor/VOC (MPI #143, MPI #144, #145)

.1 Zero VOC Latex Paint:

.1 "ProMar 200 Zero VOC, 0 g/L" by Sherwin Williams (or Equivalent)
.2 "Pure Performance Interior Latex Zero VOC 9-line" by PPG - Pittsburgh Paint (or Equivalent)
.3 "K536 Ultra Spec 500 Interior Finish" by Benjamin Moore (or Equivalent)

.4 Substrate: Gypsum Board and Plaster Ceilings and Soffits **above 6096 mm (20’ – 0”)** (gypsum and fiberglass faced wallboards, textured plasters, etc.) - Institutional Low Odour/VOC Latex Finish (INT 9.2M as amended)

.1 Top Coats: 2 coats water based dry fall coating (MPI #118, MPI#226)

.1 "Low VOC Waterborne Acrylic Dryfall, <50 g/L" by Sherwin Williams (or Equivalent)
.2 "Speedhide Interior Latex Dryfall" by PPG - Pittsburgh Paint (or Equivalent)
.3 “Coronado Super Kote 5000 Latex Dry Fall Flat N110” by Benjamin Moore (or Equivalent)

.5 Substrate: Gypsum Board Walls (gypsum wallboards, textured plasters, etc.) – Epoxy Modified Latex (INT 9.2F as amended)

.1 Primer: 1 coat multi-purpose latex interior primer sealer (MPI #50)

.1 "ProMar 200 Zero VOC Interior Latex Primer, 0 g/L" by Sherwin Williams (or Equivalent)
.2 "Speedhide Interior Latex Primer" by PPG - Pittsburgh Paint (or Equivalent)
.3 "K534 Ultra Spec 500 Waterborne Interior Primer Sealer" by Benjamin Moore (or Equivalent)

.2 Top Coats: 2 coats water-based epoxy (MPI #115)

.1 "Pro Industrial Zero VOC Waterborne Epoxy, 0 g/L" by Sherwin Williams (or Equivalent)
.2 “Pitt Glaze Acrylic Epoxy” by PPG - Pittsburgh Paint (MPI 151/153) (or Equivalent)
.3 " Corotech Acrylic Epoxy V450 " by Benjamin Moore (or Equivalent)

.6 Substrate: Fiberglass Mat Faced Gypsum Board Walls (Moisture resistant gypsum board, abuse resistant gypsum board, impact resistant gypsum board) (Non-MPI system)

.1 Primer: 1 coat high build surfacer (Minimum DFT: as recommended by manufacturer but not less than 10 mils)

.1 "Builders Solution, <50 g/L" by Sherwin Williams (or Equivalent)
.2 "Speedhide Maxbuild High Build Drywall Surfacer" by PPG - Pittsburgh Paint (or Equivalent)

.2 Sealing Coat: As recommended by paint and board manufacturer.
.3 Top Coats: 2 coats water-based epoxy (MPI #115)

.1 "Pro Industrial Zero VOC Waterborne Epoxy, 0 g/L" by Sherwin Williams (or Equivalent)
.2 “Pitt Glaze Acrylic Epoxy” (NOT MPI APPROVED) by PPG - Pittsburgh Paint (or Equivalent)
.3 " Corotech Acrylic Epoxy V450 " by Benjamin Moore (or Equivalent)

.7 Substrate: Ferrous Metals

.1 Unexposed Miscellaneous Ferrous Metals (with existing shop coat primer): No further finishing required except for touch-up of damaged surfaces. Prime with Product recommended by manufacturer for specific substrate.
.2 Doors, Frames, Miscellaneous Metals etc. - Water Based Light Industrial Coating (INT 5.1B or INT 5.18 as amended)

.1 Primer: 1 coat rust inhibitive primer (MPI #107)

.1 "Pro Industrial Pro-Cryl Universal Primer, <100 g/L" by Sherwin Williams (or Equivalent)
.2 "Pitt-Tech Plus DTM Acrylic Primer" by PPG - Pittsburgh Paint (or Equivalent)
.3 “Ultra Spec HP D.T.M. Primer FP04”by Benjamin Moore (or Equivalent)

.2 Top Coats: 2 coats acrylic Interior, Institutional Low Odor/VOC (MPI #147, MPI #153):

.1 "Pro Industrial Zero VOC Acrylic, 0 g/L" by Sherwin Williams (or Equivalent)

.2 "Pitt-Tech Plus DTM Acrylic" by PPG - Pittsburgh Paint (or Equivalent)
.3 "K540 Ultra Spec 500 Waterborne Interior Finish" by Benjamin Moore (or Equivalent)

.3 Handrails (INT 5.1K as amended)

.1 Primer: 1 coat rust inhibitive primer (MPI #107)

.1 "Pro Industrial Pro-Cryl Universal Primer, <100 g/L" by Sherwin Williams (or Equivalent)
.2 "Pitt-Tech Plus DTM Acrylic Primer" by PPG - Pittsburgh Paint (or Equivalent)
.3 “Ultra Spec HP D.T.M. Primer FP04” by Benjamin Moore (or Equivalent)

.2 Top Coats: 2 coats water-based epoxy (MPI #115)

.1 "Pro Industrial Zero VOC Waterborne Epoxy, 0 g/L" by Sherwin Williams (or Equivalent)
.2 “Pitt Glaze Acrylic Epoxy” (NOT MPI APPROVED) by PPG - Pittsburgh Paint (or Equivalent)
.3 " Corotech Acrylic Epoxy V450 " by Benjamin Moore (or Equivalent)

.8 Substrate: Galvanized Metal

.1 Repair of Galvanized Metals: Touch-up damaged surfaces with zinc-rich coating.

.1 Primer: 1 coat organic zinc-rich epoxy primer:

.1 "Zinc Clad 5" by Sherwin Williams (or Equivalent)
.2 “Corotech Organic Zinc Rich Primer V170” by Benjamin Moore (or Equivalent)

.2 Doors, Frames, Miscellaneous Metals etc. – Institutional Low Odor/VOC (INT 5.3N or 5.3K as amended)

.1 Primer: 1 coat water-based galvanized primer (MPI #134)

.1 "Pro Industrial Pro-Cryl Universal Primer, <100 g/L" by Sherwin Williams (or Equivalent)
.2 "Pitt-Tech Plus DTM Acrylic Primer" by PPG - Pittsburgh Paint (or Equivalent)
.3 “Ultra Spec HP D.T.M. Primer FP04” by Benjamin Moore (or Equivalent)

.2 Top Coats: 2 acrylic Interior, Institutional Low Odor/VOC (MPI #147)

.1 "Pro Industrial Zero VOC Acrylic, 0 g/L" by Sherwin Williams (or Equivalent)
.2 "PPG – Pure Performance Interior Latex Zero VOC" by PPG - Pittsburgh Paint (or Equivalent)
.3 "K540 Ultra Spec 500 Waterborne Interior Finish" by Benjamin Moore (or Equivalent)

.3 Handrails (INT 5.1K as amended)
.1 Primer: 1 coat rust inhibitive primer (MPI #107)

.1 "Pro Industrial Pro-Cryl Universal Primer, <100 g/L" by Sherwin Williams (or Equivalent)
.2 "Pitt-Tech Plus DTM Acrylic Primer" by PPG - Pittsburgh Paint (or Equivalent)

.3 "Ultra Spec HP D.T.M. Primer FP04" by Benjamin Moore Moore (or Equivalent)

.2 Top Coats: 2 coats water-based epoxy (MPI #115)

.1 "Pro Industrial Zero VOC Waterborne Epoxy, 0 g/L" by Sherwin Williams (or Equivalent)
.2 "Pitt Glaze Acrylic Epoxy" (NOT MPI APPROVED) by PPG - Pittsburgh Paint (or Equivalent)
.3 " Corotech Acrylic Epoxy V450 " by Benjamin Moore (or Equivalent)

.3 **Miscellaneous General Areas**

.1 Substrate: Concrete Horizontal Surfaces (Floors and Stairs):

.1 Refer to Section 03 35 00

.2 Substrate: Ferrous Exposed Ceilings and Decking (including bar joists) above 6096 mm (20' – 0") – Water-based Dry Fall (INT 5.1CC as amended)

.1 Primer:

.1 Shop-applied Q.D primer (MPI #275): Refer to Section 05 12 00. (or Equivalent)

.2 Top Coats: 1 coat water based dry fall coating (MPI #118, MPI#226)

.1 "Low VOC Waterborne Acrylic Dryfall, <50 g/L" by Sherwin Williams (or Equivalent)
.2 "Speedhide Interior Latex Dryfall" by PPG - Pittsburgh Paint (or Equivalent)
.3 "Super Spec Sweep Up Latex" by Benjamin Moore (or Equivalent)

.3 Substrate: Galvanized Exposed Ceilings and Decking (including bar joists) above 6096 mm (20' – 0") – Water-based Dry Fall (INT 5.1CC as amended)

.1 Top Coats: 2 coats water based dry fall coating (MPI #118, MPI#226)

.1 "Low VOC Waterborne Acrylic Dryfall, <50 g/L" by Sherwin Williams (or Equivalent)
.2 "Speedhide Interior Latex Dryfall" by PPG - Pittsburgh Paint (or Equivalent)
.3 "Super Spec Sweep Up Latex" by Benjamin Moore (or Equivalent)

.4 Substrate: Non-insulated Pipes, Ducts, Conduit, Valves, Fittings and Equipment and Ancillary Items where "Exposed" in Completed Work

.1 Primer: As recommended by manufacturer for specific substrate.
.2 Top Coats: 2 coats latex coating (MPI #53)

.1 "ProMar 200 Zero VOC, 0 g/L" by Sherwin Williams (or Equivalent)
.2 "Speedhide Zero Interior Latex" by PPG - Pittsburgh Paint (or Equivalent)
.3 "K536 Ultra Spec 500 Waterborne Interior Finish" by Benjamin Moore (or Equivalent)

.5 Substrate: Canvas and Cotton Coverings (Pipe and Duct Coverings, etc.) – Institutional Low Odor/Low VOC (INT 10.1D as amended)

.1 Primer: 1 coat multi-purpose latex interior primer sealer (MPI #50)

.1 "ProMar 200 Zero VOC Interior Latex Primer, 0 g/L" by Sherwin Williams (or Equivalent)
.2 "Speedhide Interior Latex Primer" by PPG - Pittsburgh Paint (or Equivalent)

.3 "K534 Ultra Spec 500 Waterborne Interior Primer Sealer" by Benjamin Moore (or Equivalent)

.2 Top Coats: 2 coats latex Interior, Institutional Low Odor/VOC (MPI #143, MPI #144, #145)

.1 Zero VOC Latex Paint:

.1 "ProMar 200 Zero VOC, 0 g/L" by Sherwin Williams (or Equivalent)
.2 "Pure Performance Interior Latex Zero VOC 9-line" by PPG - Pittsburgh Paint (or Equivalent)
.3 "K536 Ultra Spec 500 Interior Finish" by Benjamin Moore (or Equivalent)

.2 Zero VOC and Silica-free Latex Paint:

.1 "Harmony Interior Latex — Odor Eliminating Technology, 0 g/L" by Sherwin Williams (or Equivalent)
.2 "K536 Ultra Spec 500 Interior Finish" by Benjamin Moore (or Equivalent)
.3 Equivalent by PPG - Pittsburgh Paint (or Equivalent)

.4 Substrate: Steel (High Heat) including heat exchangers, breeching, pipes, flues, stacks etc. – Heat Resistant Enamel – Maximum 205 deg C (400 deg F) (INT 5.2A as amended):

.1 Primer: As recommended by manufacturer.

.2 Finish Coats: Apply heat resistant enamel (MPI #21) coats in strict accordance with manufacturer's instructions:

.1 "Kem Hi-Temp Heat-Flex II 450" by Sherwin Williams (or Equivalent)
.2 "Ameron Engineered Siloxane PSX 892HS" by PPG (or Equivalent)

END OF SECTION

PART 1 - GENERAL

1.1 PRICING

1. All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL INSTRUCTIONS

1. Read and conform to:
    1. the General Conditions and the Supplementary Conditions of the Contract.
    2. Division 01 requirements and documents referred to therein.

1.3 SUMMARY

1. Work Included: Provide labour, materials, Products, equipment and services to complete the phenolic toilet compartments specified herein. this includes, but is not necessarily limited, to:
    1. Maximum privacy, full height, phenolic-core toilet compartments, floor anchored.
    2. Barrier-free type hardware.
    3. Anchors, brackets and fastenings.
    4. Auxiliary materials required for complete installation.
2. Related Requirements: Specifications throughout all Divisions of the Project shall be read as a whole and may be directly applicable to this Section.

1.4 REFERENCES

1. Reference Standards: Latest published editions of reference standards listed in this Section in effect as of the closing date and time of the Request for Tenders for the Contract, including any amendments adopted, are applicable unless otherwise indicated.

1.5 ADMINISTRATIVE REQUIREMENTS

1. Preinstallation Meeting: Convene a pre-installation meeting at the site prior to commencing work of this Section. Review methods and sequence of work scope, special details and conditions, standards of workmanship, testing and quality control requirements, and other topics related to the work of this Section.

1.6 SUBMITTALS

1. General Requirements and Procedures for Submittals: In accordance with Section 01 30 00, Submittal Procedures.

2. Product Data: Submit manufacturer's product characteristics, catalogue cuts, installation instructions and other relevant information for each material and product used for toilet compartments work specified in this Section

3. Shop Drawings: Submit Shop Drawings indicating material layouts, details of construction, connections, and relationship with adjacent construction. As a minimum indicate following:
    1. Include plans, elevations, sections, and attachment details.
    2. Show locations of reinforcements for compartment-mounted grab bars and locations of blocking for surface-mounted toilet accessories.
    3. For overhead supported items, show ceiling grid, ceiling-mounted items, and overhead support or bracing locations.
    4. Indicate field-measured dimensions on Shop Drawings.
    5. For all overhead support work, ensure Shop Drawings are stamped by a Professional Engineer licensed to practice in Province of Ontario.

4. Samples:
    1. Samples: Submit initial selection samples for Products requiring colour, texture, or design selection. Submit manufacturer's list of finishes or colour swatches for Consultant's selection.
    2. As a minimum submit the following:
        1. Samples of phenolic finish material, minimum 152 mm (6 inches) x 152 mm (6 inches).
        2. Samples of hardware and accessories involving material and colour selection, minimum 152 mm (6 inches) thick.

1.7 CLOSEOUT SUBMITTALS

1. Operating and Maintenance Data: Submit care and maintenance instructions for Toilet Compartments to be included in building's operation and maintenance manual.

2. Warranty Documentation: Submit copy of extended warranties specified in this Section.

1.8 QUALITY ASSURANCE

1. Manufacturer Qualifications: Provide Products for work of this Section by manufacturer with at least 10 years' experience manufacturing such materials.

2. Installer Qualifications: Engage an entity with at least five years' experience installing, erecting, or assembling work similar in material, design, and extent to that shown on Drawings and Schedules, and whose work has resulted in construction with a track record of successful in-service performance.

3. Single Source Responsibility: Obtain primary materials for this Section from a single source by a single manufacturer, and secondary materials from sources recommended by manufacturers of primary materials.

1.9 DELIVERY, STORAGE AND HANDLING

1. Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

2. Store materials off-ground, in clean, dry, well-ventilated area.

3. Replace defective or damaged materials with new.

1.10 FIELD CONDITIONS

1. Environmental Restrictions: Do not deliver or install toilet compartments until building is enclosed, wet work is complete, and HVAC system is operational and will maintain temperature and relative humidity levels equal to occupancy levels for remainder of construction period.

1.11 WARRANTY

1. Warrant work of this Section for period of 5 years against defects and/or deficiencies in accordance with General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of Consultant and at no expense to Owner. Defects include but are not limited to; opening of seams and delamination of finish.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

1. Products of following manufacturers are acceptable subject to conformance to requirements of Drawings, Schedules and Specifications:
    1. ASI Group Canada;
    2. Bobrick Washroom Equipment;
    3. Bradley;
    4. EAD;

2.2 PERFORMANCE / DESIGN CRITERIA

1. Design compartment and cubicle doors to provide maximum privacy. Partition and doors to extend as close to finished floor and ceiling as allowed by Building Code in staff change areas to provide maximized privacy. Door and pilaster edges designed to overlap, eliminating visual gaps.

2. Provide for adjustment of compartments and cubicles with screw jack through steel saddles made integral with pilaster. Conceal fixings with stainless steel boot assemblies

3. Install ceiling hung compartments and cubicles in accordance with manufacturer's written instructions, unless otherwise recommended by manufacturer.

4. For barrier-free compartments, comply with applicable provisions in National Building Code and other applicable provincial code, and CSA B651.

5. Configuration:
    1. Toilet Enclosure Depth, Width: As indicated on Drawings.
    2. Toilet Enclosure Height: As indicated on Drawings.
    3. Door Height: As indicated on Drawings.
    4. Door Size and Swings:
        1. Unless otherwise indicated, provide 610-mm- (24-inch-) wide, in-swinging doors for standard toilet compartments.
        2. Provide 950-mm wide out-swinging doors with a minimum 850-mm wide clear opening (in open position) for compartments designated as barrier-free.
    5. Floor Clearance: Manufacturer's standard for maximum privacy; but not more than 150 mm (6 in).

6. Style:
    1. Privacy: Provide full height partitions with no-sightline system; floor anchored.
    2. Coordinate with Section 06 10 00 and Section 09 21 16 for provision of adequate backing and supports in walls and partitions to ensure a rigid installation.

2.3 PHENOLIC TOILET COMPARTMENTS

1. Solid Phenolic Material: Provide compartments fabricated from solid phenolic construction conforming to BS EN 438-4 or NEMA LD3, Grade CGS consisting of a core layer fabricated from sheets of kraft paper impregnated with phenolic resins.
    1. Exposed Panel Edges: manufacturer's standard black edges.
    2. Graffiti Resistance: 8 out of 9 applied marks cleaned in accordance with ASTM D6578/D6578M.
    3. Flexural modulus (Modulus of elasticity): ASTM D790, > 1.4 x 106 psi,
    4. Flexural strength: ASTM D790, > 17, 500 psi. (applies for ceiling application only),
    5. Density: ASTM D792, > 1.35 g/m3,
    6. Fire resistance: ULC S102, Flame Spread Index 5 and Smoke Developed Index 70.
    7. Thickness: partition thickness 25 mm; pilaster thickness 32 mm.
    8. Acceptable Sources for Solid Phenolic Material:
        1. Abet Laminati (Abet Corporation)
        2. Fundermax

3. Trespa International B.V

9. Colour and pattern: as selected by Consultant from phenolic manufacturer's standard colours.

2. Hardware

1. Hardware: Equip each door with suitable pivot hinges, latch, latch keeper, bumper stop, and coat hook with bumper.

2. Hinges: concealed, heavy-duty chrome plated nonferrous or aluminum casting, self-lubricating inward swing.

3. Slide bolt and keeper: chrome plated nonferrous casting or extrusion, equipped for emergency access.

4. Door stop: chrome plated nonferrous casting or extrusion with rubber insert.

5. Connecting brackets: channel shaped, anodized aluminum extrusion or casting, continuous.

6. Pilasters Shoes: minimum 22 gauge ASTM A-167 stainless steel with satin finish, not less than 75 mm (3") in height.

7. Fasteners: chrome plated nonferrous tamperproof type screws and bolts.

8. Hardware Materials and Finish:

1. Stainless steel to ASTM A743/A743M, with AISI No. 4 finish

2. Aluminum to ASTM B221, with Class II clear-anodized finish.

2.4 FABRICATION

1. Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories, and solid blocking within panel where required for attachment of toilet accessories.

2. Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at pilasters for connection to structural support above finished ceiling. Provide assemblies that support pilasters from structure without transmitting load to finished ceiling. Provide sleeves (caps) at tops of pilasters to conceal anchorage

3. Cut, shear, straighten and work steel in a manner to prevent disfigurement of finished work.

4. Ensure finished work is free of warp, open seams, buckles and other surface defects detrimental to appearance.

PART 3 - EXECUTION

3.1 EXAMINATION

1. Verify actual site conditions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation. Commencement of work implies acceptance of previously completed work.

2. Confirm location and adequacy of blocking and supports required for installation.

3. Coordinate layout and installation of supports, inserts, and anchors built into other units of work for toilet compartment anchorage.

3.2 INSTALLATION

1. Install work of this Section in strict accordance with manufacturer's written installation instructions and reviewed Shop Drawings. Supplement manufacturer's installation instructions with additional installation requirements specified in this Section to produce specified work results.

2. Install partitions and screens plumb and square to building lines and according to manufacturer's written instructions.

3. Install units rigid, straight, level, and plumb. Secure units in position indicated with manufacturer's recommended anchoring devices.

4. Provide anchorage devices and fasteners where necessary for securing to in-place construction. If necessary Provide additional reinforcing in accordance with requirements of Section 05 50 00. Provide for concealed adjustment of ceiling variations with screw jack through steel saddles made integral with pilaster. Conceal ceiling anchorage with stainless steel covers secured in position.

5. Ensure spaces between panels and pilasters, between panels and walls and between pilasters and walls are of uniform consistent width and sized to ensure that it is not possible to see persons using the compartments.

6. Coordinate installation with The Work of trades providing wall and floor finishes, washroom accessories and other adjacent components and construction.

7. Insulate contact surfaces to prevent electrolysis due to metal contact with masonry, concrete or dissimilar metal surfaces. Use bituminous paint, building paper or other approved means.

8. Perform drilling of steel, masonry or concrete necessary to Install work.

9. Install partitions and screens to tolerances specified and at locations shown.

10. Perform drilling of steel, masonry or concrete necessary to Install partitions.

11. Install hardware and ensure it is visually aligned.

12. Test, adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to stay open 32 deg when compartment is not in use. Set hinges on out-swinging doors to return doors to fully closed position.

13. Touch up damaged shop finishes with matching site-applied finishes.

3.3 TOLERANCES

1. Maximum Clearances:
    1. Pilasters and Panels: 13 mm (1/2 inch).

2. Panels and Walls: 25 mm (1 inch).

3.4 REPAIR

1. Touch up shop paint that has been damaged.

2. Replace damaged work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of Consultant at no cost to Owner.

3.5 ADJUSTING

1. Test and adjust hinges and latches for ease of operation.

2. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched.

3.6 PROTECTION

1. Protect toilet compartments from damage, soiling and contaminating substances resulting from construction activities or caused by work of other trades.

2. Where soiling or spills have occurred, remove spills and soiling from adjacent surfaces using cleaning procedures recommended in writing by affected material's manufacturer. Do not use materials or process that can damage finishes, surfaces, or construction.

3. Promptly replace Toilet Compartments work damaged during construction that cannot be satisfactorily repaired.

3.7 CLEANING AND WASTE MANAGEMENT

1. Cleaning: Maintain clean construction area at the end of each day. When activities of this Section are complete, remove materials, tools, equipment and rubbish.

2. Waste Management and Disposal: sort waste for reuse, recycling, or disposal, as specified. Remove recycling bins and containers from site and dispose of contents at the appropriate waste disposal facilities.

END OF SECTION

PART 1 - GENERAL

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL INSTRUCTIONS

.1 Read and conform to:

.1 the General Conditions and the Supplementary Conditions of the Contract;

.2 Division 1 requirements and documents referred to therein.

1.3 SUMMARY

.1 Work Included: Provide wall protection including but not limited to the following:

.1 sheet wall protection coverings

.2 corner guards

.3 accessories required for a complete installation

.2 Related Requirements: Specifications throughout the entirety of the Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them

1.4 REFERENCES

.1 Definitions:

.1 Full Height: Top of base to underside of ceiling.

.2 Reference Standards: Latest published editions of reference standards listed in this Section in effect as of the closing date and time of the Request for Tenders for the Contract, including any amendments adopted, are applicable unless otherwise indicated.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meetings:

.1 Prior to starting the work of this Section, convene a pre-installation meeting at the Project site to review the Project requirements and site conditions with pertinent parties. Conform to requirements of Section 01 30 00.

1.6 SUBMITTALS

.1 Product Data: Submit manufacturer's literature and data sheets for each type of material provided under this Section for the Project in accordance with requirements of Section 01 30 00. Ensure data sheets provide required information including detailed instructions for installing as well as maintaining, preserving and keeping materials in clean and safe conditions. Provide adequate warning of maintenance practices or cleaning agents detrimental to specified materials.

.2 Safety Data Sheets (SDS): Submit SDS for inclusion in Operation and Maintenance Manual specified in Section 01 70 00, for adhesives, sealants and any other material designated by Consultant.

.3 Shop Drawings:

.1 Submit in accordance with Section 01 30 00. Ensure Shop Drawings indicate material characteristics, details of construction, connections and relationship with adjacent construction.

.4 Samples: Submit in accordance with Section 01 30 00. If requested by the Consultant, submit samples of Products.

.5 Test and Evaluation Reports: Submit test data substantiating that proposed materials meet performance criteria specified herein. Submit independent test results showing properties and acceptable fire hazard classification of applicable materials.

1.7 CLOSEOUT SUBMITTALS

.1 Operation and Maintenance Data: Submit maintenance instructions in accordance with Section 01 70 00 for wall protection specified herein.

1.8 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Materials: Supply the following quantity of maintenance material in accordance with Section 01 77 00:

.1 Quantity: 5% of The Work.

1.9 QUALITY ASSURANCE

.1 Qualifications: Provide the work of this Section executed by competent installers with a minimum of 5 years' experience in the application of the Products, systems and assemblies specified herein and with the approval and training of the Product manufacturers.

.2 Single source responsibility: Provide components of wall protection system manufactured by same company to ensure compatibility of color, texture and physical properties.

.3 Mock-ups: Provide mock-ups in locations designated by the Consultant and as required to demonstrate quality of workmanship. Maintain mock-ups during construction in an undisturbed condition as a standard for judging the completed work.

1.10 DELIVERY, STORAGE AND HANDLING

.1 Delivery and Acceptance Requirements: Comply with material manufacturer's ordering instructions and lead time requirements to avoid delays.

1.11 WARRANTY

.1 The Contractor warrants the work of this Section for a period of 3 years from Substantial Performance of the Work against defects and/or deficiencies in accordance with the General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within this warranty period, to the satisfaction of the Consultant and at no expense to the Owner. Defects include but are not limited to: buckling, opening of seams, bond failure and extensive colour fading.

PART 2 - PRODUCTS

2.1 DESCRIPTION

.1 Regulatory Requirements:

.1 Fire Performance Characteristics: Wall panels shall have ULC or UL label indicating that they are identical to those tested in accordance with CAN/ULC S102.2 for characteristics, flame spread 25 or less; smoke development 450 or less.

.2 Install systems in accordance with Code regulations concerning access of physically challenged people and requirements of CAN/CSA B651.

2.2 MATERIALS

.1 Aluminum

.1 Aluminum Extrusions: ASTM B209M, size accurately formed as shown on Drawings, extruded aluminum alloy AA-6063- T5 or T6 for aluminum. Ensure surfaces are free from defects impairing appearance, strength and durability.

.2 Aluminum Sheet: ASTM B221M, Minimum thickness: 3 mm (1/8"); of type and characteristics to match finished extrusions; Concealed sheets to be Utility Aluminum mill finished; for intricate forming with decorative finishes use AA 1100 and for siding and exposed panels use AA-3003 with specified finish.

.2 Stainless Steel:

.1 Stainless Steel Sheet, Strip, Plate, and Flat Bar: ASTM A240 or ASTM A167 or ASTM A666, Type 304 and Type 316 alloy with exposed surfaces having No. 4 polished finish. Sizes as required to meet design requirements.

.2 Stainless Steel Tubing: ASTM A554, Grade MT 304.

.3 Stainless Steel Pipe: ASTM A312M, Grade TP 304.

.4 Provide highest architectural quality in various forms, straight and true. Ensure there are no scratches, scars, creases, buckles, ripples or chatter marks. Provide finish surfaces suitable for polishing where required. Ensure finished surfaces exposed to view are free of pitting, seam marks, roller marks, oil-canning, stains, discolourations or other imperfections.

2.3 MANUFACTURED UNITS

.1 SHEET WALL PROTECTION COVERINGS

.1 Vinyl/Acrylic Wall Protection (SWP): High impact semi-rigid sheet vinyl/acrylic wall cladding, with colour matched accessory trim pieces, outside edge caps, joint covers, inside corner and outside corners.

.1 Sheet Size: Manufacturers full sheet; maximum practical sizes to minimize seams unless otherwise indicated on Drawings.
.2 Sheet Thickness: 1.5 mm (0.060”)
.3 Trims: Manufacturer's standard, matching moldings and trim complete with division bars between panels, inside and outside corners and cap mouldings as required for complete installation.
.4 Colours and Texture: to be selected by Consultant at a later date.
.5 Height: Partial height unless otherwise indicted.
.6 Refer to Drawings and Schedules.
.7 Acceptable Products:

.1 “Acrovyn 4000” by C/S Construction Specialties Ltd.
.2 “G2” by InPro Corporation
.3 or Equivalent to the above.

.2 CORNER GUARDS:

.1 Stainless-Steel Corner Guards (CG): Satin-finish, 1.6 mm (16 ga.) minimum, Type 304 stainless-steel sheet corner guards; with 90-deg return, unless otherwise indicated; and formed edges. Provide full-height units unless otherwise indicated.

.1 Corner Guard (90o) - CG-1:

.1 Wing Length: 75 mm (3 inches)
.2 Height: As indicated on Drawings, but not less than 1220 mm.
.3 Mounting: Fully-adhered
.4 Corner Radius: 3 mm (1/8")
.5 Acceptable Products:

.1 "Model No. SM-20AN" by Construction Specialties Ltd
.2 "Model No. 183" by InPro Corporation.
.3 or Equivalent to the above.

.2 End wall Protector - CG-2:

.1 Wing Length: 50 mm (2 inches)
.2 Height: As indicated on Drawings, but not less than 1220 mm.
.3 Mounting: Fully-adhered
.4 Acceptable Products:

.1 "Model No. SSM-20AN" by Construction Specialties Ltd.
.2 "SS-WEFM" by InPro Corporation.
.3 or Equivalent to the above.

.3 Bumper Rail (BRLG):

.1 Dimensions and Profile: minimum 50 mm (2") high.

.1 Acceptable Products:

.1 "Model No. SCR-40N" by Construction Specialties Ltd.;
.2 or equivalent by InPro Corporation.

2.4 FABRICATION

.1 Accurately fit joints and intersecting members in true planes with adequate fastening.

.2 Fit and assemble work of this Section in shop where possible. Execute according to details and reviewed Shop Drawings. Where shop fabrication is not possible, execute trial assembly in shop.

.3 Fabricate finished work free from distortion, weld splatter and defects detrimental to appearance and performance.

.4 Provide exposed metal fastenings and accessories of the same material, texture, colour and finish as the base metal to which they are applied or fastened, unless otherwise specified herein.

.5 Do not expose trademarks or labels on finished surfaces.

2.5 ACCESSORIES

.1 Provide Prefabricated, injection-molded or otherwise matching end caps and inside and outside corners with concealed splices, cushions, mounting hardware, division bars between panels, and other accessories as required; field adjustable for close alignment with snap-on plastic covers (where applicable).

.2 Adhesives and Sealants: As recommended by manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Site Verification of Conditions: Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation.

.2 Verify gypsum board substrate smooth, plumb and true, free of waves bulges and within tolerances specified in Section 09 21 16.

.3 Examine walls to which impact-resistant wall protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.

.1 For impact-resistant wall protection units attached with adhesive or foam tape, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

.4 Proceed with installation only after unsatisfactory conditions have been corrected. Commencement of work implies acceptance of previously completed work.

3.2 PREPARATION

.1 Surface Preparation: Ensure substrate is dry, well-sealed and free of dirt, loose paint, wax and grease. Glossy surfaces may require sanding or priming before installation to help promote adhesion.

3.3 INSTALLATION

.1 Conform to manufacturer’s printed instructions for accurate, secure installation. Ensure proper operation.

.2 Provide the work of this Section true to dimensions, square, plumb, level and free from distortion or defects detrimental to appearance and performance.

.3 Provide work of this Section tightly fitted and level and flush to adjacent surfaces and components.

.4 Insulate between dissimilar metals, and metal and masonry materials to prevent electrolysis with bituminous paint to meet specified requirements of CAN/CGSB-1.108-M89; or with methacrylate lacquer, CAN/CGSB-1.159-92 if exposed to view.

.5 Provide splices, mounting hardware, anchors, and other accessories required for a complete installation.

.6 Provide all necessary reinforcing including but not limited to steel stud backup and securely fasten components to suit design requirements.

.7 Install impact-resistant wall protection units in locations and at mounting heights indicated on Drawings.

.8 Provide sheet wall protection covering materials on prime painted gypsum board walls where indicated. Install top and edge moldings, corners, and divider bars as required for a complete installation.

.9 Apply sheet wall protection covering in maximum widths carefully matched for colour, pattern, texture. Avoid shading. Thoroughly wash off excess adhesive from material and adjoining surfaces as work proceeds.

.10 Neatly and closely fit wall protection materials around switches, light outlets, grilles, trim and similar items. Carry wall covering into reveals, jambs, and heads of openings.

.11 Take care to ensure wall protection coverings are fully on the wall at inside corners, without coving or subsequently pulling away from the wall.

.12 Apply material to outside corners in a manner which will prevent gathering of air beneath the material on each side of the corner. No joints are allowed within 150 mm (6") of any corner.

.13 Remove material showing evidence of coming loose or showing any blisters, imperfect seams, wrinkles, dried adhesive, or other imperfections, and apply new material.

3.4 CLEANING

.1 Clean adjacent surfaces, which have been soiled or otherwise marred, to completely remove evidence of material causing same.

3.5 PROTECTION

.1 Cover finished surfaces and protect exposed corners and areas vulnerable to damage by persons or by movement of materials, tools or equipment.

END OF SECTION

PART 1 - GENERAL

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL INSTRUCTIONS

.1 Read and conform to:

.1 the General Conditions and Supplementary Conditions of the Contract.

.2 Division 1 requirements and documents referred to therein.

1.3 SUMMARY

.1 Work Included: Provide accessories including, but not limited to, the following:

.1 Clothing Hook (CH)

.2 Barrier Free Clothing Hook (CH-BF)

.3 Electric Hair (EHD)

.4 Hand Dryer (HVHD)

.5 Grab Bar (GRB-1 and GRB-2)

.6 Janitorial Unit and Shelf (JS-1)

.7 Mirror (MIR-1)

.8 Soap Dispenser – Lavatory Mounted (SD-2)

.9 Shower Rod with Curtain (SH-ROD/C)

.10 Shelf (SHF-WR1)

.2 Owner Supplied/Contractor Installed Items (Code O/C): Items marked as O/C will be supplied by Owner and Contractor shall be responsible to Install them in accordance with requirements of this Section. Contact Owner at time of installation to confirm Schedule of types and locations for items designated as such. Where required, Provide supplementary reinforcing or service connections within ceilings or partitions to accommodate components.

.1 Refer to Accessories Schedule.

.3 Owner Supplied/Owner Installed Items (O/O): The following items have been marked as O/O under this Section and have been included for illustrative purpose only. These items will be supplied by the Owner and the Owner shall be responsible to Install them in accordance with the requirements of this Section. Cooperate and coordinate with the Owner's installer without delaying the Work for satisfactory expeditious completion of the work. Where required, Provide supplementary reinforcing or service connections within ceilings or partitions to accommodate components.

.1 Refer to Accessories Schedule.

.4 Related Requirements: Specifications throughout the entirety of the Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.4 REFERENCES

.1 Reference Standards: Latest published editions of reference standards listed in this Section in effect as of the closing date and time of the Request for Tenders for the Contract, including any amendments adopted, are applicable unless otherwise indicated.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Conform to the administrative requirements of Division 01.

.2 Sequencing: Coordinate the installation work of this Section with those performing the Work of other related Sections.

1.6 SUBMITTALS

.1 Product Data: Submit the manufacturer's literature and data sheets for each type of material provided under this Section in accordance with the requirements of Division 01. Ensure data sheets provide required information including detailed instructions for installing as well as maintaining, preserving and keeping materials in clean and safe conditions. Provide adequate warning of maintenance practices or cleaning agents detrimental to the specified materials.

.2 Safety Data Sheets (SDS): Submit SDS for inclusion in Operation and Maintenance Manual specified in Section 01 70 00, for adhesives, sealants and any other material designated by Consultant.

.3 Shop Drawings: Submit Shop Drawings for work of this Section in accordance with the requirements of Division 01. Ensure Shop Drawings indicate material characteristics, details of construction, connections and relationship with adjacent construction. Submit Shop Drawings in the form of catalogue cuts and fully illustrate specified materials with a description of components, surface finishes, hardware and securement devices.

.4 Samples: Submit complete samples of each accessory and modular unit to the Consultant for the review of construction quality, materials and finish prior to delivery of required quantities of items. Submit sample of each colour where applicable. No trademark and/or labels are acceptable on exposed finishes.

.5 Maintenance Instructions: Submit maintenance instructions in accordance with the requirements of Division 01. Submit an accessories schedule, keys and parts manual as part of the Contract closeout documents. Submit two sets of the following items of manufacturer's literature:

.1 Technical Data Sheets of each item used for the Project.

.2 Service and Parts Manuals.

.3 Name of local representative to be contacted in the event of need of field service of consultation.

1.7 QUALITY ASSURANCE

.1 Installers: The Work of this Section shall be executed by competent installers with a minimum of 5 years of experience in the application of the Products, systems and assemblies specified herein and with the approval and training of the Product manufacturers.

.2 Single Source Responsibility: Ensure that the primary materials provided in this Section are obtained from one source by a single manufacturer and that secondary materials are obtained from sources recommended by the primary materials manufacturer. Ensure Products for work of this Section are keyed alike to the extent possible.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials in sealed cartons and containers with the manufacturer's name and Product description clearly marked thereon.

1.9 WARRANTY

.1 The Contractor warrants the mirrors of this Section for a period of 10 years from the date of Substantial Performance of The Work against defects and deficiencies in accordance with the General Conditions of the Contract. Promptly correct defects or deficiencies which become apparent within this warranty period, to the satisfaction of the Consultant and at no expense to the Owner. Defects include, but are not limited to, deterioration of the mirror's silvering.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Products of the following manufacturers (or Equivalent) are acceptable subject to conformance to the requirements of the Contract Documents:

.1 ASI Group Watrous Canada (ASI)

.2 Bobrick Washroom Equipment Company (Bobrick)

.3 Bradley Corporation (Bradley)

.4 Elcoma Barrier Free Products (Elcoma)

.5 Excel DryerInc.

.6 Frost Products Ltd (Frost)

.7 HealthCraft Products Inc. (HealthCraft)

.8 Kimberley-Clark Corporation (Kimberley Clark)

.9 or Equivalent to the above.

.2 Substitution Limitations: This Section is based on Products from the manufacturers listed in this Section. Comparable Products from manufacturers not listed in this Section will be considered provided they meet the requirements of this Section.

2.2 DESCRIPTION

.1 Regulatory Requirements:

.1 Install systems in accordance with OBC regulations concerning access of physically challenged and disabled persons. Comply with the requirements of CAN/CSA B651.

.2 Design and Performance Requirements:

.1 Provide accessories as specified herein with the options indicated on Drawings. Model numbers may not reflect all options required.

.2 Provide stainless steel collars to accommodate semi-recessed mounting of units whose depth exceeds wall cavity depth.

.3 Edges of sheet metal which are accessible to users or maintenance personnel shall be pneumatically sanded to yield smooth safe edges with no sharpness.

.4 Mount items with concealed fasteners unless otherwise indicated or unavoidable. Where exposed fasteners are unavoidable, use tamper-resistant type.

2.3 MATERIALS

.1 Ensure accessories are stainless steel conforming to ASTM A167, Type 304 or Type 302, of 1 type throughout, ANSI No. 4 mechanical brushed finish, of contemporary design, with minimum material thicknesses of components as specified in this Section. Arrange stainless steel sheet so grain of brushed finish runs vertically in finished installation.

.1 Minimum thickness, any location or component:0.645 mm

.2 Hygienic accessory - exposed double pan doors and panels: 0.645 mm

.3 Hygienic accessory - exposed single pan doors: 1.26 mm

.4 Reinforcement: 1.26 mm

.2 Reinforcing:

.1 Concealed Sheet Steel Reinforcing: Refer to Section 09 21 16 – Gypsum Board.

.3 Provide accessories as specified in this Section and on the Drawings and Accessory Schedule. Model numbers may not reflect all options required.

.4 Provide stainless steel collars to accommodate semi-recessed mounting of units whose depth exceeds wall cavity depth.

2.4 MANUFACTURED UNITS

.1 Clothing Hook (CH and CH-BF): Supply one per shower stall and washroom or as indicated on the Drawings, satin finished stainless steel, double hook type supplied with backplates and screws. Provide one of the following:

.1 Model No. B-6727 by Bobrick,

.2 Model No. 9124 by Bradley.

.3 Model No. 7345-S by ASI/Watrous

.4 or Equivalent to the above.

.2 Hair Dryer (EHD-1): Surface mounted, electric hair dryer, 1600 watts. Mount at heights indicated on Drawings.

.1 Acceptable Products: Conair Direct Wire 1600 Watt Wall-Mount Dryer by Conair Hospitality or approved equivalent.

.3 Hand Dryer (HVHD): Surface mounted, 120 V stainless steel hand dryer. Mount at heights indicated on Drawings.

.1 Acceptable Products: XLERATOR Hand Dryer by Excel Dryers or approved equivalent.

.4 Grab Bar (GRB-1): Stainless steel, 38 mm (1.5") outside diameter, 1.21 mm (18 ga) wall thickness with peened finish to Provide positive gripping surface unless otherwise indicated in the Contract Documents. Provide items complete with stainless steel mounting plates, flanges and accessories subject to moisture. Ensure grab bars can support a minimum load of 113 kg (250 lbs).

.1 Standard Grab Bar: Mount as shown on Drawings.

.1 Sizes: 610 mm (24”)
.2 Provide one of the following: Model No. B-6806.99 Series by Bobrick or Equivalent.

.5 Vertical L-Shaped Grab Bar (GRB-2): Provide vertical L-Shaped grab bar. Mount as shown on the Drawings. Provide the following:

.1 Model No. 3700, type 07-4P (30x30) by ASI/Watrous or equivalent by Bobrick, Bradley or Elcoma or Equivalent.

.6 Janitorial Unit with Shelf (JS-1): Type 304 stainless steel (satin finish) shelf with utility hooks and mop strip.

.1 Length: 864 mm (34”)

.2 Acceptable Products:

.1 Model No. 1308 by ASI Group Canada
.2 Model No. B-239 by Bobrick Washroom Equipment
.3 Model No. 9933 by Bradley
.4 or Equivalent to the above.

.7 Mirror (MIR-1): Supply Quality Select 6 mm (1/4") clear float glass conforming to ASTM C1503, Type 1, with process deposit of 5 silver coats, 3 copper coats and final protective seal. Supply unit in stainless steel angle framing and minimum 0.457 mm thick (26 ga) galvanized sheet steel backing. Refer to Drawings for sizes.

.1 Provide 1 of following:

.1 Model No. B-290 Series by Bobrick.
.2 Model No. 780 Series by Bradley.
.3 Model No. 0600 Series by ASI/Watrous.
.4 or Equivalent to the above.

.8 Soap Dispenser (SD-2) – Lavatory-mounted – Hands-free

.1 Soap type: liquid or lotion form.

.2 Acceptable *Products*:

.1 Model No. 20333 or 0391-(n) by ASI Group Canada
.2 Model No. B-826.18 by Bobrick Washroom Equipment
.3 Or Equivalent to the above.

.9 Shower Curtain Rods with Curtains (SH-ROD/C): Type 304 Stainless steel, 30 mm (1-1/8") od, minimum 1.2 mm (18 ga) wall thickness, complete with end flanges. Provide 1778 mm x 1830 mm (70" x 72") waterproof, scrubbable, mildew-proof, non-combustible white vinyl shower curtain as specified in this Section. Length to suit openings and as indicated on the Drawings. Fastening: Exposed. Provide one of the following:

.1 Model No. B-6047 (Shower Curtain Rod) complete with B-204-2 (Shower Curtain) and B-204-1 (Shower Curtain Hooks) by Bobrick.

.2 Model No. 9531 (Shower Curtain Rod) complete with 9533 (Shower Curtain) and 9536 (Shower Curtain Hooks) by Bradley.

.3 Model No. 1204 (Shower Curtain Rod) complete with 1200-V (Shower Curtain) and 1200SHU (Shower Curtain Hooks) by ASI/Watrous.

.4 or Equivalent to the above.

.10 Flip Up Shelf - Stainless steel (SHLF-WR1): Type 304 stainless steel, no. 4 finish, with hemmed front edge and flip up capabilities.

.1 Length:

.1 SHF-WR2: 305 mm x 127 mm (12” x 5”)

.2 Acceptable Products:

.1 Model No. B-287 by Bobrick Washroom Equipment

.2 or Equivalent to the above.

2.5 FABRICATION

.1 Fabricate accessories true, square, rigid, free from distortion and from defects detrimental to appearance and performance. Assemble sheet metal accessories by welding in accordance with CSA W59-M. Conceal welds, or grind smooth such as to be undetectable in finished work. Unless approved by the Owner, assembly fastenings, hardware fixings and mounting or installation devices shall be concealed in finished work.

.2 Use non-corrosive metal fasteners of expansion type, toggle type or other type approved by the Consultant of positive, mechanical anchor as required to suit construction to which accessory is to be mounted. Exposed fasteners, where permitted, shall be finished to match adjacent accessory surface, and be countersunk. Where accessories are mounted to sheet metal, Provide a 3 mm (1/8") thick minimum full-size metal back-up plate drilled and tapped to receive machine screws and finished to match adjacent sheet metal surface.

.3 Use stainless steel fasteners in all shower locations.

.4 Ensure frameless accessories have one piece fronts with 90 degree formed returns at their edges and openings. Ensure returns are continuously welded and ground smooth at corners. Where accessory fronts are framed, frame edges, both inside and outside, shall have 90 degree formed returns continuously welded and ground smooth at corners. Doors shall also have 90 degree formed returns.

.5 Use concealed stainless steel piano hinges which extend full-length of hinged element. Ensure hinged elements have concealed, mechanically-retained, rubber bumpers for silent closing, and close flush with faces of fronts or frames. Locate hinges to afford easy and unobstructed access to interiors taking into consideration location of accessory relative to surrounding and adjacent items and finishes.

.6 Portions of sheet metal accessory interiors which are visible in the completed work shall be stainless steel. Changes in plane shall be formed or continuously welded and ground smooth. Sheet metal accessory parts concealed in finished installation shall be galvanized or stainless sheet steel. The edges of sheet metal which are accessible by users or maintenance personnel shall be hemmed for safety with no sharp edges.

.7 Ensure lettering on accessories is silk screened with durable paint to withstand wear, or is engraved or embossed. Size, location and type face of lettering is subject to the approval of the Consultant. Ensure the edges of letters are straight and sharp.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Provide necessary wall reinforcement for grab bars and towel bars as detailed for a minimum 227 kg (500 lbs) downward pull.

.2 Install accessories in accordance with the manufacturer's printed installation instructions.

.3 Provide fastenings and mounting kits for accessories.

.4 Verify the wall opening for correct dimensions, plumbness of blocking or frames and other preparation that would affect the installation of accessories.

.5 Verify spacing of plumbing fixtures and toilet partitions that affect the installation of accessories.

.6 Securely fasten accessories, level and plumb using appropriate fastenings as recommended by the manufacturer.

.7 Provide corrosion resistant fastenings. Where fasteners are exposed, use tamper-proof fasteners finished to match items secured.

.8 Locate accessories where indicated on the Drawings and where directed by the Consultant. Obtain the Consultant's acceptance of the exact locations.

.9 Provide the manufacturer's recommended anchoring systems.

.10 Fit flanges of accessories snug to wall surfaces.

3.2 ADJUSTING, CLEANING AND POLISHING

.1 Remove protective coatings and paper including adhesives.

.2 Test mechanisms, hinges, locks and latches.

.3 Adjust and lubricate to ensure accessories are in perfect working order.

.4 Clean and polish mirrors, aluminum and stainless steel surfaces.

END OF SECTION

Deleted from contract
SEE ADD#8

PART 1 - GENERAL

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL INSTRUCTIONS

.1 Read and conform to:

.1 the General Conditions and the Supplementary Conditions of the Contract;

.2 Division 1 requirements and documents referred to therein.

1.3 SUMMARY

.1 Provide labour, materials, products, equipment and services to complete the sun control devices work specified herein. This includes, but is not necessarily limited to:

.1 Exterior sun shades a building exterior.

.2 Framing and associated anchorage.

.3 Auxiliary materials required for complete installation.

.2 Related Requirements: Specifications throughout the entirety of Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.4 REFERENCES

.1 Definitions: the following definitions shall apply to this Section:

.1 “Post-Disaster Building”: means a building that is essential to provision of services in event of a disaster. This facility is classified as post disaster as defined in the OBC.

.2 “Operational and Functional Component” and “OFC”: means components within building which are directly associated with the function and operation of the facility. OFCs consist of architectural components, building services components, and building contents. Items specified herein may be designated as OFCs and may need to be designed in accordance with performance requirements specified herein and in Section 13 48 50.

.2 Reference Standards: Latest published editions of reference standards listed in this Section in effect as of the closing date and time of the Request for Tenders for the Contract, including any amendments adopted, are applicable unless otherwise indicated.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meetings:

.1 Prior to starting work of this Section, convene a pre-installation meeting at the Project site to review the Project requirements and site conditions with pertinent parties. Conform to requirements of Section 01 30 00.

1.6 ACTION SUBMITTALS

.1 Product Data: Submit in accordance with Division 01 for the following:

.1 Submit manufacturer's instructions, printed product literature and data sheets for the sun control devices work and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Shop Drawings: Submit in accordance with Division 01 for sun control devices and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.

.3 Samples: Submit samples in accordance with Division 01 for each type of metal finish required.

1.7 QUALITY ASSURANCE

.1 Welding Qualifications:

.1 Provide welding in accordance with CSA W59-M performed by a fabricator and mechanics fully approved by the Canadian Welding Bureau as specified herein.

.2 Ensure fabricator is fully certified by Canadian Welding Bureau for fusion welding of steel structures to CSA W47.1 and for fusion welding of aluminum to CSA W47.2.

.2 Fabricator qualifications. A firm experienced in producing fencing/infill/gate products similar to those indicated for the Project and with a record of successful in-service performance.

.3 Source Limitations: Obtain sun control devices from single source from a single manufacturer where indicated to be of same type, design, or factory-applied colour finish.

.4 Licensed Professionals: Employ a full time structural Professional Engineer registered in the Province of Ontario, carrying minimum $2,000,000.00 professional liability insurance, to:

.1 design the components of the work of this Section requiring structural performance,

.2 be responsible for full assemblies and connections,

.3 be responsible for determining sizes, yield strengths, gauge thicknesses and joint spacing to allow thermal movement and loading of components in accordance with applicable codes and regulations,

.4 be responsible for production and review of Shop Drawings,

.5 inspect the Work of this Section during fabrication and erection,

.6 stamp and sign each Shop Drawing, and

.7 provide site administration and inspection of this part of the Work.

.5 Mock-ups: Provide mock-ups in locations designated by Consultant and as required to demonstrate quality of workmanship. Maintain mock-ups during construction in an undisturbed condition as a standard for judging the completed work.

1.8 FIELD CONDITIONS

.1 Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.9 WARRANTY

.1 Extended Warranty for Finishes: Repair or replace components on which finishes fail in materials or workmanship within specified warranty period.

.1 Deterioration includes, but is not limited to, the following:

.1 Colour fading more than 5 Hunter units when tested according to ASTM D2244.

.2 Chalking in excess of a No. 8 rating when tested according to ASTM D4214.

.3 Cracking, checking, peeling, or failure of paint to adhere to bare metal.

.2 Warranty Period: 10 years from date of Substantial Performance of the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Products of following manufacturers (or Equivalent) may be acceptable subject to conformance to requirements of Drawings, schedules and Specifications.

.1 Levolux;

.2 Construction Specialties

.3 TenPlus Architectural Products

.4 or Equivalent to the above.

.2 Substitution Limitations: This Specification is based on “Infiniti System” by Levolux. Equivalent Products from manufacturers listed herein offering functionally and aesthetically equivalent Products in Consultant’s opinion and subject to Consultant’s review, will be considered provided they meet the requirements of this Specification.

2.2 DESCRIPTION

.1 Regulatory Requirements:

.1 Design shall be based on Limit States Design principles using factored loads and resistance. Resistance and resistance factors shall be determined in accordance with the OBC and CSA S136 requirements.

.2 Design and Performance Requirements:

.1 Professional Engineering Design and Certification: Design sun control devices, including comprehensive engineering analysis by a Professional Engineer licensed to practice in the Province of Ontario, using structural performance requirements and design criteria indicated.

.2 Structural Performance: Sun control devices shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of sun control device components, noise or metal fatigue caused by sun control device-blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.

.1 Wind Loads: Determine loads based on pressures as indicated on Drawings.

.2 Limit deflection of members and framing to L/360.

.3 Vibration Control: Ensure sun control device members do not vibrate when subjected to above wind loading.

.4 Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

.1 Temperature Change (Range): 67 deg C (120 deg F), ambient; 100 deg C (180 deg F), material surfaces.

.5 SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

2.3 MATERIALS

.1 Steel Plates, Shapes, and Bars: ASTM A 36/A 36M or equivalent to CSA G40.20/G40.21, Grade 300W..

.2 Aluminum Extrusions: ASTM B 221M (ASTM B 221), Alloy 6063-T5, T-52, or T6.

.3 Aluminum Sheet: ASTM B 209M (ASTM B 209), Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.

.4 Fasteners: Use types and sizes to suit unit installation conditions.

.1 Use hex-head or Phillips pan-head screws for exposed fasteners unless otherwise indicated.

.2 For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.

.3 For fastening galvanized steel, use hot-dip-galvanized steel or 300 series stainless-steel fasteners.

.4 For fastening stainless steel, use 300 series stainless-steel fasteners.

.5 For color-finished sun control devices, use fasteners with heads that match colour of sun control devices.

.5 Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187.

.6 Grout: Non-shrink type, pre-mixed compound consisting of non-metallic aggregate, cement, and water-reducing and plasticizing additives.

2.4 MANUFACTURED UNITS

.1 Sun Control Devices: Provide ornamental system consisting vertical fixed shading blades, fabricated with extruded aluminum framing bars and supported by extruded aluminum posts with following characteristics:

.1 Fin Bracket: Stainless Steel.

.2 Support arm and support fixing: stainless steel.

.3 Fin: fixed extruded aluminum shading blades bars, spaced as required to provide solar shading. Size and angle: as indicated on reviewed Shop Drawings.

.4 Carrier Arm: Provide aluminum extruded tubular aluminum sections with solid aluminum caps sized as required to carry blade loadings.

.5 Basis-of-Design: “Infiniti System” by Levolux or Equivalent.

2.5 FABRICATION

.1 Factory assemble sun control devices to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

.2 Maintain equal sun control device blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.

.3 Include supports, anchorages, and accessories required for complete assembly.

.4 Join frame members to each other and to sun control device blades with fillet welds concealed from view unless otherwise indicated or size of sun control device assembly makes bolted connections between frame members necessary.

2.6 ALUMINUM FINISHES

.1 Finish sun control devices after assembly.

.2 High-Performance Organic Finish: Three-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70percent PVDF resin by weight in both colour coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

.1 Colour and Gloss: “Wood Look” colour or pattern as selected by Consultant from manufacturer's full range.

.2 Manufacturer’s standard powder coating of performance equivalent to AAMA 2605 is acceptable in lieu of high-performance organic finish specified in this Section.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Site Verification of Conditions: Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify the Consultant in writing of any conditions which would be detrimental to the installation. Commencement of work implies acceptance of previously completed work.

.2 Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

.1 Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

.1 Comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

.2 Locate and place sun control devices level, plumb, and at indicated alignment with adjacent work.

.3 Use concealed anchorages where possible.

.4 Form closely fitted joints with exposed connections accurately located and secured.

.5 Provide perimeter reveals and openings of uniform width for sealants and joint fillers.

.6 Protect unpainted galvanized and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.

3.4 FIELD QUALITY CONTROL

.1 Manufacturer Services: Arrange for Product manufacturer’s technical representative to:

.1 meet and discuss installation procedures and unique conditions at the Place of the Work.

.2 inspect substrate surfaces and recommend solutions to accommodate adverse conditions.

.3 periodically visit and inspect installation and report unsatisfactory conditions to Contractor.

.4 attend final inspection and to submit written certification that Products, systems and assemblies have been installed in accordance with manufacturer’s requirements.

3.5 ADJUSTING AND CLEANING

.1 Clean exposed sun control device surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.

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.2 Restore sun control devices damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, remove damaged units and replace with new units.

.3 Touch up minor abrasions in finishes with air-dried coating that matches colour and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION

Deleted through cost saving

PART 1 - GENERAL

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL INSTRUCTIONS

.1 Read and conform to:

.1 the General Conditions and Supplementary Conditions of the Contract.

.2 Division 1 requirements and documents referred to therein.

1.3 SUMMARY

.1 Work Included: Provide flagpoles including, but not limited to, the following:

.1 flagpoles.

.2 concrete base.

.3 excavation for flagpole base.

.2 Work not included: Flag(s) with their respective fittings for attaching to halyards.

.3 Related Requirements: Specifications throughout the entirety of the Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.4 REFERENCES

.1 Reference Standards: Latest published editions of reference standards listed in this Section in effect as of the closing date and time of the Request for Tenders for the Contract, including any amendments adopted, are applicable unless otherwise indicated.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Conform to the administrative requirements of Division 01.

.2 Sequencing: Coordinate the installation work of this Section with the Work of other related Sections.

1.6 SUBMITTALS

.1 Product Data: Submit the manufacturer's literature and data sheets for each type of material provided under this Section in accordance with the requirements of Division 01. Ensure data sheets provide required information including detailed instructions for installing as well as maintaining, preserving and keeping materials in clean and safe conditions. Provide adequate warning of maintenance practices or cleaning agents detrimental to the specified materials.

.2 Safety Data Sheets (SDS): Submit SDS for inclusion in Operation and Maintenance Manual specified in Section 01 70 00, for adhesives, sealants and any other material designated by Consultant.

.3 Shop Drawings:

.1 Submit shop Drawings in accordance with the requirements of Division 01.

.2 Indicate materials, dimensions, finishes, base jointing, anchoring and support systems, cleats, halyard boxes, trucks, finials and base collar for flagpoles.

.3 Provide templates and instructions for installation of flagpoles and bases.

.4 Samples: Submit two 50 mm x 100 mm (2" x 4") samples of flagpole finish.

1.7 QUALITY ASSURANCE

.1 Qualifications: The work of this Section shall be executed by competent installers with a minimum of 5 years of experience in the application of the Products, systems and assemblies specified herein and with the approval and training of the Product manufacturers.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Spiral wrap each flagpole with heavy kraft paper, wood strip and steel band or polyethylene wrap and pack in tubing for shipment.

.2 Deliver flagpoles in manufacturer's wrappings and in one piece.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Products of the following manufacturers (or Equivalent) are acceptable subject to conformance to the requirements of the Contract Documents:

.1 All Canadian Flagpole Co Inc. (All Canadian Flagpole)

.2 Ewing Flagpole Co. Inc. (Ewing Flagpole)

.3 or Equivalent.

.2 Substitution Limitations: Comparable Products from manufacturers not listed herein will be considered provided they meet the requirements of this Specification.

2.2 DESCRIPTION

.1 Design and Performance Requirements:

.1 Design flagpole, bases and anchorage devices in accordance with NAMM FP 1001 to resist 100 km/h (60 mph) wind velocity minimum, flagged, or 165 km/h (100 mph) unflagged.

.2 Design flagpoles to accommodate minimum flag size: 2440 mm x 3660 mm (8’ x 12’)

2.3 MATERIALS

.1 Flagpoles: Complete aluminum poles, including accessories, bases and anchorage devices.

.2 Concrete Base: CSA A23.1, CSA A23.2 and CSA A23.3; 20 MPa compressive strength after 28 Days, maximum slump 100 mm (4"), air entraining 5% to 7%.

.3 Galvanized Steel: CAN/CSA-G164-M, minimum zinc coating of 0.610 kg/m^2 (2 oz/sq ft).

.4 Aluminum: Aluminum Association alloy AA 6063-T6 seamless extruded aluminum tubing.

.5 Bituminous Paint: Isolation paint, alkali-resistant bituminous paint or epoxy resin solution. To Provide dielectric separation and which will dry to be tack-free and able to withstand high

temperatures. Cold-applied asphalt mastic complying with SSPC-Paint 12, except containing no asbestos fibers.

.1 Acceptable Products and manufacturers shall be Carboline Bitumastic 50 by Carboline Canada, or Copper Creek Top Service 760 Black by Sherwin Williams Company, or other Equivalent Product and manufacturer acceptable to the Consultant.

2.4 ACCESSORIES

.1 Final: 100 mm (4") mm diameter ball of 1.6 mm (0.063") minimum thick aluminum anodized colour to match flagpole finish.

.2 Truck Assembly: Cast aluminum, stainless steel ball bearing, non-fouling, revolving double truck assembly (finish to match flagpole).

.3 Swivel Snaps: Two per halyard aluminum with neoprene or vinyl covers.

.4 Internal Halyard System: Pole manufacturer's superior system; for poles minimum height 9 m (30') and minimum butt diameter 150 mm (6"); heavy duty aircraft control cable; exposed parts to match the flagpole finish.

.1 Internal Winch: Stainless steel, gearless automatic brake and removable handcrank.

.2 Access Door: Keyed, removable flush mounted door in reinforced frame.

2.5 FABRICATION

.1 Supply 9 m (30') long flagpole as a complete unit including the base, mounting brackets, anchorage and fittings.

.2 Cone Tapered Flagpole:

.1 Seamless, uniform, straight line tapered section above the cylindrical butt section.

.2 Taper: 25 mm (1") for every 1.7 m (5' - 6") of the run.

.3 Provide internal splicing, self-aligning sleeve of same material as flagpole for snug fitting, watertight field joints.

.3 Perform welding in accordance to the appropriate CSA standard, by welders certified by the Canadian Welding Bureau. Finish exposed welds flush and smooth.

.4 Shop apply the isolation coating to metal surfaces of flagpole (and base) that will be (encased in concrete) (below grade level).

.5 Pole Base: Fixed, anchor type, flush base assembly, cast aluminum with galvanized steel template base and galvanized steel concrete anchors of minimum ultimate pull out strength of 88.96 kN (20,000 lbs). Base cover fabricated from aluminum alloy 6061, finish to match the flagpole.

.1 Fabricate mountings of galvanized steel where encased in concrete.

2.6 FINISHES

.1 Aluminum Finishes:

.1 Finish: Brushed satin and waxed finish for cone tapered flagpoles.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Excavate ground to depth indicated on the Drawings.

.2 Perform concrete work as follows:

.1 Of size and shape indicated on the Drawings.

.2 Top of base 150 mm (6") above finish ground level.

.3 Anchor bolts for flagpole support to extend minimum of 900 mm (36") into concrete base.

.4 Vertical exposed concrete placed into formwork and horizontal top provided with drainage channels or slopped.

.5 Bring exposed surfaces to smooth steel trowel finish.

.3 Apply one coat of bituminous paint on steel surfaces in contact with concrete.

.4 Install pole, base assemblies and fittings in accordance with the Shop Drawings and the manufacturer's instructions. Use suitable equipment to prevent scuffing and damage to the pole during erection.

.5 Erect the pole plumb and true in position.

.6 Provide positive lightning ground for each flagpole installation.

.7 Check and adjust installed fittings for smooth operation of halyards.

.8 Install the flag and demonstrate operation to the Consultant.

3.2 CLEANING

.1 Upon the completion of the work, remove the protection erected under this Section. Make Good any damage done to this work and the adjoining work. Remove surplus materials, debris, tools, plant and equipment and leave the Site in a condition satisfactory to the Consultant.

END OF SECTION

SEE ADD#9
Q#293

PART 1 - GENERAL

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form,

1.2 GENERAL INSTRUCTIONS

.1 Read and conform to:

.1 the General Conditions and the Supplementary Conditions of the Contract;

.2 Division 1 requirements and documents referred to therein.

1.3 SUMMARY

.1 Work Included: Provide manually operated roller window sun control shades including but not limited to the following:

.1 Chain operated roller window shade assembly complete with translucent and blackout shades.

.2 Roller shades systems shall meet design requirements and protect roller blind when not in use, keep it clear when windows are cleaned, and protect shade from dust collection

.2 Related Requirements: Specifications throughout the entirety of the Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.4 REFERENCES

.1 Reference Standards: Latest published editions of reference standards listed in this Section in effect as of the closing date and time of the Request for Tenders for the Contract, including any amendments adopted, are applicable unless otherwise indicated.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meetings:

.1 Prior to starting work of this Section, convene a pre-installation meeting at Project site to review Project requirements and site conditions with pertinent parties. Conform to requirements of Section 01 30 00.

1.6 SUBMITTALS

.1 Product Data: Submit manufacturer's literature and data sheets for each type of material provided under this Section for the Project in accordance with requirements of Section 01 30 00. Ensure data sheets provide required information including detailed instructions for installing as well as maintaining, preserving and keeping materials in clean and safe conditions. Provide adequate warning of maintenance practices or cleaning agents detrimental to specified materials.

.2 Safety Data Sheets (SDS): Submit SDS for inclusion in Operation and Maintenance Manual specified in Section 01 70 00, for adhesives, sealants and any other material designated by Consultant.

.3 Shop Drawings: Submit Shop Drawings for Work of this Section in accordance with Section 01 30 00.

.1 Submit Shop Drawings which clearly indicate shade sizes, locations, operation, methods of attachment, and description of components. Indicate each component, size, shape, material, thickness, gauge, finish, methods of joining, joint locations, fastening devices, anchorage components, methods of attachment and relationship with adjacent components and construction.

.2 Submit reflected ceiling plans, drawn to scale, showing following items coordinated with each other, based on input from installers of items involved:

.1 Ceiling suspension system members and attachment to building structure.
.2 Ceiling-mounted or penetrating items including light fixtures, air outlets and inlets, speakers, sprinklers, recessed shades, and special moldings at walls, column penetrations, and other junctures of acoustical ceilings with adjoining construction.
.3 Shade mounting assembly and attachment.
.4 Size and location of access to shade operator and adjustable components.

.3 Field Measurements: Take field measurements prior to preparation of Shop Drawings and fabrication to ensure proper fitting of work. Do not fabricate work until Shop Drawings have been reviewed.

.4 Samples: Submit samples in accordance with Section 01 30 00. Submit following samples in sizes indicated:

.1 Submit sample shade fully representing shades to be provided complete with head rail, end caps, gears, sprocket wheels, chains, brackets and similar accessories.

.2 Submit samples of fabrics complete with edge reinforcing and finish colours for selection and approval. Do not order material until colour samples have been approved. Fabric sample: minimum 300 mm (12") square.

.5 Test Data: Submit test data substantiating that proposed shade fabric meets all performance criteria specified herein. Submit independent test results showing properties and acceptable fire hazard classification of shade fabric.

.6 Certificate: Submit written certification that materials, systems, and assemblies have been installed in accordance with manufacturer's requirements.

.1 Maintenance Instructions: Submit maintenance instructions in accordance with Section 01 70 00. Indicate methods for maintaining roller shades and finishes; precautions about cleaning materials and methods that could be detrimental to fabrics, finishes, and performance and operating hardware.

1.7 QUALITY ASSURANCE

.1 Applicator Qualifications: Provide Work of this Section executed by competent installers with a minimum of 5 years' experience in the application of the Products, systems and assemblies specified herein and with he approval and training of the Product manufacturers.

.2 Licensed Professionals: Employ a full time structural Professional Engineer registered in the Province of Ontario, carrying minimum $2,000,000.00 professional liability insurance, to:

.1 design the components of the Work of this Section requiring structural performance in accordance with OBC and requirements of standards referenced in this Section, review design documents, and provide site administration and inspection of this part of the Work.

.3 Mock-ups: Provide mock-ups in locations designated by Consultant and as required to demonstrate quality of workmanship. Maintain mock-ups during construction in an undisturbed

condition as a standard for judging completed work. The reviewed mock-up may form part of final installation if left undisturbed at the time of Substantial Performance of The Work .

.4 Single Source Responsibility: Ensure primary materials provided in this Section are obtained from 1 source by a single manufacturer and secondary materials are obtained from sources recommended by primary materials manufacturers.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials to site only when the work of this Section can be started.

.2 Before delivery to site verify each assembly for proper operation. Clean each assembly of marks and smudges prior to providing wrap up protective covering.

.3 Provide necessary crating and bundling for shipment of components to site including protection against weather likely to impair adequacy or appearance of material in finished assembly.

.4 Remove and replace damaged units at no additional cost to the Owner.

1.9 WARRANTY

.1 The Contractor warrants the work of this Section for a period of 2 years from Substantial Performance of the Work against defects and/or deficiencies in accordance with the General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within this warranty period, to the satisfaction of the Consultant and at no expense to the Owner. Defects include but are not limited to: deformation of members, mechanical failure, and failure of system to operate as designed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Products of following manufacturers (or Equivalent) are acceptable subject to conformance to requirements of Drawings, Schedules and Specifications:

.1 Altex;

.2 Elite Window Fashions

.3 Hunter Douglas Contract

.4 Nysan Shading Systems Ltd.

.5 Solarfective Products Limited

.6 Sun Glow

.7 SunProject Canada Inc.

.8 Urban Edge Shading, Inc.

.2 Substitution Limitations: This Specification is based on Solarfective “Manual Teleshade” Product. Comparable Products from manufacturers listed herein offering functionally, aesthetically equivalent Products in Consultant’s opinion and subject to Consultant’s review will be considered provided they meet the requirements of this Specification.

2.2 DESCRIPTION

.1 Regulatory Requirements:

.1 Flammability: Ensure fabric meets the OBC flammability requirements and CNAN/ULC S109 Small Scale vertical burn requirements when tested by independent testing and inspecting agency acceptable to Authorities Having Jurisdiction.

.2 Light fastness: AATCC Method 16A exceeding 60 hours. Class 5.

.3 Antibacterial and antifungal resistance:

.1 AATC Test Method 147: Pass
.2 AATC Test Method 30: Pass

.2 Design and Performance Requirements

.1 Seismic Performance: Design materials specified in this Section to withstand the effects of earthquake motions determined according to the OBC and CAN/CSA S832 requirements. The Professional Engineer referenced in this Section shall be responsible for designing systems and submitting signed and sealed analysis data and Shop Drawings illustrating seismic-resistant systems. Refer to structural Drawings for seismic sensitivity values

.2 Provide factory assembled roller window shade units consisting of surface mounted roller shade units on face of mullions or at ceiling with two end brackets, complete with shade roller tube, extruded fascia, hembar, fabric, fastenings, anchorages and accessories specified and required. Ensure units comply with requirements of WCMA A100.1.

.3 Provide installation brackets that facilitate easy removal and replacement of blinds.

.4 Design manually operated roller window shade system with side and bottom channels for easy lifting, finger tip control, with infinite positioning so that shade is capable of stopping and holding at any position within window opening.

.5 Provide assemblies to suit adjacent ceilings and finishes. Ensure removal does not require disassembly of shade unit. Provide left or right hand operative option as required to suit design requirements. Provide side and sill channels at locations requiring blackout shades.

.6 Fabric Performance Requirements:

.1 Provide shade fabric capable of hanging flat without buckling or distortion easy to clean and wipeable.
.2 Window coverings will allow control of exterior light entering room during daylight hours and provide privacy during daylight and non-daylight hours.
.3 Provide black-out window coverings where indicated on Drawings, Provide materials, tracks, seals, and operation suited to that purpose.
.4 Use window coverings manufactured from materials and mechanisms that minimize cleaning and maintenance operations and maximize infection prevention and control.
.5 Consider colour of window coverings and the impact this will have on mechanical system.
.6 Ensure edge when trimmed, hangs straight without raveling with unguided roller shade cloth rolling true and straight without shifting sideways more than $\pm$ 3 mm (1/8") in either direction due to wrap distortion or weave design.
.7 Fabric will be inherently anti-static, flame retardant, fade and stain resistant, light filtering, room darkening, & blackout fabrics providing openness factors specified herein. Fabric containing fiberglass, PVC, polyester, acrylic or vinyl laminates.

2.3 MATERIALS

.1 Formed Aluminum: ASTM B209M, Aluminum alloy 6063 - T5. Ensure surfaces are free from defects impairing appearance, strength and durability.

.2 Extruded Aluminum: ASTM B209M, Aluminum alloy 6063-XT6 for roll tube; 6060 for horizontal tracks; and 6063-T5 elsewhere

.3 Sheet Steel: ASTM A653/A653M-98, Designation Z275, stretcher levelled commercial quality galvanized steel.

.4 Chain Beads: ASTM A167, Series 300 stainless steel in ANSI No. 10 mirror finish having minimum 0.44 mm (0.017") diameter and with 47 to 48 beads for every 300 mm. (12") Chain to have pull test rating of 400 N. (90 lb.) Plastic bead chain is not acceptable.

.5 Galvanizing of odd shaped components: ASTM A153/A153M; minimum weight of zinc coating, in ounces per sq ft of surface in accordance with Table 1 of ASTM A153/A153M, for various classes of materials used on the Project.

.6 Shading Fabric: Provide vinyl coated polyester yarn. Provide fabric tensioned in finishing range prior to heat setting to keep wrap ends straight and minimize or eliminate weave distortion to keep fabric flat. Ensure fabric is dimensionally stable, non-flammable and moisture, UV, heat and fungi resistant.

.1 Solar Control Fabric (3% openness factor): Following types are acceptable:

.1 "SheerWeave Style 2410" by Phifer Wire Products or approved equivalent with following characteristics:

.1 Openness Factor: 3% + 0.0%

.2 UV. Blockage: 97%

.3 Thickness: 0.51 mm (0.020 inch)

.4 Mesh Weight: 478 g/m^2 (14.1 oz/yd^2).

.5 Composition: 36% fiberglass, 64% vinyl coated fiberglass.

.2 "E Screen Solar Protection Fabric" by Mermet Corp. or approved equivalent with following characteristics:

.1 Openness Factor: 3%

.2 UV. Blockage: 97%

.3 Thickness: 0.43 mm (0.017 inch)

.4 Mesh Weight: 393 g/m^2 (11.6 oz/yd^2).

.5 Composition: 36% fiberglass, 64% vinyl.

.2 Blackout Fabric: Following types are acceptable:

.1 "SheerWeave Style 7100" by Phifer Wire Products or approved equivalent with following characteristics:

.1 Openness Factor: 0% (Opaque)

.2 UV. Blockage: 99%

.3 Thickness: 0.64 mm (0.056 inch)

.4 Mesh Weight: 632 g/m^2 (21.6 oz/yd^2).

.5 Composition: 37% fiberglass, 63% vinyl coated fiberglass.

.2 "Avila Twilight" by Mermet Corp. or approved equivalent with following characteristics:

.1 Openness Factor: 0% (Blackout)

.2 UV. Blockage: 99%

.3 Thickness: 0.52 mm (0.020 inch)

.4 Mesh Weight: 490 g/m^2 (14.5 oz/yd^2).

.5 Composition: 100% polyester with acrylic foamed backing, PVC free.

.2 Fabric Colour: Selected by the Consultant from standard colour range of the specified manufacturer. Shade fabric on any one floor to be from the same dye lot.

2.4 MANUFACTURED UNITS

.1 Chain Operated Single Roller Window Shades (RBL-1):

.1 Provide chain operated single roller shade system with built-in clutch mechanism complete with loaded spring to allow system to be easily raised and lowered. Provide steel bead chain and connector complete with chain hold-down for each chain.

.2 Ceiling cover plate: Provide clear anodized aluminum finish for bottom coverage of shade (semi-enclosure) for recessed application in ceiling.

.3 Custom trim: Extruded aluminum to shapes and profiles indicated, where adjacent finishes abut the shade assembly, and to Provide attachment for adjacent finish, finished to match fascia/soffit.

.4 Hembar: External, clear anodized aluminum type with end caps

.5 Acceptable Products: “Manual Teleshade System” by Solarfective or “UE-205” by Urban Edge Shading or Equivalent.

.2 Dual Roller Window Shade Assembly (RBL-2):

.1 Provide chain operated dual roller shade system with built-in clutch mechanism complete with loaded spring to allow system to be easily raised and lowered. Ensure units are stacked to minimize protrusion. Provide steel bead chain and connector complete with chain hold-down for each chain.

.2 Ceiling cover plate: Provide clear anodized aluminum finish for bottom coverage of shade (semi-enclosure) for recessed application in ceiling.

.3 Hembar: External, clear anodized aluminum type with end caps.

.4 External weight bar: Clear anodized finish with end caps.

.5 Custom trim: Extruded aluminum to shapes and profiles indicated, where adjacent finishes abut the shade assembly, and to Provide attachment for adjacent finish, finished to match fascia/soffit.

.6 Blackout Channels: Extruded aluminum 28 mm (1-1/8") by 38 mm (1-1/2") complete with 12 mm (1/2") fuzz. Provide blackout channels at sides and sills. Do not Provide blackout channels at openings forming part of the building envelope.

.7 Acceptable Products: “Teleshade Dual System” by Solarfective or “UE-230” by Urban Edge Shading or Equivalent.

2.5 COMPONENTS

.1 Roller Window Shade Assembly:

.1 Design and fabricate heavy duty roller window shade assembly to keep maintenance to minimum.

.2 Ensure chain and sprocket operated and/or spring operated roller window shade assembly operates smoothly and has capability to control rate of fall, to adjust stop and hold at infinite number of positions as required.

.3 Provide automatic stop at highest and lowest shade position to prevent over winding or unrolling. Provide built-in, internal limit control winding stop contained within roller tube for shades as recommended by manufacturer. Ensure limit stop is adjustable without special tools.

.4 Ensure assembly allows fingertip control with built-in shock absorber system to prevent operator breakage under normal operating conditions. Factory set for size and travel of shades.

.5 Ensure assembly mechanism to have structural capacity to accommodate specified shades in window sizes required for this Project. Design assembly mechanism to suit size of windows and mass of system.

.2 Shade Mounting Brackets:

.1 Fabricate from minimum 3 mm (1/8") thick sheet steel and minimum 11 mm (7/16") welded steel shaft which serves as axis for entire sprocket and spring clutch assembly. Make reversible for left or right hand operation as directed by Consultant on Shop Drawings.

.2 Provide mounting in accordance with reviewed Shop Drawings as required to keep mechanism and brackets totally concealed from view when fully assembled. Mechanically attach cover plates to sheet steel brackets. Provide a means of attaching fabric without exposing hardware.

.3 Provide guides to retain gear assembly. Brackets to act as protective retainer for tube and shade assembly preventing accidental dislocation of tube and shade.

.3 Roller Tube:

.1 Design extruded aluminum alloy roller tube to suit assembly design with either end of tube to engage drive system through internal or external extruded keyway. Extruded roller tube to have wall thickness to suit design requirements with minimum wall thickness of 1.39 mm (0.0547") with reinforcement for fabric to provide anti-deflection support for wide span shades. Formed aluminum tube is unacceptable.

.2 Design tubes to be removable without removing the drive assembly, block resetting, or readjusting the pre-set stops. Shade tube to be self aligning.

.3 Roller tube to be sized and reinforced internally as necessary to prevent excessive deflection in span of tube. Excessive deflection is defined by observation whereby shades in their open position reveal puckering, sagging or billowing, or where the tube deflects beyond 4% of roller length.

.4 Identify each roller tube to its location in accordance with reviewed Shop Drawings.

.4 Fabric Mounting Spline:

.1 Fabricate snap-in-place spline of extruded vinyl with asymmetrical insertion locking channels and embossed fabric guide. Spline to have sufficient capacity to hold shades when spline is snapped and locked into the tube. Fabric shade to be readily removable without removing the tube from the retainer brackets, or removing the brackets from wall.

.2 Fabric-Guide End Cap: Fit delrin end cap with steel pin which permits up to 7 mm (5/16") lateral adjustment in tube width. End cap to have 55 mm (2-5/32") outside diameter minimum fabric guide tapered disc feature to ensure alignment and protection of shade cloth. Provide integral stainless steel eyelet at guide cables.

.5 Snap-In-Place Fascia:

.1 Provide rectangular formed metal fascia where shown of minimum 1.29 mm (0.0507") thick formed aluminum or extruded aluminum of minimum 2 mm (0.078") thick housing.

.2 Provide fascia that snaps onto shade bracket without any exposed fastening devices. Visible edges of ceiling brackets to be continuous. Clearance between arc of fascia and end of bracket to be minimum of 9 mm, (5/16",) a minimum reveal of 10 mm (3/8") will be permitted when two shades with fascia are butted together.

.3 Finished fascia to have return back at bottom to permit maximum opening of 50 mm. (2".) Provide in lengths of up to 3000 mm (10'-0") unsupported without visible sag or distortion.

.4 Where shades are face mounted to faceted window arrangement, Provide matching closure section and bridging clips between ends of abutting units.

.5 Fascia members are not required for overhead concealed application.

.6 Shade Fabric Hem Tube:

.1 Provide full shade width, single piece, prefinished, extruded aluminum section of approximately 15 mm (5/8") od with additional non-corrosive weight to maintain a weight of 1.4 kg/m (1 lb/ft) except for shades having a height dimension greater than the width, in which case weight to be 2.0 kg/m. (1.33 lb/ft.)

.2 At manufacturer's option, hem tube may be extruded aluminum, rectangular in shape, designed to hang perfectly perpendicular, and to totally conceal any heat-set or sewn seams within tube. Provide internal spline to secure the fabric evenly across full width. Provide separate port within tube to allow storage of non-corrosive weight.

2.6 FABRICATION

.1 Do necessary cutting and sewing of fabric to produce finished Product having neat, even appearance and meeting performance requirements specified.

.2 Fabricate shades with no vertical seams, and with a maximum of 2 horizontal seams per shade. Furnish fabric in adequate width to avoid horizontal seams at spacings of less than 1900 mm. (75"). Seams to be straight, even and offer minimum visual obstruction.

.3 Ensure fabric tracks perfectly straight in its movement to within ±1% of its width from fully open to fully closed position, and when rolled onto tube, stacks in layers to within ± 3 mm (1/8") of edge alignment.

.4 Provide clear, 10-12 mm (3/8" - 1/2") wide plastic edge tape reinforcing to prevent ravelling of raw edge of shades having glass fibre cores.

.5 Bottom edge to hang straight and true, with hem weights totally enclosed in extruded hem tube. Heat sealing alone is not acceptable.

.6 All sewing to incorporate heavy denier polyester yarn and machine stitching to be straight and neatly finished with no loose threads visible in finished Work. Heat seaming is not acceptable in areas in which fabric is exposed.

2.7 FINISHES

.1 Cleaning and Shop Painting for Concealed Steel Sheet Finishes: Hot dip galvanized, complying with ASTM A123/A123M.

.2 Aluminum Finish:

.1 Meeting or exceeding AAMA 2603, 1 coat system. ‘Duracron’ by PPG Industries or equivalent by Valspar (or Equivalent);

.2 Colour: To match adjacent framing.

.3 Dielectric Separator: To Provide die-electric separation between two dissimilar metals and prevent galvanic reaction. Best grade, quick drying non-staining alkali resistant bituminous paint or epoxy resin solution or membrane type acceptable to the Consultant.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Site Verification of Conditions: Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify the Consultant in writing of any conditions which would be detrimental to the installation. Commencement of work implies acceptance of previously completed work.

.1 Obtain corrective measures from Consultant prior to fabrication. Ensure suitability of adjacent building components in relationship to the work of this Section.

3.2 INSTALLATION

.1 Coordinate installation and fastenings with trades providing adjacent components. Coordinate location of support framing and blocking for installation of roller window shades.

.2 Provide, as part of the work of this Section, custom trim components including gypsum board and tee bar trim items to accommodate adjacent ceiling systems and finishes to approval of the Consultant.

.3 Install shades in accordance with manufacturer's instructions in accordance with reviewed Shop Drawings and as indicated, in true, flat planes.

.4 Securely attach all installation fittings to their mounting surfaces with screws of correct length and type, and with compatible plugs or anchors where required.

.5 Hang shades to substrate in a rigid and secure manner using fastener types and arrangements shown on Shop Drawings. Shades to have 15 mm (5/8") air space at sill unless designated as blackout.

.6 Ensure penetrating fastener do not interrupt continuity of air/vapour barrier integrity.

.7 Ensure shades and their fabrics hang flat at vertical installation without buckling or distortion. Edge when trimmed, to hang straight without curling or ravelling.

.8 Unguided roller shade cloth to roll true and straight without shifting sideways more than ±3 mm (1/8") in either direction due to warp distortions or weave design.

3.3 ADJUSTMENT AND CLEAN-UP

.1 Adjust shades for smooth operation and correct alignment. Perform system operation, service and replacements methods in presence of the Owner’s personnel.

.2 Remove protective coating. Clean shades and remove finger marks and smudges from shades and adjacent surfaces.

.3 Leave shades in raised position at completion of the work of this Section.

.4 Upon completion of the work of this Section, remove all products, materials, debris and equipment from the Site.

.5 Leave the Site in a neat and tidy condition, acceptable to the Consultant.

.6 Do all touch-up required to satisfaction of the Consultant.

3.4 ROLLER SHADE FABRIC SCHEDULES

.1 Roller Shade Fabric Schedules:

.1 Single Roller Window Shade (RBL-1):

.1 Translucent Fabric:

.1 "Mermet E Screen 3%" or "SheerWeave Style 2410" or Equivalent; 3% Open Factor

.2 Dual Roller Window Shade Assembly (RBL-2):

.1 Translucent Fabric:

.1 "Mermet E Screen 3%" or "SheerWeave Style 2410" or Equivalent; 3% Open Factor

.2 Blackout Fabric: "Mermet Avila Twilight" or "SheerWeave Style 7100" or Equivalent; 0% Open Factor

END OF SECTION

Deleted from contract
SEE ADD#2,Q#52

PART 1 - GENERAL

1.1 PRICING

.1 All costs associated with the work required by this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL INSTRUCTIONS

.1 Read and conform to:

.1 the General Conditions and Supplementary Conditions of the Contract.

.2 Division 1 requirements and documents referred to therein.

1.3 SUMMARY

.1 Work Included: Provide stainless steel casework including but not limited to following:

.1 Stainless Steel Countertops,

.2 Integral sinks where indicated.

.3 Auxiliary materials required for a complete installation.

.2 Related Requirements: Specifications throughout entirety of Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.4 REFERENCES

.1 Reference Standards: Latest published editions of reference standards listed in this Section in effect as of Bid Closing Deadline of the Project, including any amendments adopted, are applicable unless otherwise indicated.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meetings:

.1 Prior to starting work of this Section, convene a pre-installation meeting at Project site to review Project requirements and site conditions with pertinent parties. Conform to requirements of Section 01 30 00.

1.6 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's literature and data sheets for each type of material provided under this Section for Project in accordance with requirements of Section 01 30 00. Ensure data sheets provide required information including detailed instructions for installing as well as maintaining, preserving and keeping materials in clean and safe conditions. Provide adequate warning of maintenance practices or cleaning agents detrimental to specified materials.

.2 Submit data and details for construction of the stainless steel casework as well as information regarding the name, quantity, type and construction of materials (such as hardware, gauges and similar items), that will be used to complete the project.

.2 Shop Drawings:

.1 Submit Shop Drawings in accordance with Section 01 30 00 for fabricated items and assemblies of stainless steel casework with a detailed description, clearly indicated methods of construction, gauges, assembly, fastenings, services and similar items.

.2 Identify and explain any variation in Shop Drawings which do not adhere to original details and Specification requirements. Advise Consultant in writing of any conditions that would limit or adversely effect design intent.

.3 Ensure component parts and assemblies of each piece of equipment will support the loads anticipated without deflection detrimental to function, safety or appearance.

.4 Prepare fully dimensioned "Roughing-In" and final connection point Drawings for mechanical and electrical services. Separate mechanical and electrical, or combined Drawings, may be submitted. Include walk-in and fire suppression schematics and any pertinent installation diagrams including dimensioned "sleeving" drawing.

.5 Verify power and location requirements for any piece of equipment that is being supplied by Owner or is existing and being reused. Incorporate this information into the Shop Drawings, "Rough-in" and connection point Drawings.

.3 Samples:

.1 Submit sample in accordance with Section 01 30 00. Submit a sample of components or fabrication method, material or finish, for review and approval before proceeding with that aspect of work. Where necessary, request a shop inspection of an assembly which cannot be submitted for approval.

.4 Maintenance Manuals: Submit maintenance instructions in accordance with Section 01 70 00, bound and labeled.

1.7 QUALITY ASSURANCE

.1 Manufacturers: Provide Products for Work of this Section by manufacturer with minimum 10 years' experience in the manufacture of such materials.

.2 Installers: Provide Work of this Section executed by competent installers with minimum of 5 years' experience in application of Products, systems and assemblies specified and with approval and training of Product manufacturers.

.3 Single Source Responsibility: Ensure primary materials provided in this Section are obtained from 1 source by a single manufacturer and secondary materials are obtained from sources recommended by primary materials manufacturers.

.4 Mock-ups: Provide Mock-ups in locations designated by Consultant and as required to demonstrate quality of workmanship. Maintain Mock-ups during construction in an undisturbed condition as a standard for judging the completed work. Do not proceed with remaining work until installation is approved by Consultant.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Co-ordinate deliveries of stainless steel casework in conjunction with millwork and other construction activity and progress at site and as designated by Owner.

.2 Deliver, unpack and set in place all component in designated position, ready for final connection of services, for units with electrical or mechanical connections where applicable.

.3 After installation has been completed and all items checked and adjusted where necessary for satisfactory operation, arrange for inspection of stainless steel casework. If items are found unsatisfactory, make necessary corrections and adjustments.

1.9 PROJECT SITE CONDITIONS

.1 Adhere to the following prior to undertaking work of this Section:

.1 Building must be enclosed (windows and doors sealed and weather-tight);

.2 An operational HVAC system that maintains temperature and humidity at occupancy levels must be in place;

.3 Adjacent and related work shall be complete;

.4 Ceiling, overhead ductwork and lighting must be installed;

.5 Site must be free of any further construction such as “wet work”;

.6 Required backing and reinforcements must be installed accurately and the project must be ready for casework installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Products of the following manufacturers (or Equivalent) are acceptable subject to conformance to requirements of Drawings, Schedules and Specifications:

.1 Mott Manufacturing Ltd.

.2 Lab Design/United Supply Corporation.

2.2 DESCRIPTION

.1 Regulatory Requirements:

.1 Plumbing or drainage systems shall conform to Plumbing Code and Ontario Water Resources Act except as modified by regulations and bylaws of authorities having jurisdiction.

.2 Design and Performance Requirements:

.1 As a minimum countertops to be designed as follows:

.1 Countertops to support all deadloads.
.2 Concentrated Live load bearing capacity: 2.67 KN (600 lb-f)
.3 Distributed Live load bearing capacity: 200 lb/ft (0.89 kN/m) without deformation or deflection.
.4 Maximum Deflection at Midspan: L/1000 or 3 mm (1/8”) whichever is less.

.2 Installation of stainless steel countertops and work surfaces shall comply with requirements of Scientific Equipment & Furniture Association (SEFA 3-2010). Abut top and edge surfaces in one true plane with flush hairline joints and with internal supports placed to prevent deflection

2.3 MATERIALS

.1 Sheet Steel:

.1 Mild steel, cold rolled furniture grade to requirements of ASTM A1008/A1008M, Grade C or higher, with smooth surfaces to furniture quality.

.2 Galvanized Sheet Steel:

.1 Commercial quality galvanized sheet steel to ASTM 653/A653M, Designation Z275 (G90).

.3 Stainless Steel:

.1 Provide highest architectural quality in various forms, straight and true. Ensure there are no scratches, scars, creases, buckles, ripples or chatter marks. Provide finish surfaces suitable for polishing where required. Ensure finished surfaces exposed to view are free of pitting, seam marks, roller marks, oil-canning, stains, discolourations or other imperfections.

.2 Stainless Steel Sheet: ASTM A240, type 316 alloy.

.3 Finish: Unless otherwise indicated, AISI No. 4 brushed Finish

.4 Use the following minimum steel thicknesses for manufacturing: 1.2mm (18 Ga)

.4 Sealant: Conforming to requirements of Section 07 92 00.

.5 Sheet Metal Thickness:

2.4 MANUFACUTURED UNITS

.1 Stainless Steel Countertops

.1 All factory welds shall be made using the TIG process. Filler rod shall be of the same composition as the base material. Countertops to be minimum 18 ga stainless steel unless indicated otherwise.

.2 Countertops without sinks: Form tops with 32mm (1.25”) high edges with 12mm (0.5”) return flange. Reinforce with veneer core plywood or metal hat channels as required or indicated on Drawings. Form edges, flanges, side and backsplashes integrally from one sheet of steel. Intersections between side and backsplashes and work surface shall be radiused a minimum of 9mm (0.375”). Where indicated on Drawings, Provide marine edges. Marine edges shall be 25mm (1”) wide and 6mm (0.25”) high.

.3 Countertops with sinks: Form tops with 32mm (1.25”) high edges with 12mm (0.5”) return flange. Provide marine edges at all locations. Marine edges shall integrally be formed on all edges. Marine edges shall be 25mm (1”) wide and 6mm (0.25”) high. Work surface shall be reinforced with wood core or metal hat channels as required or indicated on Drawings. Form edges, flanges, side and backsplashes integrally from one sheet of steel. Intersections between sidesplashes, backsplashes and work surface shall be radiused a minimum of 9mm (0.375”).

.4 Sink Bowls: Sink bowls shall be made of the same material as the work surface and shall be of equal or greater thickness. Sinks bowls shall be formed from one piece of steel with all inside corners radiused. Welds shall be hammered, ground and polished to produce a smooth, invisible joint. Sinks shall be welded into the work surface and welds shall be ground and polished to produce a smooth, invisible joint.

.5 Joints: Factory welds shall be ground and polished to provide an invisible joint. Field connections shall be mechanical “tongue and groove” interlocking design with concealed bolts to provide a hairline seam.

.6 Sound Deadener: Countertops and sinks shall have sound deadening material applied as required to the underside. Nominal thickness shall be 1.5mm (0.062”). Sound deadener shall be waterborne, non flammable and shall contain no volatile organic compounds.

.7 Drainboards: Provide fluted drain boards in material and thickness to match tops, sloped to sink, joined integrally with tops unless otherwise noted on Drawings.

2.5 FINISH

.1 All steel furniture in this section shall be constructed of stainless steel with a #4 brushed finish. Grain direction shall be horizontal except where cabinet dimensions do not permit.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Countertop Installation:

.1 Countertops are to have been fabricated in lengths according to drawings, with ends abutting tightly and sealed with corrosion resistant sealant.

.2 Tops will be anchored to base casework in a single true plane with ends abutting at hairline joints with no raised edges at joints.

.3 Joints shall be factory prepared having no need for in-field processing of top and edge surfaces.

.4 Joints shall be dressed smoothly, surface scratches removed and entire surface cleaned thoroughly.

3.2 CLEANING

.1 Ensure all products are unsoiled and match factory finish. Remove or repair damaged or defective units.

.2 Clean all finished surfaces, including drawers and cabinet shelves, and touch up as necessary.

.3 Counter tops shall be cleaned and free of grease or streaks.

3.3 PROTECTION

.1 Counter tops and ledges shall be protected with 19 mm (1/4 inch) ribbed cardboard for the remainder of the construction process.

.2 Examine casework for damaged or soiled areas; replace, repair, and touch-up as required.

.3 Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SEE ADD#2 Q#13

SEE ADD#4 Q#100 & 131

Updated through ADD#8

PART 1 - GENERAL

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form

1.2 GENERAL INSTRUCTIONS

.1 Read and conform to:

.1 the General Conditions and the Supplementary Conditions of the Contract.

.2 Division 01 requirements and documents referred to therein.

1.3 SUMMARY

.1 Provide labour, materials, Products, equipment and services to complete the pre-engineered building work specified herein. This includes all structural steel components above grade including, but is not necessarily limited, to:

.1 Primary structural steel: Welded plate section columns and beams for bolted field assembly.

.2 Secondary structural steel: Roof purlins and wall girts, cross bracing, hoist beam and supports, and lateral support for masonry walls.

.3 Support beams for cantilevered components and conventional framing interface.

.4 Standing seam roof cladding and gutter assembly.

.5 Insulated wall assembly.

.6 Eave overhangs, internal gutters, seals, metal flashings, copings, and closures.

.7 Rigid frame and miscellaneous framing, rough opening frame.

.8 Auxiliary materials required for a complete installation.

.2 Related Requirements: Specifications throughout all Divisions of the Project shall be read as a whole, and may be directly applicable to this Section. Related requirements provided below are for convenience purposes only:

.1 Section 07 21 00 - Building Insulation.

.2 Section 07 42 46 - Insulated-Core Metal Wall Panels

1.4 REFERENCES

.1 Definitions:

.1 “Post-Disaster Building”: means a building that is essential to provision of services in event of a disaster. This facility is classified as post disaster as defined in the OBC.

.2 “Operational and Functional Component” and “OFC”: means components within building which are directly associated with the function and operation of the facility. OFCs consist of architectural components, building services components, and building contents. Items specified herein may be designated as OFCs and may need to be designed in accordance with performance requirements specified herein and in Section 13 48 50.

.2 Reference Standards: Latest published editions of reference standards listed in this Section in effect as of the closing date and time of the Request for Tenders for the Contract, including any amendments adopted, are applicable unless otherwise indicated.

1.5 DEFINITIONS

.1 The following definitions per CSSBI 30 apply to this Section:

.2 Pre-Engineered Metal Building System: means an integrated assembly of manufactured steel structural components and cladding components specifically designed by the manufacturer to support and transfer loads and provide a complete or partial building shell

.3 Structural Framing: means the steel framework consisting of primary members (rigid frames, beams, girders, trusses, arches, rafters, columns), secondary members (purlins, joists, struts, bracing, tension rods, girts, eave struts, base angle and channel, header, jambs, sills and other structural items) and all necessary hardware.

.4 Cladding: means the exposed exterior wall and roof skin of any material type and combination including fasteners and attachments, weather sealants, trim, flashing, fascia, and closures, as applicable.

1.6 PREINSTALLATION MEETINGS

.1 Pre-installation Meetings: Schedule and hold a pre-installation meeting at the Project site at least one week before beginning work on this Section to coordinate activities with related Subcontractors.

.1 Required Attendance: Subcontractor performing work of this Section, representatives from manufacturers and fabricators involved in or affected by installation.

.2 Notification: Notify Consultant and Owner of scheduled meeting dates in advance; minimum 72 hour notice required.

.3 Agenda:

.2 Review progress of related construction activities and preparations for particular activity under consideration.

.3 Make note of required sequencing and coordination with materials and activities that have preceded or will follow.

.1 Reporting: Record significant discussions, agreements, and disagreements, including required corrective measures and actions.

.2 Distribution: Distribute minutes of the meeting to each party present and to other parties requiring information not more than 72 hours after meeting.

1.7 SEQUENCING

.1 Coordinate installation with other related Sections.

.2 Supply items to be installed by other Sections in ample time to avoid delays.

.3 Supply necessary measurements, templates, and instructions to ensure smooth progression of construction activities.

.4 Arrange for manufacturer’s technical representative to review procedures and conditions prior to commencing work.

1.8 SUBMITTALS

.1 Product Data: Submit manufacturer's product characteristics, catalogue cuts, installation instructions and other relevant information for each material and product used for pre-engineered building work specified in this Section.

.2 Shop Drawings: Submit Shop Drawings indicating material layouts, details of construction, connections, and relationship with adjacent construction. As a minimum indicate following:

.1 Include plans, elevations, sections and details as applicable.

.2 Show size, location, projection of anchor bolts, grid lines, structural members, connection details, and related elements.

.3 Clearly mark components and parts, and provide erection Drawings for identification and parts assembly.

.4 Indicate field-measured dimensions on Shop Drawings.

.3 Delegated Design Submittals:

.1 Engineering design completion of pre-engineered building work is delegated to Contractor based on structural design criteria indicated in Contract Documents.

.2 Submit Shop Drawings for work of this Section that bear the stamp of a Professional Engineer registered in Province of Ontario.

.3 Submit copy of structural calculations upon request by Consultant.

.4 Embodied Carbon / Environmental Product Declarations (EPDs): When available, submit product-specific or industry-wide EPDs conforming to ISO 14025 or other recognized environmental Product declaration framework meeting following criteria:

.1 EPD Scope: Must cover Cradle-to-Gate (A1 to A3) as a minimum.

.2 EPD Impact Categories: Must report Global Warming Potential (GWP) in form of unit of kgCO2e/declared unit as a minimum.

.3 Product Options: Give preference to Products with compliant documentation when choice is at Contractor's option.

.5 Material Ingredient Disclosure: When available, submit documentation disclosing chemical inventory of materials to at least 0.1% (1000ppm) meeting following criteria:

.1 Standard: Health Product Declaration (HPD) Open Standard, Cradle to Cradle v2 (Basic level) or Cradle to Cradle v3 (Bronze level), International Living Future Institute (ILFI) Declare, or other approved material ingredient declaration framework.

.2 Product Options: Give preference to Products with compliant documentation when choice is at Contractor's option.

.6 Welding Certificate: Submit certification for welding firms and welders to verify compliance with welding qualifications specified in this section.

1.9 CLOSEOUT SUBMITTALS

.1 Operating and Maintenance Data: Submit care and maintenance instructions for pre-engineered building to be included in building operation and maintenance manual.

.2 Warranty Documentation: Submit copy of extended warranties specified in this Section.

1.10 QUALITY ASSURANCE

.1 Manufacturer Qualifications: Provide Products for work of this Section by manufacturer with at least 10 years' experience manufacturing such materials.

.1 Steel building system manufacturer must be certified to CSA A660.

.2 Provide on-site supervision by a qualified technical representative during erection.

.2 Installer Qualifications: Engage an entity with at least five years' experience installing, erecting, or assembling work similar in material, design, and extent to that shown on Drawings and Schedules, and whose work has resulted in construction with a track record of successful in-service performance.

.3 Welding Qualifications: Qualify procedures and personnel in accordance with the following:

.1 Steel: to CSA W47.1 and CSA W59

.2 Aluminum: to CSA W47.2 and CSA W59.2

.3 Stainless Steel: to CSA W47.1 (Annex K) and CSA W59.

.4 Professional Engineer's Qualifications: Employ Professional Engineer licensed to practice in Province of Ontario who carries professional liability insurance and has at least five years' experience providing engineering services of similar kind, scope, and complexity.

.1 Professional Engineer's Responsibility:

.5 production and review of Shop Drawings,

.6 design and certification of pre-engineered building, including attachments for foundation, in accordance with applicable codes and regulations,

.7 stamping and signing of each Shop Drawing and associated calculations

.8 Single Source Responsibility: Obtain primary materials for this Section from a single source by a single manufacturer, and secondary materials from sources recommended by manufacturers of primary materials.

1.11 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle pre-engineered building materials in accordance with manufacturer's written instructions.

.2 Protect pre-finished sheet steel during handling and storage as per CSSBI Bulletin No. 9.

1.12 FIELD CONDITIONS

.1 Field Measurements: Verify actual dimensions of construction contiguous with pre-engineered building by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Provided requirements of Contract Documents are satisfied, the following manufacturers may supply Products for work this Section:

.1 Butler Manufacturing Company;

.2 Robertson Building Systems

.3 Steelway Building Systems

.4 Behlen Industries

.5 Varco Pruden

2.2 PERFORMANCE / DESIGN CRITERIA

.1 Design Intent: Architectural Drawings and details are diagrammatic and are only intended to show design concept, aesthetics, interfacing requirements, configuration, components and arrangements. They are not intended to identify or solve completely problems of thermal and structural movements, assembly framing, engineering design, fixings and anchorages.

.2 Structural Performance: Provide pre-engineered building capable of withstanding the effects of the following loads in accordance with requirements of Ontario Building Code (Part 4, Structural Design) (geographical location - Newmarket):

.1 Wind Loads: Determined in accordance with OBC requirements for the project's geographical location, with a 1 in 50-year return probability.

.2 Roof Snow Loads: Determined in accordance with OBC requirements for the project's geographical location.

.3 Seismic Loads: Determined in accordance with OBC requirements for the project's geographical location.

.4 Dead Loads: Account for loads attributable to weight of building system construction, including roof, framing, and covering materials.

.5 Collateral Loads: Include additional imposed loads required by Contract Documents, such as sprinklers, mechanical, electrical, and ceiling systems.

.6 Design cold-formed metal framing used for the work of this Section to CAN/CSA S136.

.7 Design structural steel framing used for the work of this Section to CAN/CSA S16.

.3 Deflections:

.1 Calculate deflections using only bare frame method. Do not use reductions based on engineering judgment unless actual calculations for the stiffness are included in the design for the specific project.

.2 Design frame bases assuming "pinned" connections to prevent moment transfer to foundations.

.3 Limit lateral deflections due to wind and gravity loads to H/500, where H is the building height at the eaves.

.4 Limit deflections of roof purlins to [L/180] under snow and wind loading.

.5 Limit lateral deflections of wall girts to [L/180]where girts brace metal siding and [L/720] where girts brace masonry walls.

.4 Rain Screen Principle:

.1 Design exterior envelope cladding systems based on Rain Screen Principle advocated by NRCC and Provide for drainage of water entering building envelope wall systems.

.2 Provide gaskets, baffles, overlaps, seals and compartmentalization where required to achieve appropriate pressure equalization in exterior envelope cavity wall design. Maintain integrity of continuous air barrier/vapour retarder system with adjacent surrounding air barrier/vapour retarder.

.3 Incorporate means of draining moisture to exterior. Design drainage system to provide clear, internal paths of drainage of any trapped moisture within construction to exterior.

Ensure weep water discharges in a manner that avoids staining of architectural finishes, collecting in puddles or formation of icicles.

.5 Thermal Movements: Ensure roof and wall framing allow for thermal movement without causing buckling, joint seal failure, undue stress on fasteners, or other detrimental effects.

.1 Temperature Change (Range): 67 deg C (120 deg F), ambient; 100 deg C (180 deg F), material surfaces.

.6 Condensation Control: Ensure no condensation on interior surfaces under the following conditions:

.1 Interior: 22 degrees C, 30% relative humidity (RH), still air.

.2 Exterior: Determined according to OBC Climatic Design Conditions for the project's geographical location (assume January Temperature at 1% return).

.7 Accommodate structural movement with expansion joints and clips without causing permanent distortion, damage to infills, joint racking, seal breakage, water penetration, or glass breakage.

2.3 MATERIALS

.1 Steel: to CAN/CSA G40.21, with a minimum yield strength of 350 MPa. Steel must be shop primed with a 30-day primer.

.2 Bolts: to ASTM A325M, complete with nuts and washers. Provide heavy, hexagon head high strength structural bolts, of standard size and required lengths for the thickness of members joined and the type of connection.

.3 Welded Materials: in accordance with CSA W59 standards.

.4 Shop-Applied Zinc-Rich Primer Paint: As recommended by manufacturer.

.5 Galvanized Steel Sheet: to ASTM A792, structural quality grade A, with AZ165 coating, regular spangle surface, and passivated for unpainted finish. For paint finish, use AZ150 unpassivated coating.

.6 Pre-Finished System for Steel Sheet Exposed to the Exterior: zinc-coated material with a factory-applied paint system conforming to CSSBI Technical Bulletin No. 7.

.7 Screws: corrosion-resistant, purpose-made, concealed screws.

2.4 INSULATION

.1 Refer to Section 07 21 00 - Building Insulation.

2.5 METAL ROOFING SYSTEM Roof type R-2, basis of design Robertson Thermal Systems (RST)

.1 Exterior sheet-roof: factory preformed steel sheet aluminum zinc alloy coated factory preformed steel sheet, prefinished from manufacturer's standard profiles and colours. M~~, m~~inimum core thickness 0.61 mm (24 Ga), standing seam roof panels with locking seam formed around concealed sliding panel clip and sealant. Include closures, gaskets, caulking, flashing and fasteners to effect weathertight installation.

.2 Roof Panel: Provide minimum 24 gauge roof panel assembly. Colour and Finish to be selected at a later date. Basis-of-Design: "Double-Lok Panel" by Robertson.

~~.2~~.3 Roof Guard: Provide metal roof snow retention system at bottom of sloped roofs. Basis-of-Design: "ColorGard – Metal Roof Snow Bar" By S-5!

~~.3~~.4 Roof liner: factory preformed steel sheet, zinc coated, prefinished from manufacturer's standard profiles and colours. Minimum core thickness 0.61 mm (24 Gauge) and prefinished to 5000

paint series. Install roof liner on top of roof purlins, caulked and sealed to Provide roof vapour barrier.

.4.5 Install thermal spacers, hat bar and continuous 9mm rigid insulation thermal break over roof liner to accommodate thickness of insulation and attachment of panel clips and exterior roof sheet. Sealants as recommended by manufacturer.

.6 Provide components required for a complete metal roof panel assembly including copings, fasciae, corner units, ridge closures, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels unless otherwise indicated.

2.6 METAL CLADDING SYSTEM

.1 Insulated metal panel system as specified in Section 07 42 46 - Insulated-Core Metal Wall Panels.

2.7 ACCESSORIES

.1 Provide accessories as standard with metal building system manufacturer and as specified. Fabricate and finish accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes. Comply with indicated profiles and with dimensional and structural requirements.

2.8 FABRICATION

.1 Fabricate structural members according to Shop Drawings and CAN/CSA S16.1.

.2 Construct frames from welded plate section columns and roof beams, including necessary splice plates for bolted field assembly. Provide high-strength bolts for frame member assembly.

.3 Reinforce openings to maintain the design strength of structure.

.4 Factory weld base plates, cap plates, compression splice plates, and stiffener plates with shop-fabricated connection holes.

.5 Fabricate columns and roof beams with pre-drilled holes for attachment of secondary structural members and bracing, except as noted for field work on the manufacturer's erection Drawings.

.6 Use welded "H" sections or cold-formed "C" sections for exterior columns.

.7 Fabricate beams and posts with pre-drilled holes for secondary structural member attachment, except as specified for field work.

.8 Shop-fabricate splice plates and base clips with bolt connection holes. Factory weld base plates, cap plates, compression splice plates, and stiffener plates with shop-fabricated connection holes.

.9 Substitute intermediate frames for end-wall roof beams and corner posts as required.

.10 Ensure necessary endwall posts and connection holes to the intermediate frame are shop-fabricated.

.11 Design secondary structures, including purlins and girts, to support specified design loads. Place bracing as indicated on reviewed Shop Drawings.

.12 Attach diagonal bracing, consisting of hot-rolled rod, to columns and roof beams.

.13 Install cold-formed flange braces, purlin braces, and similar components as indicated on Drawings.

.14 Cladding Accessories: Brake or bend accessories to shape, using material and finish that matches the roof cladding or wall cladding.

2.9 TOLERANCES

.1 Ensure tolerances comply with CSSBI 30M.

.2 Provide holes for the attachment of other work as indicated on the Drawings.

2.10 SHOP FINISHING

.1 Clean, prepare surfaces, and shop prime structural steel in accordance with CAN/CSA S16.1, except where members are zinc-coated, zinc-aluminum alloy coated, or to be encased in concrete.

.1 Commercially blast clean frames and end structures to SSPC-SP2, SSPC-SP3 or SSPC-SP6 before painting with manufacturer's standard zinc-rich primer.

.2 Purlins and Girts: Cold form for galvanized coil.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verify actual site conditions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation. Commencement of work implies acceptance of previously completed work.

3.2 INSTALLATION

.1 Installation, generally: Install work of this Section in strict accordance with manufacturer's written installation instructions and reviewed Shop Drawings. Supplement manufacturer's installation instructions with additional installation requirements specified in this Section to produce specified work results.

3.3 ERECTION

.1 Do work in accordance with CSSBI 30M except where specified otherwise.

.2 Erect structural frame in accordance with shop drawings and to CAN/CSA-S16

.3 Connect major structural members using high-tensile bolts through pre-punched or predrilled holes for precise alignment.

.4 Do not field cut, drill, or alter structural members without written approval from the metal building system manufacturer's professional engineer.

.5 Include support for adjacent structural members as indicated on Structural Drawings. Set structural framing accurately in locations and to elevations indicated in accordance with CSA and CSSBI standards referenced in this section. Maintain structural stability of the frame during erection.

.6 Base and Bearing Plates

.1 Preparation: Clean concrete and masonry bearing surfaces of materials that may impair bond, and roughen surfaces before setting plates. Clean the bottom surface of plates.

.2 Setting Plates: Set plates for structural members on wedges, shims, or setting nuts as required.

.3 Alignment and Adjustment: Align and adjust structural framing before permanently fastening. Clean bearing surfaces and other surfaces that will be in permanent contact with framing before assembly. Perform necessary adjustments to compensate for

discrepancies in elevations and alignment. Level and plumb individual members of the structure. Allow for temperature differences between the time of erection and the mean temperature when the structure will be completed and in service.

.7 Primary Framing and End Walls: Erect framing level, plumb, rigid, secure, and true to line. Level baseplates to a true even plane with full bearing to supporting structures, set with double-nutted anchor bolts. Use grout to obtain uniform bearing and maintain a level base-line elevation. Moist-cure grout for at least seven days after placement. Make field connections using high-strength bolts installed according to manufacturer's instructions.

.8 Secondary Framing: Erect framing level, plumb, rigid, secure, and true to line. Field bolt secondary framing to clips attached to primary framing.

.1 Provide rake or gable purlins with tight-fitting closure channels and fasciae.

.2 Locate and space wall girts to suit openings such as doors and windows.

.3 Provide supplemental framing at the entire perimeter of openings, including doors, windows, ventilators, and other roof and wall penetrations.

.9 Bracing

.1 Install bracing in roof and sidewalls where indicated on erection drawings.

.2 Tighten rod and cable bracing to avoid sag.

.3 Locate interior end-bay bracing only where indicated.

.10 Framing for Openings: Provide shapes of proper design and size to reinforce openings and carry loads and vibrations imposed, including equipment furnished under mechanical and electrical work. Securely attach to structural framing.

3.4 PROTECTION

.1 Protect pre-engineered building from damage, soiling and contaminating substances resulting from construction activities or caused by work of other trades.

.2 Where soiling or spills have occurred, remove spills and soiling from adjacent surfaces using cleaning procedures recommended in writing by affected material's manufacturer. Do not use materials or process that can damage finishes, surfaces, or construction.

.3 Promptly replace pre-engineered building work damaged during construction that cannot be satisfactorily repaired.

3.5 CLEANING AND WASTE MANAGEMENT

.1 Cleaning: Maintain clean construction area at the end of each day. When activities of this Section are complete, remove materials, tools, equipment and rubbish.

.2 Waste Management and Disposal: sort waste for reuse, recycling, or disposal, as specified. Remove recycling bins and containers from site and dispose of contents at the appropriate waste disposal facilities.

END OF SECTION

PART 1 - GENERAL

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL

.1 Read and conform to:

.1 the General Conditions and Supplementary Conditions of the Contract.

.2 Division 1 requirements and documents referred to therein.

1.3 SUMMARY

.1 Work Included: Provide seismic control assemblies for operational and functional components including but not limited to following:

.1 Work in this Section includes supplying and installing complete seismic restraint systems for architectural components. Work in this Section may also include the seismic restraint design and/or equipment/product certifications to be submitted for review by the registered design professional.

.2 Architectural assemblies or components requiring seismic restraint include, but are not limited to, the following:

.1 nonstructural exterior wall components,
.2 interior partitions and infill walls,
.3 suspended ceiling assemblies and bulkheads,
.4 exit doors, and overhead doors,
.5 roof accessories, and similar components,
.6 wall-mounted components weighing more than 9 kg (20 lbs)
.7 Owner-supplied, Contractor-installed equipment,
.8 other components needing seismic restraints and listed in Contract Documents.

.2 Related Requirements: Specifications throughout the entirety of Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.4 REFERENCES

.1 Reference Standards: Latest published editions of reference standards listed in this Section in effect as of the closing date and time of the Request for Tenders for the Contract, including any amendments adopted, are applicable unless otherwise indicated.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Sequencing: Coordinate installation with the work of related Sections referenced herein.

.1 Prior to start of work, arrange for Project site meeting of parties associated with work of this Section.

.2 Scheduling:

.1 Prior to commencing work of this Section, arrange for manufacturer's technical representative to review with Contractor and Consultant procedures to be adopted and

conditions under which work shall be performed. Inspect surfaces to determine adequacy of existing and proposed conditions.

.2 Co-operate fully with other Subcontractors on the Work and promptly proceed with work of this Section as rapidly as job conditions permit.

.3 Co-operate with those performing the work of other Sections for application of all miscellaneous specialties.

.4 Supply items to be built-in in ample time to be incorporated into work of other Subcontractors, together with measurements and other information required for location of it.

1.6 SUBMITTALS

.1 Product Data: Submit manufacturer's literature and data sheets for each type of material provided under this Section for Project in accordance with requirements of Division 01. Ensure data sheets provide required information including detailed instructions for installing as well as maintaining, preserving and keeping materials in clean and safe conditions. Provide adequate warning of maintenance practices or cleaning agents detrimental to specified materials.

.2 Safety Data Sheets (SDS): Submit SDS for inclusion in Operation and Maintenance Manual specified in Section 01 70 00, for adhesives, sealants and any other material designated by Consultant.

.3 Shop Drawings: Submit in accordance with Division 01 and indicating following:

.1 Submit complete seismic restraint design, consisting of calculations, restraint selection, installation details, and other documentation signed and sealed by Professional Engineer stipulated herein. Seismic restraint Shop Drawings shall be prepared and overseen by a Professional Engineer as specified herein experienced in designing seismic restraints for operational and functional components as required by the Authority Having Jurisdiction

.2 Where walls, floors, slabs, or supplementary steel work is used for seismic restraint, submit details of acceptable attachment methods for equipment and components; including spacing, static loads, and seismic loads at all attachment and support points. Obtain approval of Consultant prior to installation.

.3 Provide specific details of seismic restraints and anchors; include number, size, and locations for each piece of equipment; provide details of suspension supports and restraints for equipment hung from ceiling.

1.7 QUALITY ASSURANCE

.1 Qualifications:

.1 Manufacturers:

.1 Provide work of this Section by a specialty consultant or equipment manufacturer designated to develop seismic restraint system and perform seismic calculations in accordance with requirements of OBC, standards stipulated herein and additional requirements particular to this Section.

.2 Ensure equipment manufacturer or specialty consultant specified herein designs, recommends, reviews, and supervises installation of proposed seismic restraint design and connection methods for entire Project, excluding work associated with Divisions 20, 21, 22, 23 & 26.

.2 Installers: Provide work of this Section executed by competent installers with minimum 5 years experience in the application of Products, systems and assemblies specified and with approval and training of the Product manufacturers.

.2 Licensed Professionals: Employ a full time structural Professional Engineer registered in the Province of Ontario, carrying minimum $2,000,000.00 professional liability insurance to:

.1 design the components of the work of this Section requiring structural performance,

.2 be responsible for full assemblies and connections,

.3 be responsible for determining sizes, yield strengths, gauge thicknesses and joint spacing to allow thermal movement and loading of components in accordance with applicable codes and regulations,

.4 be responsible for production and review of Shop Drawings,

.5 inspect the work of this Section during fabrication and erection,

.6 stamp and sign each Shop Drawing,

.7 provide site administration and inspection of this part of the Work, and

.8 submit certificate validating seismic assessment and field review of this part of the Work

.3 Single Source Responsibility: Ensure materials specified herein are designed and provided by a single seismic restraint manufacturer to ensure sole source responsibility for performance of seismic restraints used.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Delivery and Acceptance Requirements:

.1 Comply with material manufacturer’s ordering instructions and lead time requirements to avoid delays.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Products of following manufacturers (or Equivalent) are acceptable subject to conformance to requirements of Drawings, Schedules and Specifications:

.1 Mason Industries.

.2 Tecoustics.

.3 Vibro-Acoustics.

2.2 DESCRIPTION

.1 Design and Performance Requirements:

.1 Seismic Control Assemblies design is based on mutually agreed upon details submitted by Subcontractor for final review by Consultant.

.2 Drawings covering work of this Section may show design intent and profiles that are diagrammatic in nature. Drawings may also show general building standards for seismic restraint of operational and functional components, which are to be completed and coordinated by this Section. Drawings are not intended to identify or solve completely problems of structural or seismic movements, assembly framing, engineering design, fixings and anchorages

.3 Requirements of this seismic restraint Section are in addition to other requirements specified elsewhere for the support and attachment of operational and functional components.

Nothing on Contract Documents shall be interpreted as justification to waive requirements of this Section.

.4 In addition to Contract Documents requirements, final design and performance of seismic control and restraint assemblies of operational and functional components and their approval by Authorities Having Jurisdiction is the responsibility of the contractor performing the work of this Section.

.5 Design seismic restraint system and clearly indicate attachment points to building structure and design forces (in X, Y, and Z direction) at the attachment points in accordance with OBC for designated seismic hazard values for location of Project as listed in Supplementary Standard SB-1. Design anchorage in accordance with ACI 318, Appendix D.

.6 Provide attachment loading values to Professional Engineer specified herein for verification of attachment methods and building's structure ability to accept imposed loading. Base seismic restraint design on actual OFC data (dimensions, weight, center of gravity, and similar criteria) obtained from submittals or item manufacturers. Ensure that equipment manufacturer verifies that attachment points on equipment and components can accept combination of seismic loading and other loads imposed.

.7 Design seismic restraint system in accordance with OBC requirements and requirements of CAN/CSA S832 based non-exhaustively on the following:

.1 Anticipated ground motion (including spectral response acceleration as defined by local codes and Authorities Having Jurisdiction);
.2 Soil type in specific geographic area
.3 Importance Factor of Building (i.e 1.5 for post-disaster buildings)
.4 Specific element of component factor
.5 Height factor
.6 Element's or component's response modification factor
.7 Element's or component's weight.

.8 For each element or component identified herein determine seismic risk rating score (low, moderate or high) and provide mitigation and reduction procedures in accordance with CAN/CSA S832.

.9 Include in seismic analysis calculated dead loads, static seismic loads, and capacity of materials utilized for connection of the equipment or system to building structure. Detail anchoring methods, bolt diameter, embedment and welded length. Ensure seismic restraint devices are designed to accept, without failure, forces through components or system's center of gravity.

2.3 MATERIALS

.1 Provide manufacturer's standard recommended materials or proprietary systems for seismic bracing and restraint to meet requirements of local codes and Authorities Having Jurisdiction based on design and performance criteria stipulated herein. Provide materials with full published ratings, verified through third party testing and bearing OSHPD pre-approval for use in the State of California. Provide following as a minimum and as applicable:

.1 Seismic Cable Restraints: Consisting of manufactured brackets and steel cables sized to resist seismic loads with minimum safety factor of 2 and arranged to provide all directional restraint. Ensure cables are pre-stretched to achieve certified minimum modulus of elasticity.

.1 Acceptable Products: "SCB/SCBH " by Mason Industries or approved Equivalent.

.2 Seismic Solid Braces: Consisting of manufactured brackets with steel angles, channels, or strut channels to resist seismic loads with minimum safety factor of 2 and arranged to provide all-directional restraint.

.1 Acceptable Products: “SSBS, SSRF” by Mason Industries or approved Equivalent.

.3 Steel angles or strut channels: Sized to prevent buckling and clamped to vertical support rods utilizing a minimum of two clamps at each restraint location when required. Provide spacing of vertical rod stiffeners in accordance with manufacturer’s recommendations.

.1 Acceptable Products “UCC, SRC” by Mason Industries or approved Equivalent.

.4 Anchors: Provide steel bolts, screws, cast in anchors utilizing rated values acceptable to structural Professional Engineer. Ensure post-installed anchors are approved for use in seismic zones for cracked and uncracked concrete. Ensure anchors have code listing approvals with ICC-ES reports certifying rated values for seismic loads.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Site Verification of Conditions: Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation. Commencement of work implies acceptance of previously completed work.

.2 Evaluation and Assessment: Notify seismic restraint system manufacturer’s representative prior to installing seismic restraint devices. Seek manufacturer’s guidance regarding unusual installation procedures.

3.2 INSTALLATION

.1 Install seismic restraint systems in strict accordance with the manufacturer's written instructions and submittal data specified herein.

.2 Ensure installation of seismic restraints do not cause change of position of OFCs resulting in detrimental stresses or misalignment.

.3 Coordinate work with other trades to avoid rigid contact with building elements. Bring to attention of Consultant and structural consultant prior to installation, conflicts with other trades that may result in rigid contact with equipment due to inadequate space or other unforeseen conditions.

.4 Install ceiling suspension and connections components ensuring hanger rods are not subject to bending in accordance with requirements of ASTM E580.

.5 Do not brace seismic restraint system to 2 different structures, such as a wall and a ceiling.

.6 Unless otherwise indicated by seismic consultant specified herein, Provide following seismic mitigation measures to following building elements:

.1 Partitions:

.1 In buildings with flexible structural frames, anchor partitions to only structural element, such as a floor slab, and separate such partition by physical gap from other structural elements.

.2 Properly anchor masonry walls to the structure for restraint, so as to carry lateral loads imposed due to earthquake along with their own weight and other lateral forces.

.2 Ceilings And Lighting Fixtures:

.1 At regular intervals, laterally brace suspended ceilings against lateral and vertical movements, and provide with a physical separation at the walls.

.2 Independently support and laterally brace lighting fixtures. Refer to applicable portion of lighting Specifications.

.3 Facades And Glazing:

.1 Do not install concrete masonry unit filler walls in a manner that can restrain the lateral deflection of the building frame. Provide a gap with adequately sized resilient filler to separate the structural frame from the non-structural filler wall.
.2 Tie brick veneers to a separate wall that is independent of the steel frame as shown on construction drawings to ensure strength against applicable seismic forces at the project location.
.3 Install attachments to structure for all façade materials as shown on construction drawings to ensure strength against applicable seismic forces at the project location.

.4 Storage Racks, Cabinets, And Bookcases:

.1 Install storage racks to withstand earthquake forces and anchored to the floor or laterally braced from the top to the structural elements.
.2 Anchor filing cabinets that are more than 2 drawers high to the floor or walls, and equip all drawers with properly engaged, lockable latches.
.3 Anchor bookcases that are more than 30 inches high to the floor or walls, and equip any doors with properly engaged, lockable latches.

3.3 FIELD QUALITY CONTROL

.1 Manufacturers' Field Services:

.1 Upon completion of installation of seismic restraint system, have manufacturer's local representative inspect completed system and report in writing any installation errors, improperly selected seismic devices, or other faults which could affect system performance. Perform corrective measures until final approval is granted at no additional cost to Owner.

.2 Submit, upon request by Consultant, letter of certification signed by Professional Engineer specified herein, substantiating that seismic restraint materials have been properly installed.

3.4 CLEANING

.1 Upon completion of installation of seismic restraint materials and before Substantial Performance of the Work, clean debris beneath OFCs and leave the Place of the Work in a clean and acceptable condition.

END OF SECTION

Project Manual

Issued for Tender

York Region Police
Helicopter Hangar

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QCG Project No. TT-24-005

2024-09-09

The Project Manual is bound in three separate volumes as follows:

Volume 1:	Project Specifications, Division 00 to Division 19
Volume 2:	Project Specifications, Division 20 to Division 29
Volume 3:	Project Specifications, Division 30 to Division 49

VOLUME 1

PROCUREMENT AND CONTRACTING REQUIREMENTS GROUP

Division 00 Procurement and Contracting Requirements

Introductory Information

Procurement Requirements

Contracting Requirements

Not Used

SPECIFICATIONS GROUP

GENERAL REQUIREMENTS SUBGROUP

Division 01 General Requirements

FACILITY CONSTRUCTION SUBGROUP

VOLUME 2

FACILITY SERVICES SUBGROUP

VOLUME 3

SITE AND INFRASTRUCTURE SUBGROUP

END OF DOCUMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Mechanical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

1.2 REFERENCES

.1 Division 00 and Division 01 apply to and are a part of each Mechanical Division:

.1 Division 20 – Common Mechanical Requirements;

.2 Division 21 – Fire Suppression;

.3 Division 22 – Plumbing;

.4 Division 23 – Heating, Ventilating, and Air Conditioning;

.5 Division 25 – Integrated Automation.

.2 The provisions of this Section also apply to the following sections:

.1 Section 08 31 00 – Access Doors and Panels.

.2 Section 10 44 16 – Fire Extinguishers.

1.3 SUBMITTALS

.1 Submit shop drawings/product data sheets for:

.1 pressure gauges and thermometers;

.2 electric motors (submit with equipment they are associated with).

.2 Submit weight loads for selected equipment (upon request).

.3 Submit copy of architectural reflected ceiling plan drawings and elevation drawings to indicate proposed access door locations.

.4 Submit a list of equipment identification nameplates indicating proposed wording and sizes.

.5 Submit a list of pipe and duct identification colour coding and wording.

.6 Submit a proposed valve tag chart and a list of proposed valve tag numbering and identification wording.

.7 Submit drawings indicating size and location of required sleeves, recesses and formed openings in poured or precast concrete work.

.8 Submit a sample of each proposed type of access door if supplied under work of this Division.

.9 Submit samples of materials and any other items as specified in Sections of Mechanical Divisions.

.10 Submit any other submittals specified in this Section or other Sections of Mechanical Divisions.

1.4 MAINTENANCE MATERIAL SUBMITTALS

.1 As specified in Part 2 of this Section, submit a spare belt set, tagged, and identified, for each belt driven piece of equipment.

PART 2 - PRODUCTS

2.1 FIRESTOPPING AND SMOKE SEAL MATERIALS

.1 Firestopping and smoke seal system materials for mechanical penetrations through fire rated construction are specified in Section 20 05 17 - Sleeves and Sleeve Seals for Mechanical Piping, and work is to be done as part of mechanical work unless otherwise specified in Division 07.

[OR]

2.2 ACCESS DOORS

.1 Coordinate with Mechanical Contractor and General Trades Contractor to ensure access doors on project are provided by a single manufacturer, installed as part of work of General Trades Contractor and work involving both mechanical and electrical services, where possible, be accessible from common access door. Coordinate work to ensure same common location access doors are not supplied by more than one Division.

.2 Identify on reflected ceiling plans and wall elevation drawings, coordinated locations of proposed access door locations and submit to the Consultant for review.

.3 Refer to Section 08 31 00.

.4 Provide all access doors required for Mechanical work unless otherwise specified in Division 08. Coordinate consistency of look and finish of access doors on project with each Division of Work. Coordinate exact requirements with General Trades Contractor.

.5 Access doors to be rust resistant steel door panels, with concealed hinges and positive locking and self-opening screwdriver operated lock. Wall type frame to be suitable for wall installation and have integral keys for plaster walls. Doors in tile wall to be stainless steel and in ceilings to be suitable for plaster covering with only frame joint showing. Other doors to be prime painted steel.

.6 Size access doors to suit the concealed work for which they are supplied, and wherever possible they are to be of standard size for all applications, but in any case they are to be minimum 300 mm x 300 mm (12" x 12") for hand entry and 600 mm x 600 mm (24" x 24") for body entry.

.7 Lay-in type tiles, properly marked, may serve as access panels. Coordinate marking of ceiling tiles with the Consultant. Panels in glazed tile walls to be 12 gauge, 304 alloy stainless steel, No. 4 finish, with recessed frame secured with stainless steel counter-sunk flush head screws.

.8 Panels in plaster surfaces to have dish-shaped door and welded metal lath, ready to take plaster. Provide a plastic grommet for door key access.

.9 Other access doors to be welded 12 gauge steel, flush type with concealed hinges, lock and anchor straps, complete with factory prime coat. Submit to Consultant for review, details of non-standard door construction details.

.10 Access doors in fire rated ceilings, walls, partitions, structures, etc., to be ULC listed and labelled and of a rating to maintain fire separation integrity.

.11 Where access doors are located in surfaces where special finishes are required, they are to be of a recessed door type capable of accepting finish in which they are to be installed so as to maintain final building surface appearance throughout.

.12 Manufacturers:

.1 SMS.

.2 Bauco.

.3 Acudor.

2.3 FLEXIBLE PIPING CONNECTORS

.1 Double wall stainless steel flexible connectors for piping connections to vibration isolated equipment, each selected by manufacturer to suit the application. Shop drawings or product data sheets must indicate construction and performance requirements that suit the application.

.2 Manufacturers:

.1 Hyspan Precision Products Inc.;

.2 Senior Flexonics Ltd.;

.3 The Metraflex Co.

PART 3 - EXECUTION

3.1 GENERAL PIPING AND DUCTWORK INSTALLATION REQUIREMENTS

.1 Unless otherwise specified, locate, and arrange horizontal pipes and ducts above or at ceiling on floors, arranged so that under consideration of all other work in area, maximum ceiling height and/or usable space is maintained. If required to maintain ceiling heights, reroute and/or resize ductwork, with Consultant’s approval.

.2 Unless otherwise specified, install work concealed in finished spaces, and concealed to degree possible in partially finished and unfinished spaces. Refer to and examine Architectural drawings and room finish schedules to determine finished, partially finished, and unfinished areas. Walls which are painted are considered finished.

.3 Install pipes and ducts parallel to building lines and to each other.

.4 Neatly group and arrange exposed work.

.5 Locate work to permit easy access for service or maintenance as required and/or applicable. Locate valves, dampers and any other equipment which will or may need maintenance or repairs and which are to be installed in accessible construction so as to be easily accessible from access doors. Where valves, dampers and similar piping or ductwork accessories occur in vertical services in shafts, pipe spaces or partitions, locate accessories at floor level.

.6 Make connections between pipes of different materials using adapters suitable for application. Provide cast brass dielectric type adapters/unions at connections between ferrous and copper pipe.

.7 Comply with equipment and material manufacturer's installation instructions unless otherwise specified herein or on drawings, and unless such instructions contradict governing codes and regulations.

.8 Carefully clean ducts, pipe and fittings prior to installation. Temporarily cap or plug ends of pipe, ducts and equipment which are open and exposed during construction.

.9 Install piping and ductwork which are to be insulated so that they have sufficient clearance to permit insulation and finish to be applied continuously and unbroken around pipe or duct, except for ductwork at fire barriers, in which case insulation will be terminated at each side of the duct fire damper.

.10 Inspect surfaces and structure prepared by other trades before performing work. Verify surfaces or structure to receive work has no defects or discrepancies which could result in poor application or cause latent defects in installation and workmanship. Report defects in writing. Installation of work will constitute acceptance of such surfaces as being satisfactory.

.11 Any ferrous piping that exhibits in excess of 5% surface rust, either inside or outside or both, is to be wire brush cleaned to bare metal and coated with suitable primer. Steel pipe, fittings and

accessories are to be free of corrosion and dirt when work is complete or prior to being concealed from view. Where dirt is evident, clean piping prior to being concealed.

.12 Provide continuous galvanized sheet metal drip pan under drain, water and water solution piping extending through rooms with electrical equipment such as electrical, elevator equipment and transformer rooms, and other spaces provided primarily for the installation of electrical equipment. Drip pans are to be complete with a drain pipe connection and drain piping is to be extended to closest drain.

.13 For factory applied finishes, repaint or refinish surfaces damaged during shipment and installation. Quality of repair work is to match original finish. This requirement also applies to galvanized finishes.

.14 Where mechanical work is located in high humidity areas where ferrous metal products will be subject to corrosion and protection for such products is not specified, provide finishes on products to protect against corrosion or provide products which will not corrode in the environment, i.e. aluminium ductwork, copper or stainless steel pipe, etc.

.15 Provide screwed unions or flanges in piping connections to equipment and in regular intervals in long (in excess of 12 m (40')) piping runs to permit removal of sections of piping.

.16 Unless otherwise specified and except where space limitations do not permit, piping elbows are to be long radius. Eccentric reducers are to be installed with straight side at top of piping.

3.2 PIPE JOINT REQUIREMENTS

.1 Do not make pipe joints in walls or slabs.

.2 Ream piping ends prior to making joints.

.3 Properly cut threads in screwed steel piping and coat male threads only with Teflon tape or paste, or an equivalent thread lubricant. After pipe has been screwed into fitting, valve, union, or piping accessory, not more than 2 pipe threads are to remain exposed.

.4 Site bevel steel pipe to be welded or supply mill bevelled pipe. Remove scale and oxide from bevels and leave smooth and clean. Use factory made welding tees or welding outlet fittings for piping branches off mains. Do not use shop or site fabricated fittings unless written approval has been obtained.

.5 Welded joints are to be made by CWB certified licensed journeyman welders qualified in accordance with CSA B51, Boiler Pressure Vessel and Pressure Piping Code, and who are in possession of a proper certificate of qualification for each procedure to be performed. Each weld is to be identified with the welder’s identification symbol, and welds are not to be concealed until they have been inspected and approved. Electrodes are to be in accordance with CSA W48 Series, Electrodes, and requirements of CAN/CSA W117.2, Safety in Welding, Cutting and Allied Processes are to be followed.

.6 Unless otherwise specified, make flanged joints with Garlock 5500 or equivalent gasket materials to suit the application, and bolts and nuts. Bolts are not to be longer than length necessary to screw nut up flush to the end of bolt. Bolts used for flanged connections in piping with a working pressure of 690 kPa (100 psi) and greater are to be ASTM A-193 Grade B-7, with heavy hexagon nuts to ASTM A-194 CL-2H. Provide suitable washers between each bolt head and flange and between each nut and flange.

.7 A random check of bolted flanged connections will be made to verify flanged connections are properly mated with no shear force acting on bolts. Supply labour to disconnect and reconnect selected flanged joints. If improperly mated joints are found, remove and reinstall affected piping so flanges mate properly. If improperly mated joints are found, additional joints will be checked, and you will be responsible for the repair of any other improper joints discovered.

.8 Unless otherwise specified make soldered joints in copper piping using flux suitable for and compatible with type of solder being used. Clean the outside of pipe end and inside of fitting, valve, or similar accessory prior to soldering.

.9 Install mechanical joint fittings and couplings in accordance with manufacturer's instructions.

.10 Grooves are to be rolled. Make arrangements with coupling and fitting manufacturer for shop and/or site instructions and demonstrations as required, and adhere to manufacturer's instructions with respect to pipe grooving, support, type of gasket required, anchoring and guiding the grooved piping system.

.11 If pressure crimped couplings and fittings are used, ensure gaskets are fully compatible with piping fluid, and valves and piping accessories are suitable. Use only fitting manufacturer supplied crimping equipment. Comply with manufacturer’s latest published specification, instructions, and recommendations with respect to pipe, coupling, and fitting preparation and installation, and support, anchoring and guiding of the piping system.

.12 Solvent weld PVC piping in 2 parts, primer stage and cementing stage, in accordance with manufacturer’s recommendations, ASTM D2855, and CSA requirements.

.13 Install PVC piping with gasketed joints in accordance with manufacturer’s current published specifications, instructions and recommendations, and CSA requirements.

3.3 DUCT OPENINGS

.1 Duct openings, air inlet and outlet openings, fire damper and similar openings will be provided in new poured concrete work, masonry, drywall and other building surfaces by trade responsible for particular construction in which opening is required.

.2 Size openings for fire dampers to suit damper arrangement with folding blade out of air stream.

.3 For duct openings except where fire dampers are required, pack and seal space between duct or duct insulation and duct opening as specified above for pipe openings in non-fire rated construction.

3.4 SLEEVE AND FORMED OPENING LOCATION DRAWINGS

.1 Prepare and submit for review, drawings indicating size and location of required sleeves, recesses and formed openings in poured or precast concrete work.

.2 Such drawings are to be completely and accurately dimensioned and relate sleeve, recesses, and formed openings to suitable grid lines and elevation datum, and are to take into account structural items such as grade beams, column caps, and column drop slabs.

.3 Begin to prepare such drawings immediately upon notification of acceptance of bid and award of Contract.

3.5 INSTALLATION OF PIPE ESCUTCHEON PLATES

.1 Provide escutcheon plates suitably secured over exposed piping passing through finished building surfaces. A finished building surface is any surface with a factory finish or that receives a site applied finish.

.2 Install plates so they are tight against building surface concerned, completely covering pipe sleeves and/or openings, except where waterproof sleeves extend above floors, in which case fit plate tightly around sleeve.

3.6 SUPPLY OF ACCESS DOORS

.1 Supply access doors to give access to mechanical work which may need maintenance or repair but which is concealed in inaccessible construction, except as otherwise specified herein or on drawings.

.2 Before commencing installation of mechanical work, coordinate with other trades and prepare on a set of reflected ceiling plans and wall elevations, complete layouts of access doors. Submit these layouts for Consultant's review and show exact sizes and locations of such access doors. Locate and arrange mechanical work to suit.

.3 Access doors will be installed by trade responsible for particular type of construction in which doors are required. Supply access doors to trade installing same at proper time.

.4 Wherever possible, access doors to be of a standard size for each application. Confirm exact dimensions and minimum size restrictions with the Consultant prior to ordering.

.5 Group piping and ductwork to ensure minimum number of access doors is required.

.6 Submit a sample of each proposed access door for review prior to ordering.

.7 Coordinate with Electrical Contractor and General Trades Contractor to ensure access doors on project are provided by a single manufacturer, installed as part of work of General Trades Contractor and work involving both mechanical and electrical services should, where possible, be accessible from common access door. Coordinate work to ensure common location access doors are not supplied by both Mechanical Divisions and Electrical Divisions.

3.7 INSTALLATION OF VALVES

.1 Generally, valve locations are indicated or specified on drawings or specified in Sections of the Specification where valves are specified, however, regardless of locations shown or specified, following requirements apply:

.1 provide shut-off valves to isolate systems, at base of vertical risers, in branch take-offs at mains and risers on floors, to isolate equipment, to permit work phasing as required, and wherever else required for proper system operation and maintenance;

.2 install shut-off valves with handles upright or horizontal, not inverted, and located for easy access;

.3 unless otherwise specified, provide a check valve in discharge piping of each pump;

.4 valve sizes are to be same as connecting pipe size;

.5 valves are to be permanently identified with size, manufacturer's name, valve model or figure number and pressure rating, and wherever possible, valves are to be product of same manufacturer;

.6 for valves in insulated piping, design of valve stem, handle and operating mechanism is to be such that insulation does not have to be cut or altered in any manner to permit valve operation.

3.8 FINISH PAINTING OF MECHANICAL WORK

.1 Finish paint exposed mechanical work as specified and/or scheduled in accordance with requirements of Division 09.

.2 Touch-up paint damaged factory applied finishes on mechanical work products.

3.9 PIPE LEAKAGE TESTING

.1 Before piping has been insulated or concealed, and before equipment, fixtures and fittings have been connected, test piping for leakage.

.2 Tests are to be witnessed by the Consultant and/or Owner's representative, and, where required, representatives of governing authorities. Give ample notice of tests in writing and verify attendance. Have completed test report sheets dated and signed by those present to confirm proper test results.

.3 When circumstances prevent scheduled tests from taking place, give immediate and adequate notice of cancellation to all who were scheduled to attend.

.4 Gravity Drainage and Vent Piping

.1 Test piping in accordance with local governing building code.

.2 After fixtures and fittings are set and pipes are connected to building drain or drains, turn on water into pipe, fixtures, fittings and traps in order to detect any imperfect material or workmanship. Perform a smoke test if required by local governing authorities.

.5 Pumped Drainage Piping

.1 Test piping with cold water at a pressure of 1-½ times normal working pressure and maintain pressure for a minimum of 2 hours.

.6 Domestic Water Piping

.1 Test piping with cold water at a pressure of 1-½ times normal working pressure and maintain pressure for a minimum of 2 hours.

.7 Sprinkler System Piping

.1 Test system piping in accordance with requirements of NFPA No. 13, "Installation of Sprinkler Systems", and in accordance with any additional requirements of governing authorities.

.8 Standpipe System Piping

.1 Test system piping in accordance with requirements of NFPA No. 14, "Standpipe and Hose Systems", and in accordance with any additional requirements of governing authorities.

.9 CO2 Fire Extinguishing System Piping

.1 Test system piping in accordance with requirements of NFPA No. 12, "Standard on Carbon Dioxide Extinguishing Systems", and in accordance with any additional requirements of governing authorities.

.10 Clean Agent Fire Extinguishing System Piping

.1 Test system piping in accordance with requirements of NFPA No. 2001, "Standard on Clean Agent Extinguishing Systems", and in accordance with any additional requirements of governing authorities.

.11 Heat Transfer (HVAC) System Piping

.1 Test piping with cold water at a pressure of 1035 kPa (150 psi) for a minimum of 2 hours.

.12 Steam and Condensate Piping

.1 Test piping with cold water for a minimum of 2 hours at following pressures:

.1 0 kPa to 105 kPa (0 psi to 15 psi) low pressure piping – 690 kPa (100 psi);

.2 110 kPa to 690 kPa (16 psi to 100 psi) medium pressure piping – 1035 kPa (150 psi);

.3 greater than 690 kPa (100 psi) high pressure piping – 1380 kPa (200 psi).

.13 Natural Gas Piping

.1 Test piping in accordance with requirements of CAN/CSA B149.1 and any additional requirements of local governing authorities.

.2 After completion of the verification test, locate required tag stating results of the verification test at the point of entry of gas main into building, affixed to the pipe in a secure manner.

.3 Check piping joints and connections for leaks with a water/soap solution while piping is under pressure.

.14 Propane Gas Piping

.1 Test piping in accordance with requirements of CAN/CSA B149.2 and any additional requirements of local governing authorities.

.2 After completion of the verification test, locate required tag stating results of the verification test at the point of entry of gas main into building, affixed to the pipe in a secure manner.

.3 Check piping joints and connections for leaks with a water/soap solution while piping is under pressure.

.15 Compressed Air Piping

.1 Test piping with dry compressed air or nitrogen at 690 kPa (100 psi) for a minimum of 2 hours.

.2 Test piping joints with a water-soap solution while piping is under pressure to detect leaks.

.16 Fuel Oil Piping

.1 Test piping (not tanks) with dry compressed air or nitrogen for a minimum period of 2 hours at 1035 kPa (150 psi).

.2 Check piping joints and connections for leaks with a water/soap solution while piping is under pressure.

.17 Gasoline Piping

.1 Test piping (not tanks) with dry compressed air or nitrogen for a minimum period of 2 hours at 1035 kPa (150 psi) in accordance with TSSA requirements.

.2 Check piping joints and connections for leaks with a water/soap solution while piping is under pressure.

.18 Refrigerant Piping

.1 Test refrigerant piping for leakage and dehydrate in accordance with requirements of Chapter 18 of ASHRAE Handbook - Fundamentals.

.19 Control Air Piping and Tubing

.1 Test control air piping and tubing with dry compressed air or nitrogen before concealing and again before connection of instruments.

.2 Rough-in test pressure is to be 345 kPa (50 psi) maintained over 24 hours with a pressure drop not to exceed 35 kPa (5 psi).

.3 Test joints for leaks with a soap solution.

.4 Finish test is to be 205 kPa (30 psi) with a permissible loss of 7 kPa (1 psi) over a 4 hour period. Prior to connecting instruments, blow systems clean and dry, and test component connections for leaks with a water/soap solution.

.20 Pure Water Piping

.1 When piping has been properly flushed and cleaned, test at 690 kPa (100 psi) for 2 hours with only distilled water or filtered dry compressed air. If distilled water is used, drain system when testing is complete.

.21 Following requirements apply to all testing:

.1 ensure piping has been properly flushed, cleaned and is clear of foreign matter prior to pressure testing;

.2 temporarily remove or valve off piping system specialties or equipment which may be damaged by test pressures prior to pressure testing systems, and flush piping to remove foreign matter;

.3 when testing is carried out below highest level of the particular system, increase test pressure by the hydrostatic head of 7 kPa (1 psi) for every 600 mm (24") below the high point;

.4 include for temporary piping connections required to properly complete tests;

.5 piping under test pressure is to have zero pressure drop for length of test period;

.6 tighten leaks found during tests while piping is under pressure. If this is impossible, remove and refit piping and reapply test until satisfactory results are obtained;

.7 where leaks occur in threaded joints in steel piping, no caulking of these joints will be allowed under any conditions;

.8 tests are to be done in reasonably sized sections so as to minimize number of tests required;

.9 in addition to leakage tests specified above, demonstrate proper flow throughout systems including mains, connections and equipment, as well as proper venting and drainage, and include for any necessary system adjustments to achieve proper conditions.

3.10 INTERRUPTION TO AND SHUT-DOWN OF MECHANICAL SERVICES AND SYSTEMS

.1 Coordinate shut-down and interruption to existing mechanical systems with Owner. Generally, shut-downs may be performed only between the hours of 12:00 midnight Friday until 6:00 a.m. Monday morning, unless otherwise specified in Division 01. Include for costs of premium time to perform work during nights, weekends or other times outside of normal working hours, which may be necessary to comply with stipulations specified herein this Article. Services for operation of existing non-renovated areas of building are to be maintained.

.2 Upon award of a Contract, submit a list of anticipated shut-down times and their maximum duration.

.3 Prior to each shut-down or interruption, inform Owner and the Consultant in writing 5 working days in advance of proposed shut-down or interruption and obtain written consent to proceed. Do not shut-down or interrupt any system or service without such written consent. Shutdowns of some essential services may require additional advance notification time.

.4 Perform work associated with shut-downs and interruptions as continuous operations to minimize shut-down time and to reinstate systems as soon as possible, and, prior to any shut-down, ensure materials and labour required to complete the work for which shut-down is required are available at site.

.5 Pipe freezing shall be used to connect new piping to existing piping. Alternative methods may be proposed, if site conditions are evaluated and permit, and are approved by the Consultant.

.6 Where existing isolation valves do not hold, pipe freezing shall be used to connect new piping to existing piping.

3.11 MECHANICAL SERVICE REQUIREMENTS FOR FLOATING FLOOR SLABS

.1 Where mechanical services are required to be installed in or through a vibration isolated floating slab, install such services so as not to transmit any vibration to base slab on which floating floor slab is placed.

.2 Wherever possible, arrange mechanical work to avoid penetrating a floating floor slab.

3.12 EXCAVATION AND BACKFILL WORK

.1 Unless otherwise specified in Division 31, provide all excavation and backfill associated with the mechanical scope of work.

.2 Before commencement of excavation for work, determine in consultation with Consultant, Owner, Municipality and utilities, presence, if any, of existing underground services at site. Engage local utilities to locate and mark out such services. Ensure trades concerned are aware of their presence.

.3 Be responsible for any damage done to underground services caused by neglect to determine and mark out location of such services prior to excavation work commences.

.4 Where Work falls under jurisdiction of local governing utility, confirm requirements and comply with utility requirements.

.5 Unless otherwise specified in Division 31, provide excavation, backfill and related work required for mechanical work. Obtain a copy of soil test report if available from the Consultant. Depth of excavations must accommodate local governing requirements and local standard practices to compensate for local frost levels of Place of the Work.

.6 Inverts and locations of existing site services may have been site surveyed and approximate location may be shown on drawings. Confirm inverts and locations are correct, prior to commencing excavation and contact Utilities to accurately locate their services. Where discrepancies are found, immediately inform Consultant, and await a direction. Grade bottom of trench excavations as required.

.7 In firm, undisturbed soil, lay pipes directly on soil, unless otherwise directed.

.8 Before backfilling, arrange for inspection of work by the Consultant. Do not backfill work unless reviewed with the Consultant. Failure to do so prior to backfilling will require re-excavating work and re-backfill at no additional cost to Owner.

.9 Unless otherwise specified, backfill trenches within building with clean sharp sand in individual layers of maximum 150 mm (6”) thickness compacted to a density of 100% Standard Proctor. Hand compact first layers up to a compacted level of minimum 300 mm (12") above top of pipe. Hand or machine compact the balance up to grade.

.10 Unless otherwise specified, backfill trenches outside the building (not under roads, parking lots or traffic areas), up to a compacted level of 450 mm (18") thick above the pipe, hand compacted to a density of 95% Standard Proctor, using granular "A" gravel. Backfill the balance in 150 mm (6") layers with approved excavated material, compacted to 95% Standard Proctor density.

.11 Unless otherwise specified, backfill trenches outside building under roads, parking lots or traffic areas with crushed stone or granular "A" gravel in layers not exceeding 150 mm (6") thickness, compacted to 100% Standard Proctor density up to grade level.

.12 Provide minimum 1.37 m (4.5') of cover for underground piping subject to freezing and located outside building.

.13 Provide minimum 450 mm (18") of cover for underground piping subject to freezing and located inside building.

.14 After first lift of backfill has been compacted, mark entire path of pipe using continuous 75 mm (3") wide detectable identified marking tape equal to SMS Ltd. D-UGMT.

.15 Unless otherwise directed in Division 02 and/or Division 31, store and dispose of excavated materials as follows:

.1 during progress of contract, place material as directed in such a manner to minimize damage or disfigurement of ground and which in no way impedes progress of work;

.2 separately place surplus topsoil and subsoil as directed; leave site clean and unencumbered.

.16 Perform pumping as required to keep excavations free of water.

.17 Engage services of independent soils testing agency to test final backfill compaction density of each backfilled location. Compact backfill to satisfaction of testing agency and in accordance with Specification. Submit a copy of testing agency's report to the Consultant for review.

.18 Fill depressions to correct grade level with appropriate material, after an adequate period has passed to reveal any settlement. Use maximum possible compaction. Pay costs required to make good damages caused by settlement.

.19 Coordinate requirements for final surface toppings (concrete, asphalt, pavers, grass sod, etc.) with General Contractor.

3.13 CUTTING, PATCHING AND CORE DRILLING

.1 Unless otherwise provided by General Trades, perform cutting, patching, and core drilling of existing building required for installation of mechanical work. Perform cutting in a neat and true fashion, with proper tools and equipment to Consultant’s approval. Patching is to exactly match existing finishes and be performed by tradesmen skilled in particular trade or application. Work is subject to review and acceptance by the Consultant.

.2 Criteria for cutting holes for additional services:

- .1 cut holes through slabs only; no holes to be cut through beams;
- .2 cut holes 150 mm (6") diameter or smaller only; obtain approval from Structural Consultant for larger holes;
- .3 keep at least 100 mm (4") clear from beam faces;
- .4 space at least 3 hole diameters on centre;
- .5 for holes that are required closer than 25% of slab span from supporting beam face, use cover meter above slab to clear slab top bars;
- .6 for holes that are required within 50% of slab span, use cover meter underside of slab to clear slab bottom bars;
- .7 submit sleeving drawings indicating holes and their locations for Structural Consultant's review.

.3 Do not cut or drill any existing work without approval from Owner and Consultant. Be responsible for damage done to building and services caused by cutting or drilling.

.4 Where pipes pass through existing construction, core drill an opening. Size openings to leave 12 mm (½") clearance around pipes or pipe insulation.

.5 Prior to drilling or cutting an opening, determine, in consultation with Consultant and Owner, and by use of non-destructive radar scan (magnetic scan) of slab or wall, presence of any existing services and reinforcement bars concealed behind building surface to be cut and locate openings to suit. Coring is not permitted through concrete beams or girders.

.6 Where drilling is required in waterproof slabs, size opening to permit snug and tight installation of a pipe sleeve sized to leave 12 mm (½") clearance around pipe or pipe insulation. Provide a pipe sleeve, constructed of Schedule 40 galvanized steel pipe with a flange at one end and of a length to extend 100 mm (4") above slab, in opening. Secure flange to the underside of slab and caulk void between sleeve and slab opening with proper non-hardening silicone base caulking compound to produce a water-tight installation.

.7 Firestop and seal openings in fire rated construction. Do not leave openings open overnight unless approved by Owner and Consultant.

.8 Ensure openings in fire rated construction are fire stopped and sealed in accordance with requirements of article entitled Firestopping and Smoke Seal Materials in this Section. Ensure openings are not left open overnight unless approved by Owner and Consultant.

3.14 PACKING AND SEALING CORE DRILLED PIPE OPENINGS

.1 Pack and seal void between pipe opening and pipe or pipe insulation for length of opening as follows:

.1 non-fire rated interior construction – pack with mineral wool and seal both ends of opening with non-hardening silicone base caulking compound to produce a water-tight seal;

.2 exterior walls above grade – pack with mineral wool and seal both ends of sleeves water-tight with non-hardening silicone base caulking compound unless mechanical type seals have been specified;

.3 exterior walls below grade (and any other wall where water leakage may be a problem) – seal with link type mechanical seals as specified.

3.15 FLASHING FOR MECHANICAL WORK PENETRATING ROOF

.1 Unless otherwise specified in Division 07, perform required flashing work, including counter-flashing, for mechanical work penetrating and/or set in roof.

.2 Perform flashing work in accordance with requirements of drawing details and/or requirements specified in Division 07.

3.16 CLEANING MECHANICAL WORK

.1 Refer to cleaning requirements specified in Division 01.

.2 Clean mechanical work prior to application for Substantial Performance of the Work.

.3 Include for vacuum cleaning interior of air handling units and ductwork systems.

3.17 CONNECTIONS TO OTHER EQUIPMENT

.1 Carefully examine Contract Documents during bidding period and include for mechanical work piping and/or ductwork connections to equipment requiring such connections.

3.18 SEISMIC RESTRAINT ANCHOR POINTS FOR EQUIPMENT

.1 Where mechanical equipment requires seismic restraint, it is to be complete with manufacturer designed and rated seismic restraint anchor points and attachments, certified by equipment manufacturers, so equipment may be bolted down or restrained in the field.

.2 Equipment to be restrained must be designed such that the strength and anchorage of its internal components exceed force level; used to restrain and anchor the equipment to the supporting structure.

3.19 INSTALLATION OF FLEXIBLE CONNECTORS

.1 Provide flexible connectors in piping connections to seismically restrained equipment, where applicable, and wherever else shown.

.2 Provide flexible connectors in piping connections to vibration isolated equipment.

3.20 FAN NOISE LEVELS

.1 Submit sound power levels with fan shop drawings/product data, with levels measured to AMCA 300 and calculated to AMCA 301.

3.21 EQUIPMENT AND SYSTEM MANUFACTURER'S CERTIFICATION

.1 When equipment/system installation is complete, but prior to start-up procedures, arrange and pay for equipment/system manufacturer's authorized representative to visit site to examine installation, and after any required corrective measures have been made, to certify in writing to the Consultant that equipment/system installation is complete and in accordance with equipment/system manufacturer's instructions.

3.22 SYSTEM STARTUP

.1 When installation of equipment/systems is complete but prior to commissioning, perform start-up for equipment/systems as specified in mechanical work Sections in accordance with following requirements:

.1 Submit a copy of each equipment/system manufacturer's start-up report sheet to the Consultant for review, and incorporate any comments made by the Consultant.

.2 Under direct on-site supervision and involvement of equipment/system manufacturer's representative, start-up equipment/systems, make any required adjustments, document procedures, leave equipment/systems in proper operating condition, and submit to the Consultant complete set of start-up documentation sheets signed by manufacturer/supplier and Contractor.

.3 Commission interconnected life safety systems in accordance with CAN/ULC-S1001-11 and provide written report for Consultant's review.

END OF SECTION

PART 1 - GENERAL

1.1 PRE-TENDERED MECHANICAL EQUIPMENT

.1 Refer to Appendix for complete information regarding scope of work for pre-tendered equipment. Equipment has been pre-tendered, ordered, and paid for by the Owner. Associated work to be included as part of Work of Mechanical Division of this Project, that is to include for, but not be limited to, provision of following:

- .1 coordination with respective equipment manufacturers with regards to delivery, unloading and acceptance on site;
- .2 inspection upon delivery and acceptance;
- .3 unloading, transporting and moving/hoisting into installation position;
- .4 installation, connection, testing, and certification.

.2 Pre-tendered equipment includes following:

- .1 [ ];
- .2 [ ].

.3 Take over order and coordinate with various manufacturers/suppliers of pre-ordered equipment and associated Work. During inspection of pre-ordered equipment and associated components at site, report deficiencies to respective supplier and to the Owner and be responsible for resolving such deficiencies directly with respective supplier(s).

.4 Be available for and attend factory testing at supplier's offices of pre-ordered equipment and associated Work, as requested by the Consultant.

.5 Coordinate final installation requirements with manufacturers/suppliers of pre-ordered equipment and associated Work.

.6 For reference purposes, copy of shop drawing may be obtained from the Consultant after order has been made.

.7 Review installation schematics and diagrams, control system schematics, and wiring diagrams supplied by manufacturers/suppliers of pre-ordered equipment and associated Work. Coordinate interconnections with related various building systems.

.8 Refer also to Appendix for further details and requirements of pre-tendered equipment. Be responsible for review of issued documents and request further information from the Consultant, if required. Include and incorporate required provisions and associated costs required for a complete installation.

.9 Review and coordinate with each respective vendor of pre-tendered equipment the exact equipment and accessories that are being supplied and/or installed, and services being performed by pre-tendered equipment vendor. With each respective pre-tender equipment vendor, determine installation products and services which are not included as part of pre-tender packages, but which need to be supplied by respective pre-tender equipment vendor in order to complete onsite installation, and include for all costs associated with the above.

.10 Obtain following from suppliers of per-tendered equipment and submit to Owner:

- .1 operating and maintenance materials, testing and commissioning reports, and inspection certificates/ULC approvals/local governing inspection authority approvals, warrantees and other supplied documents; organize and combine documents into manuals as specified in Division 01 and/or Division 20;
- .2 spare parts, maintenance tools and kits, and loose accessories.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 PRE-TENDERED MECHANICAL EQUIPMENT

.1 Refer to respective equipment Section - Part 3 for additional installation requirements.

.2 Install equipment in accordance with drawing notes, specifications, and manufacturer's instructions and to comply with Owner's on-site standards and regulations.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 This Section specifies requirements that are common to Mechanical Divisions work Sections and it is a supplement to each Section and is to be read accordingly. Where requirements of this Section contradict requirements of Division 00 or Division 01, conditions of Division 00 or Division 01 to take precedence.

.2 Be responsible for advising product vendors of requirements of this Section.

1.2 RELATED REQUIREMENTS

.1 Division 00 and Division 01 apply to and are a part of this Section.

1.3 DEFINITIONS

.1 "concealed" – means hidden from normal sight in furred spaces, shafts, ceiling spaces, walls and partitions.

.2 "exposed" – means work normally visible, including work in equipment rooms, service tunnels, and similar spaces.

.3 "finished" - means when in description of any area or part of an area or a product which receives a finish such as paint, or in case of a product may be factory finished.

.4 “provision” or "provide" (and tenses of "provide") – means supply and install complete.

.5 "install" (and tenses of "install") – means secure in position, connect complete, test, adjust, verify, and certify.

.6 "supply" – means to procure, arrange for delivery to site, inspect, accept delivery, and administer supply of products; distribute to areas; and include manufacturer’s supply of any special materials, standard on site testing, initial start-up, programming, basic commissioning, warranties, and manufacturers’ assistance to Contractor.

.7 "delete" or "remove" (and tenses of "delete" or “remove”) – means to disconnect, make safe, and remove obsolete materials; patch and repair/finish surfaces to match adjoining similar construction; include for associated re-programming of systems and/or change of documentation identifications to suit deletions, and properly dispose of deleted products off site unless otherwise instructed by Owner and reviewed with the Consultant.

.8 "BAS" – means building automation system; "BMS" – means building management system; "FMS" – means facility management system; and “DDC” means direct digital controls; references to "BAS", "BMS", "FMS" and “DDC” generally mean same.

.9 "governing authority" and/or "authority having jurisdiction" and/or "regulatory authority" and/or "Municipal authority" – means government departments, agencies, standards, rules and regulations that apply to and govern work and to which work must adhere.

.10 "OSHA" and "OHSA" – stands for Occupational Safety and Health Administration and Occupational Health and Safety Act, and wherever either one is used, they are to be read to mean local governing occupational health and safety regulations that apply to and govern work and to which work must adhere, regardless if Project falls within either authority's jurisdiction.

.11 "Mechanical Divisions" – refers to Division 20, Division 21, Division 22, Division 23, Division 25, and other Divisions as specifically noted, and which work as defined in Specifications and/or on drawings is responsibility of Mechanical Contractor, unless otherwise noted.

.12 "Electrical Divisions" – refers to Division 26, Division 27, Division 28, and other Divisions as specifically noted, and which work as defined in Specifications and/or on drawings is responsibility of Electrical Contractor, unless otherwise noted.

.13 "Consultant" – means person, firm or corporation identified as such in Agreement or Documents, and is licensed to practice in Place of the Work, and has been appointed by Owner to act for Owner in a professional capacity in relation to the Work.

.14 Wherever words "indicated", "shown", "noted", "listed", or similar words or phrases are used in Contract Documents they are understood, unless otherwise defined, to mean product referred to is "indicated", "shown", "listed", or "noted" on Contract Documents.

.15 Wherever words "reviewed", "satisfactory", "as directed", "submit", or similar words or phrases are used in Contract Documents they are understood, unless otherwise defined, to mean that work or product referred to is "reviewed by", "to the satisfaction of", "submitted to", etc., Consultant.

1.4 DOCUMENTS

.1 Documents for bidding include but are not limited to issued Drawings, Specifications and Addenda.

.2 Specification is arranged in accordance with CSI/CSC 49 Divisions of MasterFormat.

.3 Drawings and Specifications are portions of Contract Documents and identify labour, products and services necessary for performance of work and form a basis for determining pricing. They are intended to be cooperative. Perform work that is shown, specified, or reasonably implied on the drawings but not mentioned in Specification, or vice-versa, as though fully covered by both.

.4 Review Drawings and Specifications in conjunction with documents of other Divisions and, where applicable, Code Consultant’s report.

.5 Unless otherwise specifically noted in Specifications and/or on Drawings, Sections of Mechanical Divisions are not intended to delegate functions nor to delegate work and supply of materials to any specific trade, but rather to generally designate a basic unit of work, and Sections are to be read as a whole.

.6 Drawings are performance drawings, diagrammatic, and show approximate locations of equipment and connecting services. Any information regarding accurate measurement of building is to be taken on site. Do not scale Drawings, and do not use Drawings for prefabrication work.

.7 Drawings are intended to convey the scope of work and do not show architectural and structural details. Provide, at your cost, offsets, fittings, transformations and similar products required as a result of obstructions and other architectural and/or structural details but not shown on Drawings.

.8 Locations of equipment and materials shown may be altered, when reviewed by the Consultant, to meet requirements of equipment and/or materials, other equipment or systems being installed, and of building, all at no additional cost to Contract.

.9 Specification does not generally indicate specific number of items or amounts of material required. Specification is intended to provide product data and installation requirements. Refer to schedules, Drawings (layouts, riser diagrams, schematics, details) and Specification to provide correct quantities. Singular may be read as plural and vice versa.

.10 Starter/motor control centre (MCC)/variable frequency drive (VFD) schedule drawings are both mechanical and electrical, and apply to work of Mechanical Divisions and Electrical Divisions. Be responsible for reviewing starter, MCC, VFD, and motor specification requirements prior to Bid submission. Confirm and coordinate exact scope of work and responsibility of work between Mechanical Divisions and Electrical Divisions.

.11 Drawings and Specifications have been prepared solely for use by party with whom Consultant has entered into a contract and there are no representations of any kind made by the Consultant to any other party.

.12 In the case of discrepancies between the drawings and specifications, documents will govern in order specified in “General Conditions”, however, when scale and date of drawings are same, or where discrepancy exists within specification, most costly arrangement will take precedence.

1.5 METRIC AND IMPERIAL MEASUREMENTS

.1 Generally, both metric and imperial units of measurement are given in Sections of Specification governed by this section. Measurement conversions may be generally "soft" and rounded off. Confirm exact measurements based on application. Where measurements are related to installation and onsite applications, confirm issued document measurements with applicable local code requirements, and/or as applicable, make accurate measurements onsite. Where significant discrepancies are found, immediately notify Consultant for direction.

1.6 EXAMINATION OF DOCUMENTS AND SITE

.1 Carefully examine Documents and visit site to determine and review existing site conditions that will or may affect work, and include for such conditions in Bid Price.

.2 Report to Consultant, prior to Bid Submittal, any existing site condition that will or may affect performance of work as per Documents. Failure to do so will not be grounds for additional costs.

.3 Upon finding discrepancies in, or omissions from Documents, or having doubt as to their meaning or intent, immediately notify Consultant, in writing.

1.7 WORK STANDARDS

.1 Where any code, regulation, bylaw, standard, contract form, manual, printed instruction, and installation and application instruction is quoted it means, unless otherwise specifically noted, latest published edition at time of submission of Bids adopted by and enforced by local governing authorities having jurisdiction. Include for compliance with revisions, bulletins, supplementary standards or amendments issued by local governing authorities.

.2 Where regulatory codes, standards and regulations are at variance with Drawings and Specification, more stringent requirement will apply unless otherwise directed by Owner and reviewed with the Consultant.

.3 Supplementary mandatory specification and requirements to be used in conjunction with project include but are not limited to following:

.1 Air-Conditioning, Heating and Refrigeration Institute (AHRI);

.2 Air Movement and Control Association (AMCA);

.3 American Iron and Steel Institute (AISI);

.4 American National Standards Institute (ANSI);

.5 American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc., (ASHRAE);

.6 American Society of Mechanical Engineers (ASME);

.7 American Society of Testing and Materials (ASTM);

.8 American Water Works Association (AWWA);

.9 Associated Air Balance Council (AABC);

.10 Building Industry Consulting Services, International (BICSI);

.11 Canadian Gas Association (CGA);

.12 Canadian General Standards Board (CGSB);

.13 Canadian Standards Association (CSA);

.14 Electrical and Electronic Manufacturers Association of Canada (EEMAC);

.15 Electrical Safety Authority (ESA);

.16 Electronic Industries Association (EIA);

.17 Factory Mutual Systems (FM);

.18 Illuminating Engineering Society (IES);

.19 Institute of Electrical and Electronic Engineers (IEEE);

.20 International Standards Organization (ISO);

.21 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS);

.22 National Building Code of Canada (NBC);

.23 National Electrical Manufacturers Association (NEMA);

.24 National Environmental Balancing Bureau (NEBB);

.25 National Fire Protection Association (NFPA);

.26 National Standards of Canada;

.27 NSF International;

.28 Occupational Health and Safety Act (OHSA);

.29 Ontario Building Code (OBC);

.30 Ontario Electrical Safety Code (OESC);

.31 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA);

.32 Technical Standards and Safety Authority (TSSA);

.33 Thermal Insulation Association of Canada (TIAC);

.34 Underwriters' Laboratories of Canada (ULC);

.35 Workplace Hazardous Materials Information System (WHMIS);

.36 Material Safety Data Sheets by product manufacturers;

.37 Local utility inspection permits;

.38 Codes, standards, and regulations of local governing authorities having jurisdiction;

.39 Additional codes and standards listed in Trade Sections;

.40 Owner's standards.

.4 Provide applicable requirements for barrier free access in accordance with latest edition of local governing building code.

.5 Where any governing Code, Regulation, or Standard requires preparation and submission of special details or drawings for review they are to be prepared and submitted to appropriate authorities. Be responsible for costs associated with these submittals.

.6 Unless otherwise specified, install equipment in accordance with equipment manufacturer's recommendations and instructions, and requirements of governing Codes, Standards, and Regulations. Governing Codes, Standards, and Regulations take precedence over manufacturer's instructions.

.7 Work is to be performed by journeyperson tradesmen who perform only work that their certificates permit, or by apprentice tradesmen under direct on site supervision of experienced journeyperson tradesman. Journeyperson to apprentice ratio is not to exceed ratio determined by the Board as

stated in Ontario College of Trades and Apprenticeship Act or local equivalent governing body in Place of the Work.

.8 Journeyperson tradesmen are to have a copy of valid trade certificates available at site for review with the Consultant at any time.

.9 Experienced and qualified superintendent is to be on-site at times when work is being performed.

.10 Coordinate work inspection reviews and approvals with governing inspection department to ensure that construction schedule is not delayed. Be responsible for prompt notification of deficiencies to the Consultant and submission of reports and certificates to the Consultant.

.11 Properly protect equipment and materials on site from damage due to elements and work of trades, to satisfaction of Owner and reviewed with the Consultant. Equipment and materials are to be in new condition upon Substantial Performance of the Work.

.12 Mechanical piping system work, including equipment, must comply in all respects with requirements of local technical standards authorities and CSA B51, Boiler, Pressure Vessels and Pressure Piping Code. Where required, mechanical work products must bear a CRN number.

.13 Electrical items associated with mechanical equipment are to be certified and bear stamp or seal of a recognized testing agency such as CSA, UL, ULC, ETL, etc., or bear a stamp to indicate special electrical utility approval.

1.8 PERMITS, CERTIFICATES, APPROVALS, AND FEES

.1 Contact and confirm with local authorities having jurisdiction including utility providers, requirements for approvals from such authorities. Obtain and pay for permits, certificates, and approvals required to complete Work.

.2 Be responsible for ensuring that authorities having jurisdiction which require on-site inspection of work, have ample notification to perform inspection, with sufficient lead time to correct deficiencies in a manner that will not impede schedule of completion of Work. If any defect, deficiency or non-compliant is found in work by inspection, be responsible for costs of such inspection, including any related expenses, making good and return to site, until work is passed by governing authorities.

.3 Obtain and submit to Consultant, approval/inspection certificates issued by governing authorities to confirm that Work as installed is in accordance with rules and regulations of local governing authorities and are acceptable.

.4 Include in each copy of operating and maintenance instruction manuals, copies of approvals and inspection certificates issued by regulatory authorities.

1.9 REQUIREMENTS FOR CONTRACTOR RETAINED ENGINEERS

.1 Professional engineers retained to perform consulting services with regard to Project work, i.e. seismic engineer, fire protection engineer or structural engineer, are to be members in good standing with local Association of Professional Engineers, and are to carry and pay for errors and omissions professional liability insurance in compliance with requirements of governing authorities in Place of the Work.

.2 Retained engineer’s professional liability insurance is to protect Contractor's consultants and their respective servants, agents, and employees against any loss or damage resulting from professional services rendered by aforementioned consultants and their respective servants, agents, and employees in regards to the Work of this Contract.

.3 Unless otherwise specified in Division 00 or Division 01, liability insurance requirements are as follows:

.1 coverage is to be a minimum of $1,000,000.00 CDN inclusive of any one occurrence;

.2 insurance policy is not to be cancelled or changed in any way without insurer giving Owner minimum thirty days written notice;

.3 liability insurance is to be obtained from an insurer registered and licensed to underwrite such insurance in the Place of the Work;

.4 retained consultants are to ascertain that sub-consultants employed by them carry insurance in the form and limits specified above;

.5 evidence of the required liability insurance in such form as may be required is to be issued to Owner, Owner's Consultant, and Municipal Authorities as required prior to commencement of aforementioned consultant's services.

1.10 WORKPLACE SAFETY

.1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials. Submit WHMIS MSDS (Material Safety Data Sheets) for products where required, and maintain one copy at site in a visible and accessible location available to personnel.

.2 Comply with requirements of Occupational Health and Safety Act and other regulations pertaining to health and safety, including worker's compensation/insurance board and fall protection regulations. When working in confined spaces, comply with requirements of Occupational Health and Safety Act - Ontario Regulation 632, "Confined Spaces" and any other applicable Ministry of Labour requirements.

.3 If at any time during course of work, hazardous materials other than those identified in Documents and pertaining to Project Scope of Work, are encountered, or suspected that were not identified as being present and which specific instructions in handling of such materials were not given, cease work in area in question and immediately notify Consultant. Comply with local governing regulations with regards to working in areas suspected of containing hazardous materials. Do not resume work in affected area without approval from Owner and reviewed with the Consultant.

1.11 PLANNING AND LAYOUT OF WORK

.1 Base installation layout, design, terminations, and supply of accessories, on Contract Documents with specific coordination with reviewed shop drawings.

.2 Plan, coordinate, and establish exact locations and routing of services with affected trades prior to installation such that services clear each other as well as other obstructions. Generally, order of right of way for services to be as follows:

.1 piping requiring uniform pitch;

.2 piping 100 mm (4") dia. and larger;

.3 large ducts (main runs);

.4 cable tray and bus duct;

.5 conduit 100 mm (4") dia. and larger;

.6 piping less than 100 mm (4") dia.;

.7 smaller branch ductwork;

.8 conduit less than 100 mm (4") dia.

.3 Unless otherwise shown or specified, conceal work in finished areas, and conceal work in partially finished and/or unfinished areas to extent made possible by the area construction. Install services as high as possible to conserve headroom and/or ceiling space. Notify Consultant where headroom or ceiling space appears to be inadequate prior to installation of work.

.4 Do not use Contract Drawing measurements for prefabrication and layout of piping, sheet metal work and such other work. Locations and routing are to generally be in accordance with Contract Drawings, however, prepare layout drawings for such work. Use established bench marks for both horizontal and vertical measurements. Confirm inverts, coordinate with and make allowances for work of other trades. Accurately layout work, and be entirely responsible for work installed in accordance with layout drawings. Where any invert, grade, or size is at variance with Contract Drawings, notify Consultant prior to proceeding with work.

.5 Prepare plan and interference drawings (at a minimum drawing scale of 1:50 or ¼"=1' 0") of work for coordination with each trade Contractor. Arrange for preparation of detailed section drawings of ceiling spaces of corridors and any other congested areas. Sections are to be cross referenced with plan drawings so that trades may make use of section drawings. Section drawings to indicate lateral and elevation dimensions of major services within ceiling space. Lateral dimensions are to be from grid lines and elevations from top of floor slab. Obtain from Consultant, engineering drawings for this use. Contractors' interference drawings are to be distributed among other Trade Contractors. Submit drawings to the Consultant for review. Failure of General Contractor to prepare and coordinate overall interface drawings of trades does not relieve respective Division Contractor of responsibility to ensure that work is properly planned and coordinated.

.6 Carry out alterations in arrangement of work that has been installed without proper coordination, study, and review, even if in accordance with Contract Documents, in order to conceal work behind finishes, or to allow installation of other work, without additional cost. In addition, make necessary alterations in other work required by such alterations, without additional cost.

.7 Shut-off valves, balancing devices, air vents, equipment, and similar products, particularly such products located above suspended ceilings must be located for easy access for servicing and/or removal. Products which do not meet this location requirement are to be relocated to an accessible location at no additional cost.

.8 Be responsible for making necessary changes, at no additional cost, to accommodate structural and building conditions that were missed due to lack of coordination.

1.12 SCHEDULING

.1 Include for any and all scheduling, coordination, and construction phasing to suit project, specified in Division 01 and/or as indicated on the drawings. Review exact phasing requirements with Consultant prior to start of Work.

.2 [Phasing and scheduling of Work is required in order to maintain existing building operations. Include costs (including costs for "off hours" work) for scheduling, co-ordination, and construction phasing to suit this project as specified in Division 01 and on drawings. Review phasing requirements with the Consultant prior to start of Work.]

.3 [Protect existing areas above, below, and adjacent areas of Work from any debris, noise, or interruptions to existing services to satisfaction of Owner and reviewed with the Consultant. Maintain in operation existing services to these areas to allow Owner to continue use of these areas. If services that are required to be maintained run through areas of renovations, provide necessary protection to services or reroute, in coordination with Owner and Consultant. Include for required premium time work to meet these requirements.]

.4 [Work being performed within occupied spaces and work affecting surfaces adjacent to occupied spaces may need to be performed after regular business hours. For areas where spaces are used by Owner on a 24 hours basis or over various hours, coordinate hours of work with Owner on a regular basis to suit Owner's schedule. Execute work at times confirmed with and agreed to by Owner and reviewed with the Consultant, so as not to inconvenience Owner's occupation or in any way hinder Owner's use of building. Include for required premium timework to meet these requirements.]

.5 Project partial occupancy permits may be required throughout project. Provide for each partial permit, required local governing authority certificate and any other testing/verification certificates for systems.

1.13 COORDINATION

.1 Review Contract Documents and coordinate work with work of each trade. Coordination requirements are to include but not be limited to following:

.1 requirements for openings, sleeves, inserts and other hardware necessary for installation of work;

.2 concrete work such as housekeeping pads, sumps, bases, etc., required for work, and including required dimensions, operating weight of equipment, location, etc.;

.3 depth and routing of excavation required for work, and requirements for bedding and backfill;

.4 wiring work required for equipment and systems but not specified to be done as part of mechanical work, including termination points, wiring type and size, and any other requirements.

.2 Ensure materials and equipment are delivered to site at proper time and in such assemblies and sizes so as to enter into building and be moved into spaces where they are to be located without difficulty.

.3 Wherever possible, coordinate equipment deliveries with manufacturers and/or suppliers so equipment is delivered to site when it is required, or so it can be stored within building, subject to available space as confirmed with Owner and reviewed with Owner, and protected from elements.

.4 Ensure proper access and service clearances are maintained around equipment, and, where applicable, access space for future equipment removal or replacement is not impeded. Comply with code requirements with regards to access space provision around equipment. Remove and replace any equipment which does not meet this requirement.

.5 Where work is to be integrated, or is to be installed in close proximity with work of other trades, coordinate work prior to and during installation.

1.14 PRODUCTS

.1 Be responsible for ordering of products (equipment and materials) in a timely manner in order to meet project-scheduling timelines. Failure to order products to allow manufacturers sufficient production/delivery time to meet project-scheduling timelines is an unacceptable reason to request for other suppliers or substitutions.

.2 Provide Canadian manufactured products wherever possible or required and when quality and performance is obtainable at a competitive price. Products are to be supplied from manufacturer’s authorized Canadian representative, unless otherwise noted. Unless otherwise specified, products are to be new and are to comply with applicable respective Canadian standards. References to UL listings of products to include requirements that products are to be also Underwriters Laboratories of Canada (ULC) listed for use in Canada. Products are to meet or exceed latest ANSI/ASHRAE/IES 90.1 standards, as applicable. Do not supply any products containing asbestos materials or PCB materials.

.3 Systems and equipment of this Project are to be "State of the Art" and be most recent and up to date series/version of product that is available at time of shop drawing review process. Products that have been stored or "on shelf" for an extended period of time will not be accepted. Software is to be of latest version available and be provided with updates available at time of shop drawing review process. Systems are to be designed such that its software is backwards compatible. Future upgrades are not to require any hardware replacements or additions to utilize latest software.

.4 Products scheduled and/or specified have been selected to establish a performance and quality standard, and, in some instances, a dimensional standard. In most cases, base specified manufacturers are stated for any product specified by manufacturer's name and model number. Where manufacturers are listed, first name listed is base specified company. Bid Price may be based on products supplied by any of manufacturers' base specified or named as acceptable for particular product. If manufacturers are not stated for a particular product, base Bid Price on product supplied by base specified manufacturer.

.5 Documents have been prepared based on product available at time of Bidding. If, after award of Contract, and if successful manufacturer can no longer supply a product that meets base specifications, notify Consultant immediately. Be responsible for obtaining other manufacturers product that complies with base specified performance and criteria and meets project timelines. Proposed products are subject to review and consideration by the Consultant and are considered as substitutions subject to a credit to Contract. In addition, if such products require modifications to room spaces, mechanical systems, electrical systems, etc., include required changes. Such changes are to be submitted in detail to the Consultant for review and consideration for acceptance. There will be no increase in Contract Price for revisions. Above conditions supplement and are not to supersede any specification conditions with regards to substitutions or failure to supply product as per issued documents.

.6 Listing of a product as "acceptable" does not imply automatic acceptance by the Consultant and/or Owner. It is responsibility of Contractor to ensure that any price quotations received and submittals made are for products that meet or exceed specifications included herein.

.7 If products supplied by a manufacturer named as acceptable are used in lieu of base specified manufacturer, be responsible for ensuring that they are equivalent in performance and operating characteristics (including energy consumption if applicable) to base specified products. It is understood that any additional costs (i.e. for larger starters, larger feeders, additional spaces, etc.), and changes to associated or adjacent work resulting from provision of product supplied by a manufacturer other than base specified manufacturer, is included in Bid Price. In addition, in equipment spaces where equipment named as acceptable is used in lieu of base specified equipment and dimensions of such equipment differs from base specified equipment, prepare, and submit for review accurately dimensioned layouts of rooms affected, identifying architectural and structural elements, systems and equipment to prove that equipment in room will fit properly meeting design intent. There will be no increase in Contract Price for revisions.

.8 In addition to manufacturer's products base specified or named as acceptable, other manufacturers of products may be proposed as substitutions to the Consultant for review and consideration for acceptance, listing in each case a corresponding credit for each substitution proposed. However, base Bid Price on products base specified or named as acceptable. Certify in writing to the Consultant that proposed substitution meets space, power, design, energy consumption, and other requirements of base specified or acceptable product. It is understood that there will be no increase in Contract Price by reason of any changes to associated equipment, mechanically, electrically, structurally, or architecturally, required by acceptance of proposed substitution. Consultant has sole discretion in accepting any such proposed substitution of product. Indicate any proposed substitutions in areas provided on Bid Form. Do not order such products until they are accepted in writing by the Consultant.

.9 Where products are listed as "or approved equal", certify in writing that product to be used in lieu of base specified product, at least meets space, power, design, energy consumption, and other requirements of base specified product and is equivalent or better than base specified product. When requested by the Consultant, provide full design detail drawings and specifications of proposed products. Acceptance of these "or approved equal" products is at sole discretion of the Consultant. It is understood that there will be no increase in Contract Price by reason of any changes to associated equipment, mechanically, electrically, structurally, or architecturally, required

by acceptance of approved equal product. There must be no increase in Contract price due to Consultant's rejection of proposed equivalent product.

.10 Whenever use of product other than base specified product is being supplied, ensure corresponding certifications and product information (detailed catalogue and engineering data, fabrication information and performance characteristics) are submitted to the Consultant for review. Failure of submission of these documents to the Consultant in a timely manner to allow for review will result in base specified product to be supplied at Consultant's discretion, at no additional cost to Contract.

.11 Products supplied by a manufacturer/supplier other than a manufacturer listed as acceptable may be considered for acceptance by the Consultant if requested in writing with full product documentation submitted, a minimum of 10 working days prior to Bid closing date.

.12 Any proposed changes initiated by Contractor after award of Contract may be considered by the Consultant at the Consultant's discretion, with any additional costs for such changes if accepted by Owner and reviewed with the Consultant, and costs for review, to be borne by Contractor.

.13 Whenever use of product other than based specified products or named as acceptable is being supplied, time for process of submission of other products and Consultant's review of products will not alter contract time or delay work schedule.

1.15 SHOP DRAWINGS

.1 At start-up meeting, review with the Consultant products to be included in shop drawing submission. Prepare and submit list of products to the Consultant for review.

.2 Submit electronic copies of shop drawings unless otherwise directed by the Consultant. Coordinate exact requirements with the Consultant.

.3 Submit for review, drawings showing detail design, construction, and performance of equipment and materials as requested in Specification. Submit shop drawings to the Consultant for review prior to ordering and delivery of product to site. Include minimally for preparation and submission of following, as applicable:

- .1 product literature cuts;
- .2 equipment data sheets;
- .3 equipment dimension drawings;
- .4 system block diagrams;
- .5 sequence of operation;
- .6 connection wiring schematic diagrams;
- .7 functionality with integrated systems.

.4 Each shop drawing or product data sheet is to be properly identified with project name and product drawing or specification reference. Shop drawing or product data sheet dimensions are to match dimension type on drawings.

.5 Where any item of equipment is required by Code or Standard or By-Law to meet a specific energy efficiency level, or any other specific requirement, ensure this requirement is clearly indicated on submission.

.6 Ensure proposed products meet each requirement of Project. Endorse each shop drawing copy "CERTIFIED TO BE IN ACCORDANCE WITH ALL REQUIREMENTS". Include company name, submittal date, and sign each copy. Shop drawings that are received and are not endorsed, dated and signed will be returned to be resubmitted.

.7 Consultant to review shop drawings and indicate review status by stamping shop drawing copies as follows:

.1 "REVIEWED" or "REVIEWED AS NOTED" (appropriately marked) – If Consultant's review of shop drawing is final, Consultant to stamp shop drawing;

.2 "RETURNED FOR CORRECTION" – If Consultant's review of shop drawing is not final, Consultant to stamp shop drawing as stated above, mark submission with comments, and return submission. Revise shop drawing in accordance with Consultant's notations and resubmit.

.8 Following is to be read in conjunction with wording on Consultant's shop drawing review stamp applied to each and every shop drawing or product data sheet submitted:

.1 "THIS REVIEW BY CONSULTANT IS FOR SOLE PURPOSE OF ASCERTAINING CONFORMANCE WITH GENERAL DESIGN CONCEPT. THIS REVIEW DOES NOT MEAN THAT CONSULTANT APPROVES DETAILED DESIGN INHERENT IN SHOP DRAWINGS, RESPONSIBILITY FOR WHICH REMAINS WITH CONTRACTOR. CONSULTANT'S REVIEW DOES NOT RELIEVE CONTRACTOR OF RESPONSIBILITY FOR ERRORS OR OMISSIONS IN SHOP DRAWINGS OR OF CONTRACTOR'S RESPONSIBILITY FOR MEETING REQUIREMENTS OF CONTRACT DOCUMENTS. BE RESPONSIBLE FOR DIMENSIONS TO BE CONFIRMED AND CORRELATED AT JOB SITE, FOR INFORMATION THAT PERTAINS SOLELY TO FABRICATION PROCESSES OR TO TECHNIQUES OF CONSTRUCTION AND INSTALLATION, AND FOR COORDINATION OF WORK OF SUB-TRADES."

.9 Submit each system and each major component as separate shop drawing submissions. Submit together, shop drawings for common devices such as devices of each system are to be submitted together.

.10 Obtain shop drawings for submission from product manufacturer's authorized representatives and supplemented with additional items specified herein.

.11 Do not order product until respective shop drawing review process has been properly reviewed with the Consultant.

.12 Where extended warranties are specified for equipment items, submit specified extended warranty with shop drawing submittal.

.13 Applicable mechanical equipment has been selected to meet energy efficiency requirements of ANSI/ASHRAE/IES 90.1, Energy Standards for Buildings, and shop drawings/product data submittals for such equipment must indicate compliance with this Standard or they will be returned for correction and re-submittal.

1.16 EQUIPMENT LOADS

.1 Supply equipment loads (self-weight, operating weight, housekeeping pad, inertia pads, etc.) to the Consultant, via shop drawing submissions, prior to construction.

.2 Where given choice of specific equipment, actual weight, location, and method of support of equipment may differ from those assumed by the Consultant for base design. Back-check equipment loads, location, and supports, and include necessary accommodations.

.3 Where supporting structure consists of structural steel framing, it is imperative that equipment loads, location, and method of support be confirmed prior to fabrication of structural steel. Review locations of equipment with the Consultant prior to construction.

1.17 OPENINGS

.1 Supply opening sizes and locations to the Consultant to allow verification of their effect on design, and for inclusion on structural drawings where appropriate.

.2 No openings are permitted through completed structure without written approval from Owner and reviewed with the Consultant. Show required openings on a copy of structural drawings. Identify exact locations, elevations, and size of proposed openings and submit to the Consultant for review, well in advance of doing work.

.3 Prior to leaving site at end of each day, walk through areas of work and check for any openings, penetrations, holes, and/or voids created under scope of work of project, and ensure that any openings created under scope of work have been closed off, fire-stopped and smoke-sealed. Unless directed by Owner and reviewed with the Consultant, do not leave any openings unprotected and unfinished overnight.

1.18 SCAFFOLDING, HOISTING AND RIGGING

.1 Unless otherwise specified or directed, supply, erect and operate scaffolding, rigging, hoisting equipment and associated hardware required for work, and subject to approval from Owner and reviewed with the Consultant.

.2 Immediately remove from site scaffolding, rigging and hoisting equipment when no longer required.

.3 Do not place major scaffolding/hoisting equipment loads on any portion of structure without approval from Owner and reviewed with the Consultant.

1.19 CHANGES IN THE WORK

.1 Whenever Consultant proposes in writing to make a change or revision to design, arrangement, quantity, or type of work from that required by Contract Documents, prepare and submit to the Consultant for review, a quotation being proposed cost for executing change or revision.

.2 Quotation is to be a detailed and itemized estimate of product, labour, and equipment costs associated with change or revision, plus overhead and profit percentages and applicable taxes and duties.

.3 Unless otherwise specified in Division 00 or Division 01, allowable maximum percentages for overhead and profit are to be 7% and 5% respectively.

.4 Unless otherwise specified in Division 00 or Division 01, following additional requirements apply to all quotations submitted:

.1 when change or revision involves deleted work as well as additional work, cost of deleted work (less overhead and profit percentages but including taxes and duties) is to be subtracted from cost of additional work before overhead and profit percentages are applied to additional work;

.2 material costs are not to exceed those published in the latest edition of Allpriser price guide, less 20%;

.3 mechanical material labour unit costs are to be in accordance with Mechanical Contractors Association of America Labor Estimating Manual, less 25%;

.4 electrical material labour unit costs are to be in accordance with National Electrical Contractors Association Manual of Labor Units at difficult level, less 25%;

.5 costs for journeyperson and apprentice labour must not exceed prevailing rates at time of execution of Contract and must reflect actual personnel performing work;

.6 cost for site superintendent must not exceed 10% of total hours of labour estimated for change or revision, and change or revision must be such that site superintendent’s involvement is necessary;

.7 costs for rental tools and/or equipment are not to exceed local rental costs;

.8 overhead percentage will be deemed to cover quotation costs other than actual site labour and materials, and rentals;

.9 quotations, including those for deleted work, to include a figure for any required change to Contract time.

.5 Quotations submitted that are not in accordance with requirements specified above will be rejected and returned for re-submittal. Failure to submit a proper quotation to enable Consultant to expeditiously process quotation and issue a Change Order will not be grounds for any additional change to Contract time.

.6 Make requests for changes or revisions to work to Consultant in writing and, if Consultant agrees, will issue Notice of Change.

.7 Do not execute any change or revision until written authorization for the change or revision has been obtained from the Consultant.

1.20 PROGRESS PAYMENT BREAKDOWN

.1 Prior to submittal of first progress payment draw, submit a detailed breakdown of work cost to assist Consultant in reviewing and approving progress payment claims.

.2 Payment breakdown is subject to Owner’s approval and Consultant’s review. Progress payments will not be processed until an approved breakdown is in place. Breakdown is to include one-time claim items such as mobilization and demobilization, insurance, bonds (if applicable), shop drawings and product data sheets, commissioning including testing, adjusting and balancing, system testing and verification, and project closeout submittals.

.3 Indicate equipment, material and labour costs for site services (if applicable) and indicate work of each trade in same manner as indicated on progress draw.

1.21 NOTICE FOR REQUIRED FIELD REVIEWS

.1 Whenever there is a requirement for the Consultant to perform a field review prior to concealment of any work, to inspect/re-inspect work for deficiencies prior to Substantial Performance of the Work, for commissioning demonstrations, and any other such field review, give minimum 5 working days' notice in writing to the Consultant.

.2 If Consultant is unable to attend a field review when requested, arrange an alternative date and time.

.3 Do not conceal work until the Consultant advises that it may be concealed.

.4 When Consultant is requested to perform a field review and work is not ready to be reviewed, reimburse Consultant for time and travel expenses.

1.22 PRELIMINARY TESTING

.1 When directed by the Consultant, promptly arrange, pay for, and perform site tests on any piece of equipment or any system for such reasonable lengths of time and at such times as may be required to prove compliance with Specification and governing Codes and Regulations, prior to Substantial Performance of the Work.

.2 When, in Consultant’s opinion, tests are required to be performed by a certified testing laboratory, arrange and pay for such tests.

.3 These tests are not to be construed as evidence of acceptance of work, and it is agreed and understood that no claim for delays or damage will be made for injury or breakage to any part or

parts of equipment or system due to test where such injuries or breakage were caused by faulty parts and/or workmanship of any kind.

.4 When, in Consultant's opinion, tests indicate that equipment, products, etc., are defective or deficient, immediately remove such equipment and/or products from site and replace them with acceptable equipment and/or products, at no additional cost.

1.23 PROVISIONS FOR SYSTEMS/EQUIPMENT USED DURING CONSTRUCTION

.1 Permanent building mechanical systems are not to be used for temporary heating or cooling purposes during construction.

1.24 TEMPORARY SERVICES

.1 Coordinate with Prime Contractor, requirements for temporary services including but not limited to temporary heating, cooling, and water. Unless otherwise noted, provide required services in compliance with requirements of local governing building code and local governing inspection authorities.

.2 Maintain fire protection of areas which may include fire watch during temporary shutdowns of existing systems, in accordance with requirements of local governing code and local governing authorities.

1.25 MAINTAINING EQUIPMENT PRIOR TO ACCEPTANCE

.1 Maintain equipment in accordance with the manufacturer's printed instructions prior to start-up, testing and commissioning.

.2 Employ a qualified millwright to check and align shafts, drives, and couplings on all base mounted split coupled motor driven equipment.

.3 Where equipment lubrication fittings are not easily accessible, extend the fittings to accessible locations using copper or aluminium tubing.

.4 All filters are to be new upon Substantial Performance of the Work. This is in addition to any spare filters specified.

1.26 RECORD DOCUMENTATION

.1 Drawings for this project have been prepared on a REVIT system using Revit software of release version reviewed with the Consultant. For purpose of producing record "as built" drawings, copies of Contract Drawings can be obtained from the Consultant.

.2 As work progresses at site, clearly mark in red in a neat and legible manner on a set of bound white prints of Contract Drawings, changes, and deviations from routing of services and locations of equipment shown on Contract Drawings, on a daily basis. Changes and deviations include those made by addenda, change orders, and site instructions. Use notes marked in red as required. Maintain white print red line as-built set at site for exclusive use of recording as-built conditions, keep set up-to-date at all times, and ensure set is always available for periodic review. As-built set is also to include the following:

.1 dimensioned location of inaccessible concealed work;

.2 locations of control devices with identification for each;

.3 for underground piping and ducts, record dimensions, invert elevations, offsets, fittings, cathodic protection and accessories if applicable, and locate dimensions from benchmarks to be preserved after construction is complete;

.4 for fire protection systems, record actual locations of equipment, sprinkler heads, and valves, drains, and test locations, and deviations of pipe routing and sizing from that shown on the drawings;

.5 location of piping system air vents;

.6 location of concealed services terminated for future extension and work concealed within building in inaccessible locations.

.3 Before applying for a Certificate of Substantial Performance of the Work, update a clean copy of Contract Drawing set in accordance with marked up set of "as-built" white prints including deviations from original Contract Drawings, thus forming an "as-built" drawing set. Submit "as-built" site drawing prints to the Consultant for review. Make necessary revisions to drawings as per Consultant's comments, to satisfaction of the Consultant.

.4 Use final reviewed "as-built" drawing set to provide CAD files of drawings thus forming true "as-built" set of Contract Drawings. Identify set as "Project Record Copy". Load digital copies of final reviewed by the Consultant as-built drawings onto USB type flash drive. Provide 2 complete sets of "as-built" drawings on separate USBs. Submit "as-built" sets of white prints and USBs to Consultant.

.5 Submitted drawings are to be of same quality as original Contract Drawings. REVIT drawing files are to be compatible with Revit software release version confirmed with the Consultant.

.6 Unless otherwise noted in Division 00 or Division 01, failure to maintain accurate record drawings will incur additional 5% holdback on progress claims until drawings are brought up to date to satisfaction of Owner and reviewed with the Consultant.

.7 For projects with phased turnover of project (refer to Division 01), review with the Consultant completeness of as-built drawings prior to turn over of an area. Interim as-built drawings to be made available to Owner's maintenance personnel.

.8 Where part of the Mechanical Scope of Work, retain and pay for services of a land surveyor registered in Place of the Work to measure, verify, and record size, location, invert elevation and pitch of buried piping services, and, when complete, transfer survey work to as-built drawings.

1.27 OPERATION AND MAINTENANCE DATA

.1 For each item of equipment for which a shop drawing is required (except for simple equipment), supply indexed copies of equipment manufacturers' operating and maintenance (O&M) instruction data manuals. Consolidate each copy of data as a PDF file on a USB drive. Consolidated O&M manual PDF to include:

.1 front cover: project name; wording – "Mechanical Systems Operating and Maintenance Manual"; and date;

.2 introduction sheet listing Consultant, Contractor, and Subcontractor names, street addresses, telephone and fax numbers, and e-mail addresses;

.3 equipment manufacturer's authorized contact person name, telephone number and company website;

.4 Table of Contents sheet, and corresponding index tab sheets;

.5 copy of each "REVIEWED" or clean, updated "REVIEWED AS NOTED" shop drawing or product data sheet, with manufacturer's/supplier's name, telephone and fax numbers, email address, company website address, and email address for local source of parts and service; when shop drawings are returned marked "Reviewed As Noted" with revisions marked on shop drawing copies, they are to be revised by equipment supplier to incorporate comments marked on "Reviewed" shop drawings and a clean updated copy is to be included in operating and maintenance manuals;

.6 Operating data is to include:

.1 pressure test reports, and certificates issued by governing authorities;

.2 description of each system and its controls;

.3 control schematics for equipment/systems including building environmental controls;

.4 wiring and connection diagrams;

.5 if applicable, BAS architecture and all required operating data;

.6 description of operation of each system at various loads together with reset schedules and seasonal variances;

.7 operation instruction for each system and each component;

.8 description of actions to be taken in event of emergencies and/or equipment failure;

.9 valve tag schedule, and flow diagrams to indicate valve locations.

.7 Maintenance data is to include:

.1 operation and trouble-shooting instructions for each item of equipment and each system;

.2 schedules of tasks, frequency, tools required, and estimated task time;

.3 recommended maintenance practices and precautions;

.4 complete parts lists with numbers.

.8 Performance data is to include:

.1 equipment and system start-up data sheets;

.2 equipment performance verification test results, and final commissioning report;

.3 final testing, adjusting and balancing reports.

.9 copies of warranties;

.10 items requested specifically in Section Articles.

.2 Operating and maintenance instructions are to relate to job specific equipment supplied under this project and related to Owner’s building. Language used in manuals is to contain simple practical operating terms and language easy for in-house maintenance staff to understand how to operate and maintain each system.

.3 Before applying for a Certificate of Substantial Performance of the Work, assemble one copy of O&M Manual and submit to the Consultant for review prior to assembling remaining copies. Incorporate Consultant's comments into final submission.

1.28 COMMISSIONING

.1 After successful start-up and prior to Substantial Performance of the Work, commission the mechanical work. Commissioning work is the process of Contractor demonstrating to Owner and Consultant, for purpose of final acceptance, by means of successful and documented functional performance testing, that systems and/or subsystems are capable of being operated and maintained to perform in accordance with requirements of Contract Documents, as further described below.

.1 Retain services of a testing, adjusting, and balancing agency to perform testing and balancing of mechanical system air/fluid flows and capacities, prior to operational performance testing. Refer to Section 20 05 93 – Testing, Adjusting, and Balancing for Mechanical Systems.

.2 Test, adjust and operate equipment and systems after start-up but before functional performance testing, to confirm operations are in accordance with requirements of Contract Documents. Verify modes and sequences of control and monitoring, interlocks, and responses to emergency conditions. Complete commissioning data sheets to document successful operational performance testing.

.3 Repeat successful operational performance testing with completed commissioning data sheet documentation in the presence of Consultant and Owner to validate and verify equipment and systems are complete in all respects, function correctly, and are ready for acceptance.

.4 Submit final commissioning data sheets, TAB reports as specified in Section 20 05 93 – Testing, Adjusting, and Balancing for Mechanical Systems, project closeout documents, and other required submittals.

1.29 WARRANTY

.1 Unless otherwise specified in Division 00 and Division 01, warrant mechanical work to be in accordance with Contract Documents and free from defects for a period of 1 year from date of issue of a Certificate of Substantial Performance of the Work.

.2 Where equipment includes extended warranty period, e.g., 5 years, first year of warranty period is to be governed by terms and conditions of warranty in Contract Documents, and remaining years of warranty are to be direct from equipment manufacturer and/or supplier to Owner. Submit signed and dated copies of extended warranties to the Consultant.

.3 Warranty to include parts, labour, travel costs and living expenses incurred by manufacturer’s authorized technician to provide factory authorized on-site service.

.4 Repair and/or replace any defects that appear in Work within warranty period without additional expense to Owner. Be responsible for costs incurred in making defective work good, including repair or replacement of building finishes, other materials, and damage to other equipment. Ordinary wear and tear and damage caused wilfully or due to carelessness of Owner’s staff or agents is exempted.

.5 Do not include Owner deductible amounts in warranties.

.6 It is understood that warranties are to commence from time of Substantial Performance of the Work, regardless of what is noted within following Sections of Specification. Be responsible for providing whatever "bridging" or additional extended warranty period is required from time that material is purchased until this time.

.7 Visit building during warranty period with Owner representatives. Owner to organize these visits. At these meetings, Owner representatives are to review performance of systems. If performance is satisfactory, then no further action needs to be taken. If unsatisfactory, then correct deficiencies, as directed by Owner representatives, to satisfaction of Owner's representatives. These site visits to occur:

.1 once during 1st month of building operation;

.2 once during 3rd month of building operation;

.3 once between 4th and 10th month in a season opposite to 1st and 3rd month visits.

1.30 CLOSEOUT SUBMITTALS

.1 Prior to application for Substantial Performance of the Work, submit required items and documentation specified, including following as applicable to the project:

.1 Operating and Maintenance Manuals;

.2 as-built record drawings and associated data;

.3 extended warranties for equipment as specified;

.4 operating test certificates, i.e. Sprinkler Test Certificate;

.5 final commissioning report and TAB report;

.6 identified keys for equipment and/or panels for which keys are required, and other items required to be submitted;

.7 other data or products specified.

1.31 INSTRUCTIONS TO OWNER

.1 Refer to equipment and system operational and maintenance training requirements specified in Division 01.

.2 Train Owner's designated personnel in aspects of operation and maintenance of equipment and systems as specified. Demonstrations and training are to be performed by qualified technicians employed by equipment/system manufacturer/supplier. Supply hard copies of training materials to each attendee.

.3 Provide training to Owner as specified in trade Sections on the operation and maintenance procedures of mechanical systems and equipment.

.4 Unless where specified otherwise in trade Sections, minimum requirements are for manufacturer/suppliers of each system and major equipment, to provide minimum two separate sessions each consisting of minimum 4 hours on site or in factory training (at Owner's choice), of Owner's designated personnel (for up to 6 people each session), on operation and maintenance procedures of system.

.5 For each item of equipment and for each system for which training is specified, prepare training modules as specified below. Use Operating and Maintenance Manuals during training sessions. Training modules include but are not limited to:

.1 Operational Requirements and Criteria – equipment function, stopping and starting, safeties, operating standards, operating characteristics, performance curves, and limitations;

.2 Troubleshooting – diagnostic instructions, test and inspection procedures;

.3 Documentation – equipment/system warranties, and manufacturer's/supplier's parts and service facilities, telephone numbers, email addresses, and the like;

.4 Maintenance – inspection instructions, types of cleaning agents to be used as well as cleaning methods, preventive maintenance procedures, and use of any special tools;

.5 Repairs – diagnostic instructions, disassembly, component removal and repair instructions, instructions for identifying parts and components, and review of any spare parts inventory.

.6 Before instructing Owner's designated personnel, submit to the Consultant for review preliminary copy of training manual and proposed schedule of demonstration and training dates and times. Incorporate Consultant's comments in final copy.

.7 Obtain in writing from the Consultant list of Owner's representatives to receive instructions. Submit to Consultant prior to application for Certificate of Substantial Performance of the Work, complete list of systems for which instructions were given, stating for each system:

.1 date instructions were given to Owner's staff;

.2 duration of instruction;

.3 names of persons instructed;

.4 other parties present (manufacturer's representative, consultants, etc.).

.8 Obtain signatures of Owner's staff to verify they properly understood system installation, operation, and maintenance requirements, and have received operating and maintenance instruction manuals and "as-built" record drawings.

.9 Submit to the Consultant copy of electronic version of training materials and include in operating and maintenance manuals submission.

1.32 FINAL INSPECTION

.1 Submit to Consultant, written request for final inspection of systems. Include written certification that:

.1 deficiencies noted during job inspections have been completed;

.2 field quality control procedures have been completed;

.3 systems have been tested and verified, balanced, and adjusted, and are ready for operation;

.4 maintenance and operating data have been completed and submitted to, reviewed with the Consultant and accepted by Owner;

.5 tags and nameplates are in place and equipment identifications have been completed;

.6 clean-up is complete;

.7 spare parts and replacement parts specified have been provided and acknowledged by the Consultant;

.8 as-built and record drawings have been completed and submitted to and reviewed with the Consultant and accepted by Owner;

.9 Owner's staff has been instructed in operation and maintenance of systems;

.10 commissioning procedures have been completed.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 CLEANING

.1 During construction, keep site reasonably clear of rubbish and waste material resulting from work on a daily basis to the satisfaction of Owner and Consultant. Before applying for a Certificate of Substantial Performance of the Work, remove rubbish and debris, and be responsible for repair of any damage caused as a result of work.

.2 Clean equipment and devices installed as part of this project.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Motors and starters for all equipment specified in Mechanical Divisions.

1.2 RELATED REQUIREMENTS

.1 Section 26 05 83 – Wiring Connections.

1.3 SUBMITTALS

.1 Submit shop drawings/product data sheets for:

.1 electric motors (submit with equipment they are associated with).

.2 Submit a list of equipment identification nameplates indicating proposed wording and sizes.

PART 2 - PRODUCTS

2.1 EQUIPMENT BELT DRIVES

.1 ANSI/RMA Standard V-belt type rated at minimum 1.5 times motor nameplate rating, and in accordance with following requirements:

.1 belts are to be reinforced cord and rubber, and multiple belts are to be matched sets;

.2 sheaves are to be cast iron or steel, secured to shafts with removable keys unless otherwise specified, standard adjustable pitch (± 10% range) for motors under 10 hp, fixed pitch type with split tapered bushing and keyway for motors 10 hp and larger, and, if required, replaced as part of mechanical work to suit system air/water quantity testing and balancing work;

.3 motor slide rail adjustment plates are to allow for centre line adjustment.

.2 Supply a spare belt set (tagged and identified) for each belt drive and hand to Owner upon Substantial Performance of the Work.

2.2 EQUIPMENT DRIVE GUARDS AND ACCESSORIES

.1 For V-belt drives – removable, 4-sided, fully enclosed, galvanized sheet steel guards to OHSA standards, cleaned, factory primed and painted with yellow equipment enamel, complete with a 2-piece full length hinged front panel to permit belt maintenance or replacement without removing guard, and 40 mm (1-½") diameter tachometer openings at each shaft location.

.2 For flexible couplings – removable "U" shaped galvanized steel guards to OHSA Standards with a 2.3 mm (3/32") thick frame and expanded mesh face.

.3 For unprotected fan inlets and outlets – unless otherwise specified, removable 20 mm (¾") galvanized steel wire mesh with galvanized steel frames, all to OHSA Standards.

2.3 ELECTRIC MOTORS

.1 Unless otherwise specified, motors are to conform to NEMA Standard MG 1, applicable IEEE Standards, and applicable CSA C22.2 standards, and are to meet NEMA standards for maximum sound level ratings under full load. Confirm motor voltages prior to ordering.

.2 Vertically mounted and submersible motors are to be purposely designed for mounting in this attitude.

.3 Efficiency of 1-phase motors to 1 hp is to be in accordance with CAN/CSA C747. Efficiency of 3-phase motors 1 hp and larger is to be in accordance with CAN/CSA C390 or IEEE 112B.

.4 Unless otherwise specified, 1-phase motors smaller than ½ hp are to be 115 V, continuous duty capacitor start type with an NEMA 48 or 56 frame size, solid base, heavy-gauge steel shell with solid die-cast end shields, dynamically balanced die-cast rotor, integral automatic reset thermal overload protection, Class "B" insulation, and a 1.15 service factor at 40°C (105°F) ambient temperature.

.5 Explosion-proof 1-phase motors are to be totally enclosed, fan cooled, 115 V continuous duty capacitor start type in accordance with CSA C22.2 No. 145, as specified for standard 1-phase motors but suitable for use in Class 1 Group D hazardous locations and complete with a rolled steel shell and a 1.0 service factor at 40°C (105°F) ambient temperature.

.6 Unless otherwise specified, motors ½ hp and larger are to be totally enclosed, fan cooled, 3-phase, T-frame, squirrel cage continuous duty induction motors suitable for voltages indicated on Drawings, NEMA Design "B" for normal starting torque or Design "C" for high starting torque as required by the application, each complete with Class "B" insulation, a 1.15 service factor at 40°C ambient temperature, grease lubricated open ball bearings with grease fittings to permit re-lubrication without dismantling motor, a cast iron frame with cast iron feet where required, cast iron end bracket and precision machined bearing fit, and balanced carbon steel shaft assembly with die-cast aluminum rotor windings.

.7 Explosion-proof 3-phase motors are to be totally enclosed fan cooled motors in accordance with CSA C22.2 No. 145, generally as specified above for standard 3-phase motors but suitable for use in Class 1 Group D hazardous locations and with a 1.0 service factor at 40°C (105°F) ambient temperature.

.8 Motor(s) for 2-speed fan(s) are to be as above but 2-speed double winding type.

.9 Unless otherwise indicated, motors 30 hp and larger are to be complete with a heat sensing PTC thermistor in the end turn of stator winding for each phase and connected in series inside motor with 2 marked leads brought out to motor conduit box.

.10 Motors for equipment with variable frequency drives are to be generally as specified above but inverter duty type to NEMA Standard MG 1 Part 31, quantified by CSA for operation from a variable frequency drive of type specified, and complete with Class "H" insulation. Motors are to be equipped with AEGIS, or approved equal, shaft grounding ring system to protect bearings from damage by diverting harmful shaft voltages and bearing currents to ground.

.11 Motors 150 hp and larger with "wye-delta" reduced voltage starters are to be complete with six leads for connection to motor starter.

.12 Motors for equipment which is scheduled or specified with a corrosion resistant coating or constructed from corrosion resistant materials are to be factory coated with a primer and epoxy paint finish.

.13 Manufacturers:

.1 TECO-Westinghouse Motors (Canada) Inc.;

.2 Canadian General Electric;

.3 Baldor Electric Co.;

.4 U.S. Electrical Motors;

.5 Weg Electric Corp.;

.6 Marathon Electric;

.7 Toshiba Corp.;

.8 Leeson Canada.

2.4 MOTOR STARTERS AND ACCESSORIES

.1 Motor starters must be capable of starting associated motors under the imposed loads. Confirm starter voltage matches motor prior to ordering.

.2 Unless otherwise specified, starters for 1-phase motors are to be 115 V, thermal overload protected manual starting switches with a neon pilot light, a surface or recessed enclosure to suit the application, and, where automatic operation is required, a separate H-O-A switch in an enclosure to match starter enclosure.

.3 Unless otherwise specified, starters for 3-phase motors less than 50 hp are to be combination "quick-make" and "quick-break" fused disconnects and full voltage non-reversing across-the-line starters, each complete with and overload relay per phase, an enclosure to suit the application, and, a H-O-A switch, pilot lights, control transformer, auxiliary contacts, and other accessories as per motor starter schedule.

.4 Unless otherwise specified, starters for 3-phase motors 50 hp to 150 hp are to be reduced voltage, non-reversing, auto-transformer type starters complete with one overload relay per phase, an enclosure to suit the application, and, a H-O-A switch, pilot lights, control transformer, auxiliary contacts, and other accessories as per motor starter schedule.

.5 Unless otherwise specified, starters for 3-phase motors 150 hp and larger are to be reduced voltage, non-reversing, closed transition "wye-delta" starters complete with one overload relay per phase, an enclosure to suit the application, and, a H-O-A switch, pilot lights, control transformer, auxiliary contacts, and other accessories as per motor starter schedule.

.6 Starters for 2-speed double winding motors are to be generally as specified above but suitable for motor and equipped with a 45 second time delay to permit equipment to coast down to low speed before it is operated at low speed.

.7 Starters for 2-speed single winding motors are to be generally as specified above but suitable for motor and equipped with a 45 second time delay to permit equipment to coast down to low speed before it is operated at low speed.

.8 Starters for reversible motors for cooling towers are to be generally as specified above but suitable for motor and equipped with a 45 second time delay to allow fan(s) to coast down to a stop before being operated in reverse rotation.

.9 Unless otherwise specified, motor starter enclosures are to be in accordance with following NEMA ratings:

.1 enclosures located in sprinklered areas – Type 2;

.2 enclosures exposed to the elements – Type 3R, constructed of stainless steel;

.3 enclosures inside the building in wet areas – Type 3R, constructed of stainless steel;

.4 enclosures in explosion rated area – Type 7 with exact requirements to suit the area and application;

.5 enclosures except as noted above – Type 1;

.6 enclosures located in finished areas – as above but recess type with brushed stainless steel faceplate.

.10 Motor control centres are to be multi-unit, 2.28 m (9') high, NEMA Class 1, type "B", factory assembled, dead front, floor mounted, free-standing motor control centre with tin plated copper bus and an NEMA Type 1 or Type 2 enclosure as for loose starters specified above. Each motor control centre is to be complete with starters as specified above, load and control wiring terminal boards, and required facilities for line and load side power wiring connections.

.11 Disconnect switches for motor control centres are to be heavy-duty, CSA certified, front operated switches as per motor starter schedule, each complete with a handle suitable for padlocking in "off" position and arranged so that door cannot be opened with handle in "on" position and an NEMA enclosure as specified for loose starters. Fusible units are to be complete with fuse clips to suit fuse types specified below.

.12 Fuses are to be, unless otherwise scheduled or specified, English Electric Ltd. HRC fuses, Form I Class "J" for constant running equipment and Form II Class "C" for equipment that cycles on and off.

.13 Manufacturers:

.1 Rockwell Automation Inc. - Allen-Bradley;

.2 Eaton Corp. – Cutler-Hammer;

.3 Eaton Corp. – Moeller Electric;

.4 Siemens Canada;

.5 Schneider Electric.

2.5 SPRINKLER PROOFING

.1 Provide drip shields for protection of surface mounted equipment enclosures from water spray and dripping of liquids. Features of shields include:

.1 factory constructed by respective equipment manufacturers;

.2 constructed from non-combustible materials (sheet steel);

.3 enamel painted to match equipment;

.4 surfaces and edges filled/sanded smooth prior to painting;

.5 supported from equipment with structural steel rods/metal framing or other method approved by Consultant;

.6 structural support finish painted to match shield.

.2 Include with equipment shop drawings, detailed dimensions of drip shields and methods of supporting.

.3 Equipment with top cable/conduit entries to include additional sealing of entries with gasketting and/or waterproof sealant to prevent water from entering enclosure.

.4 Design ventilation louvers such that live components are not exposed to water spray and dripping liquids.

.5 Above requirements are additional minimum "sprinkler proof" standards for equipment specified as NEMA 1, 2 or 12.

.6 Obtain CSA approval where required by local governing authorities.

PART 3 - EXECUTION

3.1 INSTALLATION OF EQUIPMENT DRIVE GUARDS AND ACCESSORIES

.1 Provide OHSA guards for exposed accessible rotating parts such as belt drives, couplings, fan wheels, and shaft ends on mechanical equipment.

.2 Install belt guards to allow movement of motors for adjusting belt tension.

.3 Provide a means to permit lubrication and use of test instruments with guards in place.

.4 Secure guards to equipment or equipment base but do not bridge sound or vibration isolation.

.5 Where equipment oil level gauges, oil reservoirs, grease cups, or grease gun fittings are integral with equipment but are not easily accessible for service, extend to an accessible location using aluminium or copper tubing.

3.2 SUPPLY OF MOTOR STARTERS AND ACCESSORIES

.1 Unless otherwise shown or specified, supply a starter for each item of motorized equipment. Refer to Motor Starter Schedule.

.2 Where 3-phase starters are indicated in motor control centres, supply motor control centres with starters and bolt to a concrete housekeeping pad.

.3 Where package type equipment with integral starters, or equipment with starters integral in loose power and control panels supplied with equipment is fed from a motor control centre, provide a disconnect switch in motor control centre in lieu of a motor starter.

.4 Where 3-phase starters are indicated and/or scheduled to be mounted on a motor starter panel, starters will be mounted and connected, complete with panels and splitter trough, as part of electrical work. Hand starters to electrical trade at site when they are required.

.5 Where package type equipment with integral starters, or equipment with starters integral in loose power and control panels supplied with equipment is fed from a motor starter panel, a disconnect switch will be provided on motor starter panel as part of electrical work.

.6 Unless otherwise specified or shown on drawings, 1-phase motor starters will be mounted adjacent to equipment they serve and connected complete as part of electrical work. Hand starters to electrical trade at site at the proper time.

3.3 ELECTRICAL WIRING WORK FOR MECHANICAL WORK

.1 Unless otherwise specified or indicated, following electrical wiring work for mechanical equipment will be done as part of the electrical work:

.1 "line" side power wiring to motor starters or disconnect switches in motor control centres and starters or disconnects on motor starter panels, and "load" side wiring from starters or disconnects to equipment.

.2 "line" side power wiring to individual wall mounted starters, and "load" side wiring from starters to equipment.

.3 "line" side power wiring to pre-wired power and control panels and variable frequency drives (VFD), and "load" side power wiring from the panels and VFD's to equipment.

.4 provision of receptacles for plug-in equipment.

.5 provision of disconnect switches for motors in excess of 10 m (30 ft) from starter location, or cannot be seen from starter location, and associated power wiring.

.6 motor starter interlocking in excess of 24 V.

.7 wiring from motor winding thermistors in motors 30 hp and larger to motor starter contacts.

.8 120 V power connections to electrical receptacles integral with small ceiling exhaust fans.

.9 [120 V power connections to small exhaust fans, and ceiling fans for all line voltage control devices, including but not limited to wiring through toggle switches, line voltage thermostats, countdown timer switches, or line voltage speed controllers. Coordinate requirements with Electrical Division.]

.10 120 V wiring connections to lighting fixture/switch combinations integral with air handling units.

.11 120 V wiring connections to duplex receptacles integral with air handling unit control panels.

.12 120 V wiring connections to BAS system controllers/panels and other control system or component requiring 120 V power including, but not limited to, VAV boxes, dampers, low voltage transformers, etc.

.2 Mechanical wiring work not listed above or specified herein or on drawings to be done as part of electrical work is to be installed in conduit and is to be done as part of mechanical work in accordance with wiring requirements specified for electrical work.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Variable Frequency Drives (VFD's) for all equipment specified in Mechanical Divisions.

1.2 SUBMITTALS

.1 Shop Drawings/Product Data: Submit shop drawings with product data sheets for variable frequency drives (VFDs). Include:

.1 construction and performance details;

.2 wiring and control schematics;

.3 dimensions of units;

.4 calculations specific to installation showing total harmonic voltage distortion is less than 5%;

.5 certified production test results with serial numbers for harmonic mitigation performance and energy efficiency under actual variable frequency drive loading.

1.3 CLOSEOUT SUBMITTALS

.1 Certification Letter: Submit a start-up and installation certification letter from supplier of VFDs as specified in Part 3 of this Section;

.2 Parameters: Prepare list of parameters for uploading for Owner's future use as specified in Part 3 of this Section. Load on USB type flash drive and submit to the Consultant.

.3 Extended Warranty: Where extended warranty is specified to be included, include a copy of VFD extended warranty in each Operating and Maintenance Manual. Prior to Substantial Performance of Work, submit a copy of warranty to Owner.

.4 Additionally, coordinate with Prime Contractor and Electrical Contractor to ensure that shop drawings clearly identify that proposed VFDs and connected motors are 100% compatible and Mechanical Contractor to sign off on selected VFDs.

1.4 COORDINATION WITH ELECTRICAL DIVISIONS

.1 This Section specifies VFD requirements for motors. Ensure that VFDs packaged with various system equipment, complies with specifications of this Section.

.2 VFDs are each to be approved by respective manufacturers of VFDs and connected motors, as suitable for installation on scheduled motors. VFD output current rating to match or exceed connected motor nameplate full load current rating.

.3 Coordinate and review with Electrical Divisions, responsibility requirements for supply of VFDs, harmonic filters and requirements for control and power conductors and connections.

.4 Check that motors are equipped with AEGIS or approved equal, shaft grounding ring system to protect bearings from damage in motors by diverting harmful shaft voltages and bearing currents to ground.

.5 Additionally, review and confirm responsibilities with Consultant and Prime Contractor.

1.5 WARRANTY

.1 VFDs to be warranted free from defective labour and materials for period of 36 months from date of Substantial Performance of the Work. Include for initial one year Contract warranty and an

additional 2 year extended warranty direct to Owner. Extended warranty terms and conditions are to be identical to one year Contract warranty, and extended warranty period is to commence day Contract warranty expires.

PART 2 - PRODUCTS

2.1 VFD BASIC REQUIREMENTS

.1 VFDs supplied on project to be products of same manufacturer and be CSA approved, ULC listed and labelled. Base specified product is ABB ACH series units that include compliance with following standards:

.1 CSA C22.2 No.14 Industrial Control Equipment;

.2 UL 508 - Industrial Control Equipment;

.3 UL 508C – Power Conversion Equipment;

.4 NEMA ICS 7 - Adjustable-Speed Drives.

.2 Basis for limiting harmonics is to be provided generally to IEEE Standard 519 - Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems, except intended for user's electrical distribution system with point of common coupling (where harmonic limits are assessed) to be set at input terminals of harmonic mitigating equipment.

.3 Refer to Schedule of VFDs on drawings for features to include with respective VFDs.

.4 VFDs to include following basic requirements:

.1 regardless of horsepower (hp) rating are to be of same VFD model; I/O and control circuit boards as well as keypads are to be identical and interchangeable regardless of hp rating;

.2 to be capable of starting into a coasting load (forward or reverse) up to full speed and accelerate or decelerate to set point without safety tripping or component damage (flying start);

.3 6-pulse width modulated (PWM) AC to AC converter utilizing latest isolated gate bipolar transistor (IGBT) technology; PWM switching pattern to include a motor flux optimization circuit that automatically reduces applied motor voltage to the motor to optimize energy consumption and audible motor noise;

.4 carrier frequency control circuit that reduces the carrier frequency based on actual VFD temperature that allows higher carrier frequency without derating VFD or operating at high carrier frequency only at low speeds;

.5 provisions that determine motor torque and flux every 25 µs (40,000 times per second);

.6 completely assembled and tested by manufacturer in their facility;

.7 designed to provide at least 250,000 hours mean time before failure (MTBF) when specified preventative maintenance is performed.

.8 bypass system completely factory wired and tested;

.9 door interlocked padlockable disconnect switch that disconnects all input power from drive and all internally mounted options;

.10 control panel keyboard and display with password protection against parameter changes.

2.2 VFD RATINGS

.1 VFDs to be rated to operate from 3-phase input voltage of 208 V or 600 V ± 10%, as scheduled, and frequency range from 48 Hz to 63 Hz. In addition, a tolerated voltage window to allow system to

operate from a line of +30% to -35% nominal voltage. System to incorporate circuitry that allows drive or bypass contactor to remain “sealed in” over this voltage tolerance at a minimum.

.2 VFDs to employ a full wave rectifier to prevent input line notching and operate at a minimum fundamental input power factor of 0.97 at all speeds and loads.

.3 VFDs efficiency to be 96% or better at full speed and load.

.4 Output voltage and current ratings to match adjustable frequency operating requirements of standard 3-ph, 60 Hz, NEMA design B inverter-duty motors in compliance with NEMA-MG1, Part 31 Standard. Overload current capacity for variable torque overload capacity to be 110% of rated current for 1 minute out of 10 minutes and 130% for 2 seconds. Output frequency to be adjustable between 0 Hz and 500 Hz.

.5 Open loop static speed regulation to be 0.1% to 0.3% (10% of motor slip). Dynamic speed accuracy to be 4%-sec. or better open loop.

.6 When a suitable motor is used, drive provides breakaway torque equal to 200% of rated motor torque. Torque response time to be 5 ms or less.

.7 Enclosures:

.1 in climate controlled areas – minimum NEMA 12 with drip shield;

.2 in non-climate controlled areas – NEMA 3R.

2.3 HARMONIC FILTERS AND REACTORS

.1 VFDs to include internal 5% impedance AC line reactor (or equivalent 5% impedance dual positive and negative DC bus reactors) provided as a standard to reduce input current harmonic content and provide isolation from power line transients and to reduce RFI emissions.

.2 VFDs serving motors sized 11 kW (15 hp) or more to be provided with harmonic filters to limit harmonics distortion produced by each drive to following maximum levels as measured on input side of drive:

.1 Total harmonic distortion (voltage) – 5%;

.2 Total harmonic distortion (current) – 10%.

.3 Harmonic filter to be based on MIRUS International Inc. “LINEATOR AUHF” series, with features as follows:

.1 manufactured and tested in accordance with latest applicable standards of ULC, CSA and NEMA;

.2 treat characteristic low frequency harmonics generated by a 3-phase, diode bridge rectifier load (5th, 7th, 11th, 13th, etc.);

.3 passive inductor/capacitor network;

.4 low capacitive reactance (KVAR) of less than 20% of kVA rating, to ensure compatibility with engine generator sets;

.5 full load efficiency of harmonic mitigation equipment / VFD combination to be greater than 96%;

.6 copper wiring;

.7 220°C system insulation class and temperature rise of 130°C;

.8 anti-vibration pads between reactor or transformer core and enclosure;

.9 manufacturer’s standard ventilated, NEMA-3R enclosure.

2.4 CONTROLS AND ADJUSTMENT FUNCTIONS

.1 Include for following:

.1 programmable critical frequency lockout ranges to prevent VFD from operating load continuously at an unstable speed;

.2 proportional integral derivative (PID) speed loop regulators with an auto tune function as well as manual adjustments; PID set point controllers to allow pressure or flow signals to be connected to VFD, using microprocessor in VFD for closed loop control; includes 250 mA of 24 VDC auxiliary power and capability of loop powering a transmitter supplied by others; two parameter sets for first PID that allow sets to be switched via a digital input, serial communications or from keypad for night setback, summer/winter set points, etc.; independent, second PID loop that can utilize second analogue input and modulate analogue outputs to maintain set point of an independent process (i.e. valves, dampers, etc.); set points, process variables, etc. to be accessible from serial communication network;

.3 programmable analogue inputs that accept current or voltage signals.

.4 programmable analogue outputs (0-20 mA or 4-20 mA), that may be programmed to output proportional to Frequency, Motor Speed, Output Voltage, Output Current, Motor Torque, Motor Power (kW), DC Bus voltage, Active Reference, and other data;

.5 programmable digital inputs;

.6 programmable digital Form-C relay contact outputs for programmable on and off delay times and adjustable hysteresis; rated for maximum switching current 8 A at 24 VDC and 0.4 A at 250 VAC; maximum voltage 300 VDC and 250 VAC; continuous current rating 2 A RMS;

.7 run permissive circuit - for damper or valve control; dry contact closure that will signal damper to open (VFD motor does not operate); when damper is fully open, a normally open dry contact (end-switch) closes; closed end-switch is wired to a VFD digital input and allows motor operation; two separate safety interlock inputs, when either is opened, motor to coast to stop, and damper to close;

.8 two independently adjustable accel and decel ramps with 1-1800 seconds adjustable time ramps;

.9 fireman’s override input - upon receipt of a contact closure from fireman’s control station, VFD operates in one of two modes: operate at a programmed predetermined fixed speed or operate in a specific fireman’s override PID algorithm that automatically adjusts motor speed based on override set point and feedback; mode overrides all other inputs (analogue/digital, serial communication and keypad commands), except customer defined safety run interlock, and forces motor to run in one of the two modes; "Override Mode" to be displayed on control panel; upon removal of override signal, VFD resumes normal operation.

.2 Operator Control Panel:

.1 front mounted plug-in operator control panel consisting of keypad, multi-line backlit LCD display for programming and fault diagnostics;

.2 keys (switches) for HAND, OFF, AUTO, and manual speed control INCREASE/DECREASE;

.3 menu navigation and parameter selection keys for custom programming;

.4 date and time clock - clock to have a battery backup with 10 years minimum life span; clock to be used to date and time stamp faults and record operating parameters at time of fault; if battery fails VFD l automatically reverts to hours of operation since initial power up; clock also to be programmable to control start/stop functions, constant speeds, PID parameter sets and output relays; VFD to have a digital input that allows an override to time clock (when in off mode) for a programmable time frame; four (4) separate, independent timer functions that have both weekday and weekend settings;

.5 parameter names, fault messages, warnings and other information to be displayed in complete words or standard abbreviations to allow user to understand what is being displayed without use of a manual or cross reference table, as follows:

.1 “HAND” position to start drive and modify reference frequency by use of INCREASE/DECREASE keys;

.2 “OFF” position stops drive;

.3 "AUTO" position allows drive to be started or stopped using whichever remote start/stop command configured; drive speed controlled by external speed reference input or by PID controller.

.4 applicable operating values to be capable of being displayed in engineering (user) units; operating displayed include:

.1 Output Frequency;

.2 Motor Speed (RPM, %, or Engineering units);

.3 Motor Current;

.4 Drive Temperature;

.5 DC Bus Voltage;

.6 Output Voltage.

2.5 PROTECTIVE FUNCTIONS

.1 For each programmed warning and fault protection function, keypad displays a message in complete words or standard abbreviations.

.2 VFDs include metal oxide varistors (MOV’s) for phase to phase and phase to ground line voltage transient protection.

.3 Short circuit current rating of 100,000 amps to be provided per UL 508C without relying on line fuses.

.4 Ground fault protection, motor phase loss protection and phase unbalance protection to be provided. Single phase protection to be provided on input and output.

.5 VFDs to provide electronic motor overload protection qualified per UL 508C.

.6 Protection to be provided for AC line or DC bus overvoltage at 130% of maximum rated or undervoltage at 65% of minimum rated.

.7 Stall protection to be programmable to provide a warning or stop VFD after motor has operated above a programmable torque level for a programmed time limit.

.8 Underload protection to be programmable to provide a warning or stop VFD after motor has operated below a selected underload curve for a programmed time limit.

.9 Overtemperature protection to provide a warning if power module temperature is less than 5°C (9°F) below overtemperature trip level.

.10 Input terminal to be provided for connecting a motor thermistor (PTC type) to drive’s protective monitoring circuitry. An input to also be programmable to monitor an external relay or switch contact.

.11 VFDs through 56 kW (75 hp) to be protected from damage from input and output power miss-wiring. VFD to sense this condition and display an alarm on control panel.

.12 EMI / RFI filters to be provided as per standard EN 61800-3.

.13 dv/dt long lead filter (LRC) to protect power system network.

.14 Automatic reset feature to automatically reset selected faults and attempt to restart drive based on control parameters such as adjustable time delays, number of restart attempts and duration of restart attempts. Faults include following:

.1 Overcurrent;

.2 Overvoltage;

.3 Undervoltage;

.4 Analogue input signal reference loss;

.5 External fault.

.15 Additional built-in protection circuits include:

.1 Overcurrent trip limit;

.2 Undervoltage trip limit;

.3 Microprocessor fault;

.4 Keypad control panel loss;

.5 Serial communication loss;

.6 External fault interlock inputs;

.7 Adjustable output frequency and motor speed limits;

.8 Pass code parameter change protection;

.9 Keypad operator control lockout.

2.6 ELECTRONIC BYPASS

.1 Electronic bypass system to be a fully operational horsepower rated manual and automatic system for full speed operation without VFD, with following components and features:

.1 factory wired and tested microprocessor controlled bypass system consisting of an output contactor and bypass contactor, service (isolation) switch and VFD input fuses; (bypass designs, which have no VFD only fuses, or that incorporate fuses common to both VFD and bypass will not be accepted);

.2 bypass enclosure door and VFD enclosure to be interlocked such that input power is turned off before either enclosure can be opened;

.3 door interlocked padlockable disconnect switch that disconnects all input power from drive and all internally mounted devices;

.4 following operators:

.1 bypass Hand-Off-Auto;

.2 drive mode selector and light;

.3 bypass mode selector and light;

.4 bypass fault reset;

.5 bypass LCD display, 2 lines for programming and status / fault / warning indications.

.5 motor protection from single phase power conditions; bypass system to detect a single phase input power condition while running in bypass, disengage motor in a controlled fashion, and give a single phase input power indication;

.6 bypass system does not depend on VFD for bypass operation; bypass to be completely functional in both Hand and Automatic modes even if VFD is removed from enclosure for repair / replacement;

.7 run permissive circuit - for damper or valve control; dry contact closure that will signal damper to open (VFD motor does not operate); when damper is fully open, a normally open dry contact (end-switch) closes; closed end-switch is wired to a VFD digital input and allows motor operation; two separate safety interlock inputs, when either is opened, motor to coast to stop, and damper to close;

.8 bypass control to monitor status of VFD and bypass contactors and indicate when there is a welded contactor contact or open contactor coil; this failed contactor operation to be indicated on Bypass LCD display as well as over serial communications protocol;

.9 bypass control to include a programmable time delay for bypass start and control panel indication that this time delay is in process; this allows VAV boxes to be driven open before motor operates at full speed in bypass mode; time delay to be field programmable from 0-120 seconds;

.10 bypass control to be programmable for manual or automatic transfer to bypass; user to be able to select via control panel programming which drive faults will generate an automatic transfer to bypass and which faults require a manual transfer to bypass;

.11 adjustable motor current sensing circuit for bypass and VFD mode to provide proof of flow indication; condition is indicated on control panel display, transmitted over building automation protocol and on a relay output contact closure;

.12 programmable digital inputs, and programmable Form-C relay outputs;

.13 relay outputs from bypass to be programmable for any of following indications:

.1 system started;

.2 system running;

.3 bypass override enabled;

.4 drive fault;

.5 bypass fault;

.6 bypass H-O-A position;

.7 motor proof of flow (broken belt);

.8 overload;

.9 bypass selected;

.10 bypass run;

.11 system started (damper opening);

.12 bypass alarm;

.13 over temperature.

.14 digital inputs for system accept 24 VAC or 24 VDC; bypass incorporates internally sourced power supply and does not require an external control power source; bypass power board to supply 250 mA of 24 VDC for use by others to power external devices;

.15 interlock terminal strip: provide a separate terminal strip for connection of freeze, fire, smoke contacts, and external start command; external safety interlocks to remain fully functional whether system is in VFD or bypass mode; remote start/stop contact to operate in VFD and bypass modes; terminal strip allows for independent connection of up to four (4) unique safety inputs;

.16 User is able to select text to be displayed on keypad when safety opens; example text display indications include "Firestat", "Freezestat", "Over pressure" and "Low pressure"; user is able to determine which of four (4) safety contacts is open over serial communications connection;

.17 Class 10, 20, or 30 (selectable) electronic motor overload protection is included as required for specific applications.

2.7 MANUAL BYPASS

.1 Bypass system to be a fully operational horsepower rated manual system for full speed operation without VFD, with following components:

.1 VFD and By-pass output contactors, mechanically and electrically interlocked to allow only one mode of operation at one time;

.2 service switch or contactor to isolate VFD from supply;

.3 VFD input fuses;

.4 door mounted VFD/OFF/BY-PASS selector switch;

.5 VFD ON and BY-PASS ON indicator lights;

.6 door mounted HAND/OFF/AUTO switch if Hand operation is unavailable at VFD control panel;

.7 terminals for external customer safety interlocks.

.2 Bypass designs, which have no VFD only fuses, or that incorporate fuses common to both VFD and bypass are not acceptable.

.3 Door interlocked padlockable fused disconnect switch that supplies power to VFD and bypass, and disconnects input power from drive, bypass and all internally mounted devices.

2.8 COMMUNICATIONS

.1 VFD to be complete with communications connections of integrated RS-485 port suitable to allow for VFD to be controlled, supervised, monitored and programmed from one remote control panel or PC with VFD system Windows based application software.

.2 Communications protocol to be industry standard compatible to BAS of building. Coordinate exact requirements with Mechanical Divisions controls contractor and BAS vendor to ensure that appropriate interface module is supplied for drive system to communicate with BAS being used in building with interface capability to include serial communication standard protocols as follows:

.1 ModBus;

.2 Johnson Controls Metasys N2;

.3 Siemens Building Technologies FLN;

.4 BACnet.

.3 Serial communication to be used for drive setup, diagnostic analysis, monitoring and control with capabilities to include, but not be limited to:

.1 run-stop control;

.2 speed set adjustment;

.3 proportional/integral/derivative PID control adjustments;

.4 current limit;

.5 accel/decel time adjustments;

.6 ability to lock and unlock control panel keypad;

.7 capability of allowing BAS to monitor feedback such as process variable feedback, output speed / frequency, current (in amps), % torque, power (kW), kilowatt hours (resettable), operating hours (resettable), and drive temperature;

.8 monitoring relays output status, and digital input status and analogue output values;

.9 transmitting diagnostic warning and fault information over communications bus to BAS or other monitoring system;

.10 remote fault reset.

.4 Serial communication and Windows based software to be used for drive setup, diagnostic analysis, monitoring and control. Software to provide real time graphical displays of drive performance. VFD software communication capabilities include, but not be limited to:

.1 system ON/OFF;

.2 system status;

.3 Suitable input for speed control;

.4 run-stop control;

.5 ability to force unit to bypass;

.6 ability to lock and unlock control panel keypad;

.7 allowing BAS to monitor feedback such as, current (in amps), kilowatt hours (resettable), operating hours (resettable), and logic board temperature;

.8 monitoring relays output status, and all digital input status;

.9 transmitting diagnostic warning and fault information over communications bus to BAS or other monitoring system;

.10 remote fault reset;

.11 keypad "Hand" or "Auto" selected, and status indications and settings transmitted over serial communications bus;

.12 monitor if motor is running under load in both VFD and bypass (proof of flow) in VFD mode over serial communications or Form-C relay output;

.13 minimum of 40 field parameters to be capable of being monitored in bypass mode.

2.9 SITE SERVICES, TRAINING, AND MAINTENANCE MANUALS

.1 Provide onsite inspection, testing, start up and verification work of VFDs and filters by manufacturer’s authorized technician. Allow a minimum of 1/2 day per system. Also include for a second visit to site of one (1) day duration to train operating personnel in operation and

maintenance of drives. Provide verification reports and supply soft copy of system programming parameters.

.2 Upon completion of installation, supplier of VFDs to supply minimum one hard copy of complete sets of service and maintenance manuals including wiring and connection diagrams. Include for digital copy loaded onto a USB type flash drive.

.3 Provide system training and instructions on operating and maintenance procedures. Refer to additional requirements in General Instructions section and Division 01.

.4 Include for manufacturer's authorized technician to be in attendance to assist Commissioning Agent during commissioning process.

2.10 MANUFACTURERS

.1 Manufacturer List:

.1 ABB;

.2 Schneider Electric (Square D);

.3 Rockwell Automation;

.4 Eaton Cutler Hammer;

.5 Siemens Electric;

.6 Control Techniques.

PART 3 - EXECUTION

3.1 INSTALLATION OF VARIABLE FREQUENCY DRIVES

.1 Provide variable frequency drives for motorized equipment in accordance with drawing requirements. Coordinate requirements for conductors and connections with Electrical Divisions Contractor.

.2 Ensure that variable speed drives supplied are products of same manufacturer.

.3 Unless otherwise noted on drawings or in Part 2 of this Section, include minimally, a manual bypass with each VFD. Supply electronic bypass with VFDs noted and/or scheduled on the drawings.

.4 Ensure wire length between VFD and motor is less than 15 m (50') with properly sized conductors.

.5 Install VFDs in accordance with manufacturer's instructions. Ensure that VFDs installation include upstream protection, either fuses or circuit breakers in accordance with VFD manufacturer's recommendations and local electrical code requirements. Advise Electrical Divisions Contractor of these requirements in addition to required conductors and connections. Provide required control wiring and connections.

.6 Review VFD and related connected motor installation. Provide local disconnect to VFD in accordance with local governing code requirements.

.7 Mount VFDs operating controls/display at approximately 1.5 m (5') above finished floor level, unless otherwise directed by the Consultant. Provide dual back to back C-channel support system from floor to ceiling, complete with cross bracing to form a solid backing for VFD mounting at required locations.

.8 Properly support VFDs. Coordinate exact locations on site with the Consultant.

.9 Where VFDs are required for custom made air handling units VFDs to be supplied, factory mounted on fan cabinets, and "load" side connected to fan motors by air handling unit manufacturer. "Line" side power wiring to these VFDs to be provided as part of Electrical Divisions work.

.10 Where VFDs are required for commercial fans, mount each VFD generally where shown but with exact location to ensure that VFD is accessible in accordance with local governing electrical code requirements. "Line" and "load" side power wiring to these VFD's to be provided as part of Electrical Divisions work.

.11 Where VFDs are required for pumps, mount each VFD generally where shown but with exact location to ensure that VFD is accessible in accordance with local governing electrical code requirements. "Line" and "load" side power wiring to these VFDs to be provided as part of Electrical Divisions work.

.12 Install harmonic mitigation filter equipment as follows:

.1 in accordance with manufacturer's recommended installation practices and to comply with applicable local governing codes;

.2 provide each VFD as specified in per Part 2, with a harmonic filter sized as per manufacturer's rating table to match rating of connected VFD;

.3 mount harmonic filters sized up to 110 kW (150 hp) typically to wall/ceiling construction using suitable brackets, metal C-channel framework and vibration isolators assemblies, ensuring full support of units acceptable to local governing authorities;

.4 mount harmonic filters sized greater than 110 kW (150 hp) typically to floor mounted concrete pads with suitable vibration isolators and seismic restraints in accordance with local governing building codes;

.5 ensure that adequate ventilation and space for access is provided;

.6 review exact locations with the Consultant prior to installation;

.7 coordinate with Electrical Division Contractor to ensure units are connected complete to line side supply feed and to VFD in accordance with VFD manufacturer's instructions for standalone VFDs and VFD system with bypass; include required control wiring and connections.

.13 Ground and bond equipment as per local governing electrical code requirements and manufacturer's instructions.

.14 Provide engraved lamacoid nameplate identifying each piece of equipment. Review exact nomenclature with the Consultant.

.15 Be responsible for ensuring that VFDs, harmonic filters and connected motors are properly installed, connected, tested in proper working order and operation verified.

3.2 INSTALLATION OF VARIABLE FREQUENCY DRIVES

.1 Provide VFDs for motorized mechanical equipment in accordance with drawing requirements and coordinated with mechanical equipment vendors and Mechanical Divisions Contractor.

.2 Ensure that VFDs supplied for project are products of same manufacturer.

.3 Unless otherwise noted on drawings or in Part 2 of this Section, include minimally, a manual bypass with each VFD. Supply electronic bypass with VFDs specifically noted and/or scheduled on drawings.

.4 Supply and install wiring and connections to VFDs and harmonic filters are to recommendations of VFD Manufacturer. Ensure wire length between VFD and motor is less than 15 m (50') with properly sized conductors. Obtain required wiring diagrams from equipment vendors. Provide required control wiring and connections.

.5 Install VFDs in accordance with manufacturer's instructions.

.6 Review VFD and related connected motor installation. Provide local disconnect (fusible switch or breaker) to VFD in accordance with local governing electrical code requirements and VFD manufacturer instructions. Confirm requirements with VFD vendor.

.7 Mount VFDs operating controls/display at approximately 1.5 m (5') above finished floor level, unless otherwise directed by the Consultant. Provide dual back to back C-channel support system from floor to ceiling, complete with cross bracing to form a solid backing for VFD mounting at required locations.

.8 Properly support VFDs. Coordinate exact locations on site with Mechanical Divisions Contractor and review with the Consultant.

.9 Coordinate installation and control of VFDs with Mechanical Division Contractor and Controls Contractor. Confirm communications protocol required for compatibility with BAS and ensure VFD system includes for proper protocol.

.10 Install harmonic mitigation filter equipment as follows:

.1 to be handled, stored and installed in accordance with manufacturer's recommended installation practices and to comply with applicable local governing codes;

.2 provide each VFD as specified in per Part 2, with a harmonic filter sized as per manufacturer's rating table to match rating of connected VFD;

.3 mount harmonic filters sized up to 110 kW (150 hp) typically to wall/ceiling construction using suitable brackets, metal C-channel framework and vibration isolators assemblies, ensuring full support of units acceptable to local governing authorities;

.4 mount harmonic filters sized greater than 110 kW (150 hp) typically to floor mounted concrete pads with suitable vibration isolators and seismic restraints in accordance with local governing building codes;

.5 ensure that adequate ventilation and space for access is provided;

.6 review exact locations with the Consultant prior to installation;

.7 provide required conductors and connections in accordance with filter manufacturer's instructions; obtain required wiring diagrams from equipment vendors;

.8 connect complete to line side supply feed and to VFD in accordance with VFD manufacturer's instructions for standalone VFDs and VFD system with bypass.

.11 Ground and bond equipment as per local governing code requirements and manufacturer's instructions. Refer also to requirements of grounding and bonding article.

.12 Provide engraved lamacoid nameplate identifying each piece of equipment. Review nomenclature with the Consultant.

.13 Be responsible for ensuring that VFDs, harmonic filters and connected motors are properly installed, connected, tested in proper working order and operation verified.

3.3 TESTING, START-UP, AND VERIFICATION

.1 When installation of VFDs are complete, arrange for VFD manufacturer/supplier to:

.1 supply factory authorized technician at site for minimum of 4 hours per system to examine installation and connection of each VFD, and to perform start-up and set-up procedures in conjunction with equipment start-up and testing procedures;

.2 supply factory authorized technician at site for minimum of one 8 hour day to train Owner's personnel on VFD operating and maintenance procedures;

.3 prepare and submit letter to certify that VFDs have been properly installed, tested and adjusted, and are in proper operating condition;

.4 submit list of start-up and testing parameters for uploading for future use by Owner.

.2 Start-up data entries to include motor nameplate power, speed, voltage, frequency and current.

.3 Inspect VFDs and accessories for verification of proper operation and installation.

.4 Inspect interface wiring to BAS for verification of proper operation and installation.

.5 Verification of wire terminations to VFDs and bypass and to operational circuitry.

.6 Installation verification of VFD, bypass and motor being driven for proper operation and reliability.

.7 Verification that connections and communications to BAS or other monitoring/remote control system are of proper operation and installation and of full communications compatibility.

.8 Measurement for verification of proper operation on each of following items:

.1 Motor voltage and frequency;

.2 Verification of proper motor operation;

.3 Control input for proper building automation system interface and control calibration.

.9 Calibration check for following set points (and adjustment as necessary):

.1 minimum speed;

.2 maximum speed;

.3 acceleration and deceleration rates.

.10 Verify harmonic compliance with onsite field measurements of both voltage and current harmonic distortion at point of common coupling-input terminals of harmonic mitigating equipment with and without equipment operating. Utilize recording type Fluke 41 or equivalent harmonics analyser displaying individual and total harmonic currents and voltages.

.11 Document testing and results in a report signed by a Professional Engineer licensed in the Place of Work and authorized by system manufacturer. Include for minimum 3 hard copies and electronic copy of report to be submitted to the Consultant for review.

.12 Additionally, refer to applicable installation, testing, coordination, and verification requirements in Electrical Divisions Sections.

.13 Coordinate procedures specified above to be performed by VFD manufacturer/supplier authorized technician with system commissioning work.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 This Section specifies firestopping and smoke seal requirements that are common to mechanical work Sections of the Specification and it is a supplement to each Section and is to be read accordingly.

1.2 SUBMITTALS

.1 At least 4 weeks prior to work commencing, submit a sample of each type of firestop and smoke seal system in applied form, for approval. Identify each system with manufacturer's name and type, ULC designation, and proposed use. After samples are reviewed, work is to conform to reviewed samples.

.2 Submit a product data sheet and a WHIMIS sheet for each firestopping and smoke seal product.

.3 Submit for review, full company name and experience of proposed firestopping and smoke seal system applicator.

.4 Sleeve and Formed Opening Location Drawings

.1 Prepare and submit for review, drawings indicating size and location of required sleeves, recesses and formed openings in poured or precast concrete work.

.2 Such drawings are to be completely and accurately dimensioned and relate sleeve, recesses, and formed openings to suitable grid lines and elevation datum, and are to take into account structural items such as grade beams, column caps, and column drop slabs.

.3 Begin to prepare such drawings immediately upon notification of acceptance of bid and award of Contract.

1.3 CLOSEOUT SUBMITTALS

.1 Submit a letter of proper firestopping and smoke seal certification as specified in Part 3 of this Section.

1.4 QUALITY ASSURANCE

.1 Applicator is to have a minimum of 3 years of successful experience on projects of similar size and complexity, and applicator's qualifications are to be reviewed by the Consultant.

.2 Comply with firestopping and smoke seal product manufacturer's recommendations regarding suitable environment conditions for product installation.

PART 2 - PRODUCTS

2.1 PIPE SLEEVES

.1 Galvanized Sheet Steel – Minimum 16 gauge galvanized steel with an integral flange at one end to secure sleeve to formwork construction.

.2 Polyethylene – Factory fabricated, flanged, high density polyethylene sleeves with reinforced nail bosses.

.3 Waterproof Galvanized Steel Pipe – Schedule 40 mild galvanized steel pipe with a welded-on square steel anchor and water stop plate at sleeve midpoint.

.4 Galvanized Steel or Cast Iron Pipe – Schedule 40 mild galvanized steel, or Class 4000 cast iron.

2.2 FIRESTOPPING AND SMOKE SEAL MATERIALS

.1 Ensure all sealant and fire stopping is low VOC type in accordance with LEED.

.2 Asbestos-free elastomeric materials tested, listed and labelled by ULC in accordance with CAN/ULC-S115 and CAN/ULC-S101 for installation in ULC designated firestopping and smoke seal systems to provide a positive fire, water and smoke seal, and a fire-resistance rating (flame, hose stream and temperature) not less than fire resistance rating of surrounding fire rated construction.

.3 Materials are to be compatible with abutting dissimilar materials and finishes and complete with primers, damming and back-up materials, supports, and anchoring devices in accordance with firestopping manufacturer's recommendations and ULC tested assembly.

.4 Pipe insulation forming part of a fire and smoke seal assembly is specified in Section entitled Mechanical Insulation.

.5 Manufacturers:

.1 A/D Fire Protection Systems "FIREBARRIER";

.2 Tremco Inc. Fire Protection Systems Group "TREMSTOP";

.3 3M Canada;

.4 Hilti (Canada) Ltd. Firestop Systems;

.5 Specified Technologies Inc.

2.3 WATERPROOFING SEAL MATERIALS

.1 Modular, mechanical seal assemblies consisting of interlocking synthetic rubber links shaped to continuously fill annular space between pipe and pipe sleeve or wall opening, assembled with stainless steel bolts and pressure plates and designed so when bolts are tightened the links expand to seal the opening watertight. Select seal assemblies to suit pipe size and sleeve size or wall opening size.

.2 Manufacturers:

.1 Thunderline Corp. (Power Plant Supply Co.) "LINK SEAL" Model S-316;

.2 The Metraflex Co. "MetraSeal" type ES.

2.4 PIPE ESCUTCHEON PLATES

.1 One-piece chrome plated brass or #4 finish type 302 stainless steel plates with matching screws for attachment to building surface, each plate sized to completely cover pipe sleeve or building surface opening, and to fit tightly around pipe or pipe insulation.

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPE SLEEVES

.1 Where pipes pass through concrete and/or masonry surfaces provide pipe sleeves as follows:

.1 in poured concrete slabs – unless otherwise specified, minimum 16 gauge flanged galvanized steel or, where permitted by governing authorities, factory fabricated plastic sleeves;

.2 in concrete or masonry walls – Schedule 40 galvanized steel pipe or Class 4000 cast iron pipe.

.2 Sleeves in waterproofed slabs or walls are to be lengths of Schedule 40 mild galvanized steel pipe with a waterstop plate in accordance with drawing detail. Provide waterproof sleeves in following locations:

.1 in mechanical room floor slabs, except where on grade;

.2 in slabs over mechanical, fan, electrical and telephone equipment rooms or closets;

.3 in floors equipped with waterproof membranes;

.4 in roof slab;

.5 in waterproof walls.

.3 Size sleeves, unless otherwise specified, to leave 12 mm (½") clearance around pipes, or where pipe is insulated, a 12 mm (½") clearance around pipe insulation.

.4 Pack and seal void between pipe sleeves and pipe or pipe insulation in non-fire rated construction for the length of sleeves as follows:

.1 pack sleeves in interior construction with mineral wool and seal both ends of sleeves with non-hardening silicone base caulking compound;

.2 pack sleeves in exterior walls above grade with mineral wool and seal both ends of sleeves water-tight with approved non-hardening silicone base caulking compound unless mechanical type seals have been specified;

.3 seal sleeves in exterior walls below grade (and any other wall where water leakage may be a problem) with link type mechanical seals as specified.

.5 Where sleeves are required in masonry work, accurately locate and mark sleeve location, and hand sleeves to mason for installation.

.6 Terminate piping for sleeves that will be exposed so sleeve is flush at both ends with building surface so sleeve may be completely covered by an escutcheon plate, except for sleeves in waterproof floors which are to terminate 100 mm (4") above finished floor.

.7 "Gang" type sleeving will not be permitted.

.8 Where sleeves are provided in non-fire rated construction for future piping, or where piping has been removed from existing sleeves, cap and seal both ends of sleeved opening.

3.2 INSTALLATION OF WATERPROOF MECHANICAL SEALS

.1 Provide watertight link type mechanical seals in exterior wall openings.

.2 Assemble and install each mechanical seal in accordance with manufacturer's instructions.

.3 After installation, periodically check each mechanical seal installation for leakage and, if necessary, tighten link seal bolts until seal is completely watertight.

END OF SECTION

PART 1 - GENERAL

1.1 SUBMITTALS

.1 Submit shop drawings/product data sheets for:

.1 pressure gauges and thermometers;

PART 2 - PRODUCTS

2.1 PRESSURE GAUGES AND THERMOMETERS

.1 Pressure gauges as follows:

.1 adjustable, glycerine filled, 100 mm or 115 mm (4" or 4-½") diameter and each accurate to within 1% of scale range;

.2 type 304 stainless steel case with relief valve and polished stainless steel bayonet;

.3 stainless steel rotary movement with stainless steel bushings and socket;

.4 clear acrylic window;

.5 dual scale white dial with a scale range such that working pressure of system is at approximate mid-point of scale;

.6 black pointer.

.2 Pressure gauge accessories and additional requirements as follows:

.1 a bronze ball type shut-off valve is to be provided in the piping to each pressure gauge;

.2 each pressure gauge for piping and equipment with normal everyday flow is to be equipped with a brass pressure snubber;

.3 each pressure gauge for steam piping or steam equipment is to be equipped with a steel coil syphon;

.4 pressure gauges in fire protection piping must be ULC listed and labelled;

.3 Manufacturers:

.1 H.O. Trerice Co.;

.2 Weiss Instruments;

.3 Ashcroft.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Provide pressure gauges in following locations where applicable:

.1 in valved tubing across suction, suction strainer (if applicable), and discharge piping of each circulating pump;

.2 in supply and return piping connections to main mechanical plant equipment such as boilers, chillers, heat exchangers, main coils, etc.;

.3 in expansion tank(s);

.4 in separate domestic hot water storage tank(s);

.5 at top most outlet in each standpipe fire protection system riser;

.6 in piping at each side of a pressure reducing valve;

.7 in potable water service piping downstream of meter;

.8 wherever else shown and/or specified.

.2 Provide thermometers in following locations where applicable:

.1 in supply and return piping connections to main mechanical plant equipment such as boilers, chillers, cooling towers, heat exchangers, main coils, etc., unless temperature indication is supplied with equipment;

.2 wherever else shown and/or specified.

.3 Conform to following installation requirements where applicable:

.1 for installation of thermometers in piping wells, provide a coat of metallic base heat transfer paste or grease in piping well;

.2 for pressure gauges in piping at equipment locations, install pressure gauge between equipment and first pipe fitting;

.3 locate, mount and adjust instruments so they are easily readable;

.4 where pressure gauges and/or thermometers are located at high level or in an area where they cannot be easily seen, provide remote reading instruments.

END OF SECTION

PART 1 - GENERAL

PART 2 - PRODUCTS

2.1 PIPING HANGERS AND SUPPORTS

.1 Pipe hanger and support materials, including accessories, are to be, unless otherwise specified, in accordance with Manufacturers Standardization Society (MSS) Standard Practice Manual SP-58, Pipe hangers and Supports-Materials, Design and Manufacture, and where possible, MSS designations are indicated with each product specified below. Conform to following requirements:

- .1 unless otherwise specified, ferrous hanger and support products are to be electro-galvanized;
- .2 hangers and supports for insulated piping are to be sized to fit around insulation and insulation jacket.

.2 Hangers and supports for horizontal suspended piping as follows:

- .1 adjustable steel clevis hanger – MSS Type 1;
- .2 adjustable swivel ring band hanger – MSS Type 10;
- .3 adjustable roller hanger – MSS Types 41, 43, and/or 45, with MSS Type 39 steel protection saddle.

.3 Supports for horizontal pipe on vertical surfaces as follows:

- .1 steel offset pipe clamp – Anvil Fig. 103 or Myatt Fig. 170;
- .2 heavy-duty steel pipe clip – MSS Type 26;
- .3 single steel pipe hook – Myatt Fig. 156;
- .4 epoxy coated steel pipe stays are not permitted.

.4 Floor supports for vertical risers as follows:

- .1 copper tubing riser clamp – MSS Type 8;
- .2 heavy-duty steel riser clamp – MSS Type 8.

.5 Supports for vertical piping on vertical surfaces as follows:

- .1 steel offset pipe clamp – Anvil Fig. 103 or Myatt Fig. 170;
- .2 heavy-duty steel pipe bracket or soil pipe bracket – MSS Type 26;
- .3 extension split pipe clamp – MSS Type 12;
- .4 epoxy coated steel pipe stays are not permitted.

.6 Base support for vertical risers in excess of 6 m (20') high extending out from base mounted equipment is to consist of a base elbow support with flange.

.7 For horizontal pipe on racks, Unistrut or equal galvanized steel pipe racks with pipe securing hardware as follows:

- .1 standard galvanized steel U-bolts/clamps supplied by rack manufacturer;
- .2 adjustable roller chair – MSS Type 44 with MSS Type 39 steel protection saddle.

.8 Special hangers and supports for various applications as follows:

- .1 vibration isolated riser supports – black steel riser clamps as specified above, complete with neoprene–steel–neoprene sandwich type vibration isolation pads between clamp and floor;

.2 for groups of pipes having same slope – MSS Type 32 welded steel brackets, Anvil Fig. 46 universal trapeze assemblies, or Unistrut or equal support assemblies, all with U-bolts, clamps, etc., to secure pipes in place;

.3 for sections of piping connected to vibration isolated equipment – hangers and supports as specified above but complete with MSS Type 48 spring cushions;

.4 for piping on existing roof – Portable Pipe Hangers (Canada) Inc. "PP" Series prefabricated portable pipe support system components to suit pipe, complete with required accessories including bases, galvanized structural steel frames, and galvanized steel pipe hangers and supports conforming to MSS SP-58;

[OR]

.5 for piping on new roofs – Lexcor "Flash-Tite" or Thaler Roofing Specialties Products Inc. "MERS" Series insulated aluminum support risers with diameter, height, securement method and flashing to suit the application, channel type aluminum cross members, and galvanized steel pipe hangers and supports conforming to MSS SP-58, complete with all required accessories;

.6 for glass drain and vent piping – special padded hangers supplied by pipe supplier;

.7 for plastic piping – generally as specified above but in accordance with pipe manufacturer's recommendations;

.8 for fire protection piping – generally as above but ULC listed and/or FM approved, and in accordance with Chapter requirements of NFPA Standard applicable to piping system;

.9 for bare horizontal copper piping – generally as above but factory vinyl coated to prevent direct copper/steel contact;

.10 for bare copper vertical piping – corrosion resistant ferrous clamps with flexible rubber gasket type material (not tape) to isolate pipe from clamp;

.11 insulation protection shields to and including 40 mm (1-½") dia. – MSS Type 40 galvanized steel shields with ribs to keep shield centred on hanger.

.9 Hanger rods are to be electro-galvanized carbon steel (unless otherwise specified), round, threaded, to ASTM A36, complete with captive machine nuts with washers at hangers, sized to suit loading in accordance with Table 3 in MSS SP-58, but in any case, minimum 9.5 mm (3/8") diameter.

.10 Manufacturers:

.1 E. Myatt & Co. Inc.;

.2 Anvil International Inc.;

.3 Empire Industries Inc.;

.4 Hunt Manufacturing Ltd.;

.5 Unistrut Canada Ltd.;

.6 Nibco Inc. "Tolco";

.7 Taylor Pipe Supports.

PART 3 - EXECUTION

3.1 INSTALLATION OF FASTENING AND SECURING HARDWARE

.1 Provide fastening and securing hardware required for mechanical work to maintain installations attached to structure or to finished floors, walls, and ceilings in a secure and rigid manner capable

of withstanding dead loads, live loads, superimposed dead loads, and any vibration of installed products.

.2 Use fasteners compatible with structural requirements, finishes and types of products to be connected. Do not use materials subject to electrolytic action or corrosion where conditions are liable to cause such action.

.3 Where floor, wall or ceiling construction is not suitable to support loads, provide additional framing or special fasteners to ensure proper securement to structure that is to support the products. Provide reinforcing or connecting supports where required to distribute loading to structural components.

.4 Obtain written consent before using explosive actuated fastening devices. If consent is obtained, comply with requirements of CAN/CSA Z166.1 and CAN/CSA Z166.2.

.5 Do not attach fasteners to steel deck without written consent from the Consultant.

3.2 INSTALLATION OF PIPE HANGERS AND SUPPORTS

.1 Provide required pipe hangers and supports.

.2 Provide any additional structural steel channels, angles, inserts, beam champs and similar accessories required for hanging or supporting pipe. Unless otherwise shown or specified, hang or support pipes from structure only.

.3 For insulated pipe, size hanger or support to suit diameter of insulated pipe and install hanger or support on outside of insulation and insulation finish.

.4 Support requirements for underground piping are as follows:

.1 support underground pipe, unless otherwise specified, on a well compacted bed of dry, natural, undisturbed earth free from rocks or protrusions of any kind, or on compacted material as specified;

.2 support underground service piping penetrating building exterior walls or foundations to prevent pipe damage if minor building settlement occurs;

.3 ensure bedding and supports for underground pipes are flat and true and allowances are made for pipe hubs, couplings, or other protrusions so no voids are left between pipe and bedding.

.5 Unless otherwise shown or specified, hang and/or support horizontal pipe above ground by means of hangers and/or supports specified in Part 2 of this Section. Unless otherwise shown or specified, hangers for suspended pipe less than or equal to 25 mm (1") dia. are to be clevis type or adjustable ring type, and hangers for suspended pipe greater than or equal to 40 mm (1-½") dia. are to be adjustable clevis type.

.6 Space hangers and supports in accordance with following:

.1 cast iron pipe – hang or support at every joint with maximum 2.4 m (8') spacing;

.2 plastic pipe – conform to pipe manufacturer’s recommended support spacing;

.3 glass pipe – conform to pipe manufacturer’s recommended support spacing and support requirements;

.4 copper and steel pipe – hang or support at spacing in accordance with following schedule:

Pipe dia.	Max. Spacing Steel	Max. Spacing Copper
to 25 mm (1")	2.4 m (8')	1.8 m (6')
40 mm (1-½")	2.7 m (9')	2.4 m (8')
50 mm (2")	3.0 m (10')	2.7 m (9')
65 mm (2-½")	3.6 m (12')	3.0 m (10')
75 mm (3")	3.6 m (12')	3.0 m (10')
90 mm (3-½")	3.6 m (12')	3.6 m (12')
100 mm (4")	4.2 m (14')	3.6 m (12')
250 mm (10")	6.0 m (20')	
300 mm (12")	6.7 m (22')	

.5 flexible grooved pipe/coupling joint piping – as above but with not less than one hanger or support between joints;

.7 Where pipes change direction, either horizontally or vertically, provide a hanger or support on horizontal pipe not more than 300 mm (12") from elbow, and where pipes drop from tee branches, support tees in both directions not more than 50 mm (2") on each side of tee.

.8 When pipes with same slope are grouped and a common hanger or support is used, space hanger or support to suit spacing requirement of smallest pipe in group and secure pipes in place on common hanger or support.

.9 Provide roller hangers or supports for heat transfer piping greater than or equal to 150 mm (6") diameter and conveying a material 75°C (170°F) or greater to facilitate pipe movement due to expansion and contraction, and at each hanger or support tack weld a steel protection saddle to pipe to protect piping insulation.

.10 Unless otherwise shown or specified, support vertical piping by means of supports specified in Part 2 of this Section, spaced in accordance with following:

.1 support vertical pipes at maximum 3 m (10') intervals or at every floor, whichever is lesser;

.2 for sections of vertical piping with a length less than 3 m (10'), support pipe at least once;

.3 for vertical cast iron plain end pipe (mechanical joint type), secure riser or pipe clamp around pipe under a flange integral with pipe for vertical support purposes, or provide a length of hub and spigot pipe to facilitate proper support;

.4 for vertical steel pipe risers in excess of 3 m (10'), weld shear lugs to pipe to carry load;

.5 for vibration isolated piping risers, provide rubber-steel-rubber vibration isolation pads between riser clamps and floor.

.11 Support piping on the roof as follows:

[OR]

.1 on new roof – supply manufactured roof supports as per Part 2 of this Section to accommodate piping involved and support spacing specified above, and hand supports to roofing trade on roof for installation as part of roofing work, then secure piping in place on supports.

.12 Each hanger, support or securement for horizontal bare copper tubing is to be plastic coated to prevent direct contact between pipe and ferrous hanger. Each wall or floor clamp for vertical bare copper piping is to be isolated from pipe by means of strips of flexible rubber inserts. Use of painted ferrous hangers and supports, including those painted with copper coloured paint, is not acceptable. Site application of tape or other types of isolation is not acceptable.

.13 For insulated horizontal piping less than or equal to 40 mm (1-½") diameter, provide galvanized steel insulation protection shields between insulation and hanger or support. Install shields immediately after pipe is insulated.

.14 Do not support piping from steel deck without written consent from Consultant.

3.3 EQUIPMENT BASES AND SUPPORTS

.1 Unless otherwise specified or required, set floor mounted equipment on minimum 100 mm (4") high reinforced concrete housekeeping pads 200 mm (8") clear of equipment on each side and end, or a minimum of 200 mm (8") from centreline of equipment anchor bolts to edge of the base, whichever is larger. Conform to following requirements:

.1 supply dimensioned drawings and equipment base templates, and provide anchor bolts for proper setting and securing of equipment on pads;

.2 place anchor bolts during concrete pour and be responsible for required levelling, alignment, and grouting of equipment;

.3 as a minimum, use wire mesh reinforcement, however, for pads for large heavy equipment, use reinforcement as per structural drawing details.

.2 For equipment not designed for base mounting, where required, provide welded, cleaned and prime coat painted structural steel stands or supports conforming to following requirements:

.1 provide stands and supports, except those for small equipment, designed by a structural engineer registered in jurisdiction of the work, and submit stamped and signed design drawings with calculations as shop drawings for review;

.2 flange bolt steel stands to concrete housekeeping pads;

.3 seismically restrained stands and supports in accordance with applicable requirements.

.3 Where indicated on mechanical drawings, provide welded, cleaned and prime coat painted structural steel platforms, designed by a structural engineer registered in the jurisdiction of the work, for service access to equipment. Submit stamped and signed design drawings with calculations as shop drawings for review. Conform to following requirements:

.1 platforms in accordance with OHSA requirements and adequately sized, braced, anchored, and, as required, seismically restrained;

.2 flooring equal to Fisher & Ludlow "Tru-Weld" Type 19-4, Borden type W/B (19-W-4), welded steel bar type grating;

.3 support legs constructed of welded Schedule 40 black steel pipe with welded steel cross-bracing, securely anchored and sway braced;

.4 safety guard rails, constructed from minimum 32 mm (1-¼") dia. Schedule 40 black steel pipe, for all platforms and complete with vertical stanchions at maximum 1.2 m (48") centres, top and intermediate horizontal railing, and toe plates at floor;

.5 vertical ladders constructed of Schedule 40 black steel pipe, 25 mm (1") dia. for equal height rungs, 40 mm (1-½") for stringers, anchored to floors and walls and sway braced as required;

.6 ships ladders, used wherever space conditions permit, of welded steel construction, climbing at an approximate 60º angle, and complete with channel iron stringers, open grate equal height risers approximately 165 mm (6-½") wide and factory made by grating manufacturer, handrails, and suitable anchoring and support.

3.4 CONCRETE WORK FOR MECHANICAL EQUIPMENT BASES AND PADS

.1 Unless otherwise specified in Division 03, provide poured concrete work, including reinforcing and formwork, required for mechanical equipment bases/pads. Perform concrete work in accordance with requirements specified in Division 03.

.2 Unless otherwise specified in Division 03, concrete is to be minimum 20,700 kPa ready-mix concrete in accordance with CAN/CSA-A23.1 and the Ontario Building Code.

.3 Submit for review, dimensioned shop drawings, prepared and stamped by a professional structural engineer registered in the jurisdiction of the work, for concrete pads or bases for support of large, heavy equipment. Indicate on shop drawings total weight of pad or base as well as equipment it is provided for, and concrete reinforcing.

.4 Ensure that bases and pads are keyed into the structure to meet seismic restraint requirements where applicable.

[OR]

END OF SECTION

PART 1 - GENERAL

1.1 SUBMITTALS

.1 Submit heating cable and control shop drawings/product data sheets, complete with control schematics.

1.2 CLOSEOUT SUBMITTALS

.1 Submit a start-up certification letter from cable supplier as specified in Part 3 of this section.

.2 Submit certified cable megger test reports as specified in Part 3 of this section.

PART 2 - PRODUCTS

2.1 DOMESTIC HOT WATER TEMPERATURE MAINTENANCE CABLE

.1 Raychem Canada Ltd. "HWAT-Plus", CSA approved, 120 V, 1 phase heating cable sets to maintain temperature in domestic hot water piping, each set as specified/scheduled on drawings and complete with a Raychem AMC-1B thermostat set at 45°C (115°F), and following:

.1 required lengths of "HWAT-P1" self-regulating heating cable;

.2 "RayClic-PC" power connection with end seal per circuit;

.3 "RayClic-T" tee connections with end seals as required for pipe branches;

.4 "RayClic-S" splice connections as required;

.5 GT-66 glass tape to secure cable on pipe, and "Electric Traced" adhesive labels to be secured to pipe insulation.

.6 Complete with integral ground fault protection.

.2 Manufacturers:

.1 Raychem Canada Ltd.;

.2 Dimplex/Chromalox Inc.;

.3 Tyco Thermal Controls/Pyrotenax.

2.2 PIPE FREEZE PROTECTION HEATING CABLE

.1 Raychem Canada Ltd. "XL-Trace-CR" CSA certified, self-regulating piping freeze protection cable sets as specified and/or scheduled on drawings, each set complete with:

.1 required lengths of "XL-TRACE" self-regulating heating cable;

.2 power connection with end seal per circuit;

.3 tee connections with end seals as required for pipe branches;

.4 splice connections as required;

.5 GT-66 glass tape to secure cable on pipe, and "Electric Traced" adhesive labels to be secured to pipe insulation;

.6 pipe temperature sensing thermostat.

.7 Complete with integral ground fault protection.

.8 C910-485 microprocessor-based, single-point commercial heating cable control system with integrated equipment ground-fault protection, BACnet gateway, dry contact alarm output, NEMA 4X fiber reinforced plastic enclosure, 120-277 V 30 A double pole relay.

.2 Manufacturers:

.1 Raychem Canada Ltd.;

.2 Dimplex/Chromalox Inc.;

.3 Tyco Thermal Controls/Pyrotenax.

2.3 ELECTRIC SNOW MELTING CABLE

.1 Raychem Canada Ltd. "ElectroMelt EM2-XR" CSA certified, parallel circuit construction, self-regulating cable consisting of 2 #14 gauge nickel coated copper bus wires embedded in a parallel self-regulating polymer core and covered by a crosslinked dielectric jacket, protected by a tinned-copper braid and a 70 mm (2-3/4") thick modified polyolefin outer jacket, and complete with "ElectroMelt EMK-XJB" junction boxes for power connections and end seal terminations. Additional accessories as follows:

.1 expansion joint kits to permit cable to cross heated surface expansion joints;

.2 splice kits to permit splicing or repairing cable;

.3 for each snow melting area, an anodised aluminium snow melting area caution sign for flush with grade installation.

.4 Complete with integral ground fault protection.

.2 Manufacturers:

.1 Raychem Canada Ltd.;

.2 Dimplex/Chromalox Inc.;

.3 Tyco Thermal Controls/Pyrotenax.

2.4 SNOW MELTING CABLE CONTROL

.1 Raychem Canada Ltd. components as follows:

.1 Model CIT-1, 24 V AC, roof or mast mounting, solid-state, microcontroller design aerial snow sensor to detect falling or blowing precipitation at 3.37°C (38°F) before snow or ice begins to accumulate;

.2 Model APS-4C surface wall mounting snow controller with contactor and integral 30 mA ground fault circuit interrupter, test/reset facility, a relay interface for connection to a building management system, and an adjustable high temperature sensor to protect heating cable from excessive temperature.

.3 Complete with integral ground fault protection.

.2 Manufacturers:

.1 Raychem Canada Ltd.;

.2 Dimplex/Chromalox Inc.;

.3 Tyco Thermal Controls/Pyrotenax.

PART 3 - EXECUTION

3.1 INSTALLATION OF DOMESTIC WATER TEMPERATURE MAINTENANCE CABLE

.1 Supply electric tracing cable sets to maintain temperature of domestic hot water piping.

.2 Hand cable sets and accessories and cable manufacturer's installation instructions to electrical trade at site for installation on piping. Clearly identify piping to be traced. Ensure piping has been pressure tested prior to cable installation and manufacturer's installation instructions are observed.

.3 After cable installation but before application of piping insulation, megger test and commission cable in presence of the Consultant and in accordance with cable manufacturer's installation and operation manual. Replace any damaged or faulty cable, and when satisfactory results have been obtained, submit signed test reports to the Consultant.

.4 When traced piping has been insulated, install "Electrically Traced" labels on opposite sides of pipe at 3 m (10') intervals and in accordance with requirements specified in Section 20 05 00 – Common Work Results for Mechanical.

3.2 INSTALLATION OF FREEZE PROTECTION HEATING CABLE

.1 Supply electric tracing cable sets to prevent piping from freezing.

.2 Hand cable sets and accessories and cable manufacturer's installation instructions to electrical trade at site for installation on piping. Clearly identify piping to be traced. Ensure piping has been pressure tested prior to cable installation and manufacturer's installation instructions are observed.

OR

.3 Mount heat tracing controller as indicated on drawings or within 2 m of start of heat tracing.

.4 After cable installation but before application of piping insulation, megger test and commission cable in presence of the Consultant and in accordance with cable manufacturer's installation and operation manual. Replace any damaged or faulty cable, and when satisfactory results have been obtained, submit signed test reports to the Consultant.

.5 When traced piping has been insulated, install "Electrically Traced" labels on opposite sides of pipe at 3 m (10 ft) intervals and in accordance with requirements specified in Section 20 05 00 – Common Work Results for Mechanical.

.6 When cable installations are complete, check and test operation of each cable set with heater manufacturer's representative, make any required adjustments, and have cable manufacturer certify in writing that cable sets have been properly installed and operate as intended.

3.3 INSTALLATION OF SNOW MELTING SYSTEM CABLE

.1 Supply electric heating cable to prevent ice and snow formation on exterior surfaces.

.2 Hand cable and accessories and cable manufacturer's installation instructions to electrical trade at site for installation on the surfaces. Clearly identify areas to be heated. Ensure surfaces are cleaned and suitable for cable installation prior to cable installation, and manufacturer's installation instructions are observed.

.3 Install snow sensor and connect to snow controller with 24 V wiring in conduit in accordance with sensor manufacturer's instructions and wiring standard of electrical work. Test operation of sensor and controller in presence of cable manufacturer's representative and adjust as required.

.4 After cable installation but before placement of covering surface material, megger test and commission cable in presence of the Consultant and in accordance with cable manufacturer's

installation and operation manual. Replace any damaged or faulty cable, and when satisfactory results have been obtained, submit signed test reports to the Consultant.

.5 Carefully place an aluminium snow melting area caution sign flush with grade at each snow melting area, and coordinate placement with trade constructing finished surface.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 This Section specifies vibration isolation product requirements that are common to mechanical work Sections of the Specification and it is a supplement to each Section and is to be read accordingly.

1.2 RELATED REQUIREMENTS

.1 [Section 13 48 13 – Manufactured Sound and Vibration Control Components: floating floor for mechanical and generator rooms to minimize sound and vibration transmission to spaces below.]

1.3 SUBMITTALS

.1 Submit copies of manufacturer's product data sheets for products specified in this Section. Product data sheets are to include product characteristics, limitations, dimensions, finishes, and installation recommendations.

1.4 CLOSEOUT SUBMITTALS

.1 Submit a letter from vibration isolation manufacturer to certify correct installation of products, as specified in Part 3 of this Section.

1.5 SEISMIC RESTRAINT REQUIREMENTS

.1 Where applicable to the project, for requirements for the use of a Seismic Consultant and seismic restraint requirements required for vibration isolated materials and equipment, refer to Section 20 05 48.16 – Seismic Controls for Mechanical Systems.

PART 2 - PRODUCTS

2.1 GENERAL

.1 Vibration isolation products are to be in accordance with the most recent edition of the ASHRAE Handbook and/or as indicated on drawings, schedules, details, and as specified below.

.2 Springs are to be stable, colour coded, selected to operate at no greater than 2/3 solid load, designed in accordance with Society of Automotive Engineers Handbook Supplement 9 entitled Manual on Design and Application of Helical and Spiral Springs, and with spring diameters in accordance with manufacturer's recommendations to suit static deflection and maximum equipment load.

.3 Steel components of isolation products not exposed to the weather or moisture are to be zinc plated. Steel components of isolation products exposed to the weather or in a damp, moist environment are to be factory painted with rust inhibiting primer and 2 coats of neoprene.

.4 Where weight of isolated equipment may change significantly due to draining or filling with a liquid, vibration isolators are to be equipped with limit stops to limit spring extensions.

.5 Seismic rated isolators and snubbers are to be listed, rated, and approved by State of California Office of Statewide Health and Planning Department (O.S.H.P.D.) and carry an O.S.H.P.D. pre-approved number. Seismic restraints supplied with vibration isolation are to meet requirements specified in Section 20 05 48.16 – Seismic Controls for Mechanical Systems.

.6 Flexible piping connections to vibration isolated equipment are specified in the appropriate piping sections of the Specification.

2.2 ISOLATION PADS

.1 Sandwich type pads, 20 mm (¾") nominal thickness, selected for 3.2 mm (1/8") static deflection unless otherwise specified, consisting of 2 waffle type or ribbed 50 durometer neoprene pads permanently bonded to a minimum 10 gauge steel plate, and complete with rubber bushed bolt holes and equipment anchor bolts with neoprene isolation grommets.

.2 Manufacturers:

.1 Vibro-Acoustics Ltd. Type NSN;

.2 The VMC Group Vibration Mounting & Controls Inc. (Korfund-Dynamics) "SHEAR-FLEX PLATES";

.3 Kinetics Noise Control Vibron Products Group Type NGS/NGD;

.4 Mason Industries Inc. Type SW/S/SW with HG Bolt Insertion Washers;

.5 J. P. America Inc. Type JSJ.

2.3 RUBBER FLOOR ISOLATORS

.1 Captive, bridge bearing quality neoprene mount selected for a minimum 4 mm (0.15") static deflection unless otherwise specified, with an integral ductile iron housing and integral equipment anchor bolt.

.2 Manufacturers:

.1 Vibro-Acoustics Ltd. Type R;

.2 The VMC Group Vibration Mounting & Controls (Korfund-Dynamics) Type RSM;

.3 Kinetics Noise Control Vibron Products Group Type RQ;

.4 Mason Industries Inc. Type BR;

.5 J. P. America Inc. Type TRM.

2.4 SPRING FLOOR ISOLATORS

.1 Seismically rated captive spring mount isolator complete with levelling bolts, upper and lower neoprene spring cups, neoprene cushion, ductile iron housing, neoprene sound pads, and neoprene isolation grommets for securing bolts.

.2 Manufacturers:

.1 Vibro-Acoustics Ltd. Type SFS;

.2 The VMC Group Vibration Mounting & Controls (Korfund-Dynamics) Type AMSR;

.3 Kinetics Noise Control Vibron Products Group Type FLSS;

.4 Mason Industries Inc. Type SSLFH;

.5 J. P. America Inc. Type TSO-C-SC.

2.5 OPEN SPRING MOUNTS

.1 Base mount free-standing assemblies, each complete with a stable colour coded steel spring welded in place, drilled mild steel mounting plate bonded to a ribbed rubber or neoprene acoustical pad, and an external 16 mm (5/8") diameter level adjustment bolt.

.2 Manufacturers:

.1 Vibro-Acoustics Ltd. Type FS;

.2 The VMC Group Vibration Mounting & Controls (Korfund-Dynamics) "Spring-Flex" Type A;

.3 Kinetics Noise Control Vibron Products Group Type FDS;

.4 Mason Industries Inc. Type SLFH;

.5 J. P. America Inc. Type TSO.

2.6 CLOSED SPRING MOUNTS

.1 Base mount free-standing enclosed assemblies, each complete with stable colour coded spring(s), 2 piece cast housing, non-binding rubber horizontal stabilizers, a ribbed rubber or neoprene acoustical pad bonded to base of the closed housing, and an external level adjustment bolt.

.2 Manufacturers:

.1 Vibro-Acoustics Ltd. Type CM;

.2 The VMC Group Vibration Mounting & Controls (Korfund-Dynamics) "Spring-Flex" Types B and C;

.3 Kinetics Noise Control Vibron Products Group Type FLS;

.4 Mason Industries Inc. Type C;

.5 J. P. America Inc. Type TSC.

2.7 TOTALLY RETAINED SPRING MOUNTS

.1 Base mount free-standing enclosed and retained assemblies to limit both vertical and lateral movement of mounted equipment, each complete with stable colour coded spring(s), drilled welded steel housing and top plate, ribbed rubber or neoprene acoustical pad bonded to bottom of housing, vertical limit adjusting hardware, and a level adjustment bolt.

.2 Manufacturers:

.1 Vibro-Acoustics Ltd. Type CSR;

.2 The VMC Group Vibration Mounting & Controls (Korfund-Dynamics) "Spring-Flex" Type MS;

.3 Kinetics Noise Control Vibron Products Group Type SM;

.4 Mason Industries Inc. Type SLRSO;

.5 J. P. America Inc. Type TSR.

2.8 SPRING HANGERS

.1 Welded steel plate housing with top and bottom rod mounting holes and spring retainer, neoprene double deflection isolation element, stable colour coded spring, and heavy-duty rubber washers.

.2 Manufacturers:

.1 Vibro-Acoustics Ltd. Type SHR-SN;

.2 The VMC Group Vibration Mounting & Controls (Korfund-Dynamics) "Spring-Flex" Series HRSA;

.3 Kinetics Noise Control Vibron Products Group. Type SRH;

.4 Mason Industries Inc. Type 30N;

.5 J. P. America Inc. Type TSH.

2.9 NEOPRENE HANGER ISOLATORS

.1 Neoprene double deflection rod isolators with steel housing and hanger rod bushing, selected for a minimum 4 mm (0.15") static deflection unless otherwise specified.

.2 Manufacturers:

.1 Vibro-Acoustics Ltd. Type NH;

.2 The VMC Group Vibration Mounting & Controls (Korfund-Dynamics) Type HR;

.3 Kinetics Noise Control Vibron Products Group Type RH;

.4 Mason Industries Inc. Type HD or WHD;

.5 J. P. America Inc. Type TRH.

2.10 CONCRETE INERTIA TYPE EQUIPMENT BASE

.1 Welded steel bases, each complete with a structural black steel channel frame, concrete reinforcing rods, and brackets for spring mounts welded to frame.

.2 Manufacturers:

.1 Vibro-Acoustics Ltd. Type CIB;

.2 The VMC Group Vibration Mounting & Controls (Korfund-Dynamics) Type CPF;

.3 Kinetics Noise Control Vibron Products Group. Type CIB;

.4 Mason Industries Inc. Type KSL;

.5 J. P. America Inc. Type BCI.

2.11 STEEL EQUIPMENT BASE

.1 Fully welded structural steel equipment and motor support bases, each complete with a wide flange steel frame, full depth cross members, brackets for spring mounts, and adjustable motor slide rails.

.2 Manufacturers:

.1 Vibro-Acoustics Ltd. Type SB;

.2 The VMC Group Vibration Mounting & Controls (Korfund-Dynamics) Type WFB;

.3 Kinetics Noise Control Vibron Products Group Type SFB;

.4 Mason Industries Inc. Type WFSL;

.5 J. P. America Inc. Type BWS (with motor slide rail).

2.12 COMBINATION STEEL/CONCRETE INERTIA EQUIPMENT BASE

.1 Welded steel bases with a structural black steel channel frame, concrete reinforcing rods, bottom sheet steel pan, brackets for spring mounts welded to frame and adjustable motor slide rails.

.2 Manufacturers:

.1 Vibro-Acoustics Ltd. Type CIB (with motor slide rails);

.2 The VMC Group Vibration Mounting & Controls (Korfund-Dynamics) Type WPF (with motor slide rails);

.3 Kinetics Noise Control Vibron Products Group Type CIB (with motor slide rails);

.4 Mason Industries Inc. Type BMK or K;

.5 J. P. America Inc. Type BSI (with motor slide rail).

2.13 SLUNG STEEL BASE

.1 Slung steel bases of structural members with gusset plates welded to ends and complete with adjustable motor slide rails and vertical section size to suit equipment's motor power output.

.2 Manufacturers:

.1 Vibro-Acoustics Ltd. Type SS;

.2 The VMC Group Vibration Mounting & Controls (Korfund-Dynamics) Type CPF;

.3 Kinetics Noise Control Vibron Products Group Type CIB-H;

.4 Mason Industries Inc. Type MSL.

2.14 CONTINUOUS RAIL TYPE ISOLATION FOR ROOF MOUNTED EQUIPMENT

.1 Continuous rooftop isolation shipped completely assembled, consisting of:

.1 galvanized steel sections formed to fit roof curb and associated equipment with a flexible air and weather seal joining upper and lower rail sections;

.2 stable springs, cadmium plated and selected to provide minimum deflection with 50% additional travel to solid;

.3 neoprene cushioned and wind restraints allowing 6 mm (¼") movement before engaging and resisting wind loads in any lateral direction.

.2 Manufacturers:

.1 Vibro-Acoustics Ltd. Vibro-Acoustics Type RTR;

.2 The VMC Group Vibration Mounting and Controls (Korfund-Dynamics) Type RTIR;

.3 Kinetics Noise Control Vibron Products Group Type KSR;

.4 Mason Industries Inc. Type RSC;

.5 J. P. America Inc. Type BRC.

PART 3 - EXECUTION

3.1 INSTALLATION OF VIBRATION ISOLATION MATERIALS

.1 Unless otherwise stated in the drawings, schedules and/or typical details, vibration isolation is to be provided for all mechanical equipment as per the recommendations contained within in the most recent edition of the ASHRAE Handbook.

.2 Supply to vibration isolation product manufacturer or supplier a copy of a "reviewed" shop drawing or product data sheet for each piece of equipment to be isolated and dimensioned pipe layouts of associated piping to be isolated.

.3 Unless otherwise specified, vibration isolation products are to be product of one manufacturer.

.4 Ensure vibration isolation manufacturer coordinates material selections with equipment provided in order to ensure adherence to performance criteria. Allow for expansion and contraction when material is selected and installed.

.5 Unless otherwise indicated, install isolation materials for base mounted equipment on concrete housekeeping pad bases which extend at least over the full base and isolated area of the isolated equipment. Additional requirements are as follows:

.1 block and shim bases level so ductwork and piping connections can be made to a rigid system at proper operating level, before isolated adjustment is made, and ensure there is no physical contact between isolated equipment and building structure;

.2 steel bases are to clear the sub-base by 25 mm (1");

.3 concrete bases are to clear the sub-base by 50 mm (2").

.6 Isolate piping larger than 25 mm (1") dia. directly connected to motorized and/or vibration isolated equipment with 25 mm (1") static deflection spring hangers at spacing intervals in accordance with following:

.1 for pipe less than or equal to 100 mm (4") dia. – first 3 points of support;

.2 for pipe 125 mm (5") to 200 mm (8") dia. – first 4 points of support;

.3 for pipe equal to or greater than 250 mm (10") dia. – first 6 points of support;

.7 First point of isolated piping support is to have a static deflection of twice the deflection of the isolated equipment but maximum 50 mm (2").

.8 Secure top of spring hanger frame rigidly to structure, and do not install spring hangers in concealed locations.

.9 Where it is impossible to use at least 2 spring hangers, provide Senior Flexonics Ltd. Style 102 (or 102-U as required) or equal, twin sphere, moulded rubber flexible connection assemblies, selected by manufacturer and suitable in all respects for intended application, and complete with required nipples and connections to provide proper vibration isolation.

.10 Isolate designated piping risers at floor support points in accordance with drawing detail and/or where indicated on drawings.

.11 Erect roof curb vibration isolation in accordance with instructions shipped with assembly. Match vibration isolation with associated roof top unit and orient isolation as identified by manufacturer to ensure proper loading and optimum performance. Caulk top of roof curb with 2 beads of caulking provided and centre isolation assembly onto roof curb and, unless otherwise noted, screw in place with 50 mm (2") lag screws at 900 mm (36") O.C. Position gasket on top rail or alternatively, caulk with 2 beads of caulking provided and orient and lower roof top unit onto isolation rails and, unless otherwise noted, screw unit into top rail with 25 mm (1") lag screws at 900 mm (36") O.C. After roof top unit is secured in place, but before damageable work is installed, spray each isolated equipment assembly with water and correct any water leaks.

.12 For control wiring connections to vibration isolated equipment ensure flexible metallic conduit with 90° bend is used for conduit 25 mm (1") dia. and smaller, and for conduit larger than 25 mm (1") dia., use Crouse Hinds EC couplings. Connections are to be long enough so that conduit will remain intact if equipment moves 300 mm (12") laterally from its installed position, and flexible enough to transmit less vibration to structure than is transmitted through vibration isolation. Coordinate these requirements with mechanical trades involved. If electrical power connections are not made in a similar manner as part of the electrical work, report this fact to the Consultant.

.13 For requirements pertaining to seismically restrained vibration isolation, refer to Section 20 05 48.16 – Seismic Controls for Mechanical Systems.

.14 Arrange and pay for vibration isolation product manufacturer to visit site to inspect installation of his equipment. Perform revision work required as a result of improper installation. When vibration isolation equipment manufacturer is satisfied with the installation, obtain and submit a letter stating manufacturer has inspected the installation and equipment is properly installed.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 This Section specifies seismic control and restraint requirements that are common to mechanical work Sections of the Specification and it is a supplement to each Section and is to be read accordingly.

1.2 SEISMIC CONSULTANT

.1 Retain and pay for services of an experienced Seismic Consultant who is a registered professional engineer licensed in the jurisdiction of the work and a member in good standing of a Professional Engineers Association in the jurisdiction of the work.

.2 Seismic Consultant is to:

.1 determine proper seismic hazard level, design, recommend, and review proposed mechanical work seismic restraint shop, placement and securing drawings, and sign and stamp drawings prior to submittal for review as specified below;

.2 supervise installation of mechanical work seismic restraint and, when work is complete, certify in writing that seismic restraint work has been installed in accordance with signed, stamped and reviewed drawings;

.3 prepare and submit to Municipality and authorities having jurisdiction, on a form approved by Municipality and authorities having jurisdiction, at the beginning of seismic restraint work and when work is complete, original signed and sealed Letters of Assurance for design, installation, and field review of seismic restraint work.

1.3 SUBMITTALS

.1 Obtain required equipment information and submit manufacturer's shop drawings/product data sheets for restraining devices and steel bases. Include placement data, and details of attachment to both equipment and structure meeting requirements of forces involved. Product data sheets and drawings are to be signed and stamped by Seismic Consultant referred to above.

.2 If requested, submit samples of seismic restraint materials for review.

1.4 CLOSEOUT SUBMITTALS

.1 Submit copies of Seismic Consultant's Letters of Assurance as specified above.

.2 Submit copies of Seismic Consultant and seismic control manufacturer's certification letters as specified in Part 3 of this Section.

1.5 QUALITY ASSURANCE

.1 Seismic restraints are to be designed by a registered professional engineer as specified above, and are to be installed by qualified tradesmen under supervision of and to the approval of the design engineer.

.2 Unless otherwise specified, seismic control and restraints are to be designed in accordance with Code requirements, ANSI/SMACNA Seismic Restraint Manual: Guidelines for Mechanical Systems, SMACNA/ASHRAE Service Restraint Applications CD-ROM, and the P.P.I.C. Manual Guidelines for Seismic Restraints of Mechanical Systems and Plumbing Piping Systems, all of which are to form a part of this Section.

.3 Seismic control and restraints for fire protection piping and equipment are to be in accordance with NFPA requirements. When specified and/or required, design is also to include Factory Mutual requirements.

.4 Restraint products must be tested in an independent testing laboratory, or certified by Seismic Consultant, to confirm restraint products meet requirements of this Section, i.e. dynamic ultimate limit load state as required by Code, "Fail Safe" design, etc. If particular tests are carried out to represent a restraint type, test is to be valid for the full load range of the restraint. Submit such tests or certification when requested.

.5 Seismic control and restraint product manufacturers are to provide required assistance during installation, and, when installation is complete, submit written reports listing any deficiencies to the installation.

PART 2 - PRODUCTS

2.1 GENERAL

.1 Isolation, anchors, bolts, bases, restraints, etc., are to be designed to withstand without failure or yielding, the dynamic G load as specified in Code for the seismic zone in which building is located. Design loads are ultimate limit state loads (1.5 times working load) acting through the centre of gravity of the anchored or restrained equipment. "Fail Safe" designs are acceptable.

.2 For both isolated and non-isolated floor mounted equipment, i.e. tanks, heat exchangers, boilers, etc., design and provide anchors and bolts to withstand, without failure or yielding, a dynamic ultimate limit state load as defined in Code, of the greater of 0.3 g (2.94 m/s^2) or as required by Code, applied horizontally through the centre of gravity.

.3 Where impact forces may be significant, use ductile materials.

.4 Seismic restraining devices factory supplied with equipment are to meet requirements of this Section.

2.2 MANUFACTURERS

.1 Mason Industries Inc.;

.2 Kinetics Noise Control;

.3 Vibro-Acoustics Ltd;

.4 Price Industries Inc.

2.3 SLACK CABLE RESTRAINTS

.1 Aircraft cable galvanized slack cable restraints meeting current requirements of Building Code, sized to suit the application and complete with required cable ties, anchor hardware (selected for a load equal to twice the weight of the equipment), and similar connection accessories.

2.4 ANCHOR BOLTS

.1 Equal to Mason Industries type SAB seismic anchor bolts.

2.5 FLEXIBLE PIPING CONNECTIONS

.1 Flexible piping connectors are to be supplied with seismic restraint materials. Where flexible connections are not specified with piping in other Sections they are to be equal to Mason Industries

twin sphere, non-metallic connectors with hose lengths preset in strict accordance with manufacturer's instructions and to approval of Seismic Consultant, each rated for continuous operation at 1725 kPa at 87.7°C (250 psi at 190°F) or 1380 kPa at 121°C (200 psi at 250°F), and complete with:

.1 nylon tire cord reinforced EPDM body;

.2 ductile iron reinforcing ring and ductile iron screwed or flanged connections as required and to suit piping system operating pressure.

2.6 VIBRATION ISOLATION PRODUCTS

.1 Refer to Section 20 05 48.13 - Vibration Controls for Mechanical Systems.

PART 3 - EXECUTION

3.1 INSTALLATION OF SEISMIC RESTRAINT MATERIALS

.1 Provide seismic restraint for mechanical equipment, piping, and ductwork, including diffusers, grilles, etc., as per requirements of current edition of Building Code and this Section of the Specification.

.2 Following Mechanical Components Restraint Guide is to be used as a general guide only to establish appropriate restraint methods, hardware, and attachments, however, due to differences in construction, size, weight, and configuration of different manufacturer's equipment and variety of ways and means that equipment and components can be installed, specific restraint methods are to be confirmed in the field. Seismic restraint materials and methods are to be reviewed and approved by Seismic Consultant.

.3 Mechanical Component Restraint Guide:

Item	Type of Restraint	Minimum no. of Restraints	Notes
In-line Pumps	SCR	2	Pipe mounted type pump
Pumps Non-Isolated	BTHP	4	Base mount type pump
Pumps Isolated	SNBR	4	Base mount type pump
Expansion Tanks	SCR	4	
D.H.W. Tanks	SCR	4	Attach to removable steel strap yoke
Glycol Tanks	SCR	4	Attach to removable steel strap yoke
Boilers			
- With Base	BTHP	4	
- Without Base	CSSB	4	
Chillers			
- Isolated	SNBR	4	
- Non-Isolated	BTHP	4	

Item	Type of Restraint	Minimum no. of Restraints	Notes
Cooling Towers Closed Circuit Coolers			
- Isolated	SNBR	4	
- Non-Isolated	BTSLPR	4	
Heat Exchangers	BTHP	4	Bolt to custom support frame
Radiant Panels	SCR	4	Per panel section
Unit Heaters	TSR-SCR	4	
Force Flow Heaters	TSR-SCR	4	
AHU's and A/C Units Free Standing			
- With Base	BTHP	4	
- Without base	CSSB	4	
AHU's and A/C Units Suspended			
- Isolated	SCR	4	
- Non-Isolated	SCR	4	
Packaged Rooftop Air Units (all types)			
On roof curb	BTRC	4	Roof curb bolted to roof.
Humidifiers	BTHP	4	Bolt unit to custom stand.
Electronic		4	Bolt stand to housekeeping pad or structure.
Fans – Suspended			
- Isolated	SCR	4	
- Non-Isolated	SCR	4	
Fans – Freestanding			
- Isolated	SNBR	4	
- Non-Isolated	BTHP	4	

Item	Type of Restraint	Minimum no. of Restraints	Notes
Grilles, Registers, Diffusers	SCR	4	Where not bolted to duct (i.e. in tee-bar ceilings)
Airflow Control Valves	SCR	4	Where suspended
Air Compressor Receiver Sets - Isolated - Non-Isolated	BTHP	4	
Piping	SCR TSR	As required	As per Specification
Ductwork	SCR TSR	As required	As per Specification

.4 Legend

Legend	
SCR	Slack cable restraint (bolted to structure)
SNBR	Seismic snubber (bolted to structure)
TSR	Threaded support rod (bolted or clamped to structure)
BTSLPR	Bolt to sleeper (sleeper bolted to structure)
BTHP	Bolt to concrete housekeeping pad (pad to be keyed to structure)
CSSB	Custom steel shoe base (bolted to structure)
BTRC	Bolt to roof curb (roof curb bolted to roof structure)

.5 Provide structural steel bases for equipment unless equipment manufacturer certifies direct attachment capabilities.

.6 Space restraints under equipment so minimum distance between adjacent corner restraints is at least equal to the height of the centre of gravity of the equipment. Include the height of the centre of gravity on shop drawings, otherwise, design for increased forces on supports and submit design calculations with shop drawings. In particular, chillers are to meet this requirement.

.7 Floor mounted isolated equipment is to be installed on 100 mm (4") high concrete housekeeping pads with at least 200 mm (8") clearance between drilled inserts and edges of pads. Ensure housekeeping pads are keyed to structure to resist seismic displacement.

.8 Requirements pertaining to seismic control work are as follows:

.1 execute seismic control and restraint work in accordance with drawing details, reviewed shop drawings, ANSI/SMACNA Seismic Restraint Manual, PIPC Manual: Guidelines for Seismic Restraints of Mechanical Systems and Plumbing Piping Systems, and National Uniform Seismic Installation Guidelines (NUSIG);

.2 seismic control systems are to work in all directions;

.3 fasteners and attachment points are to resist same maximum load as the seismic restraint;

.4 drilled or power driven anchors and fasteners are not permitted;

.5 no equipment, equipment supports or mounts are to fail before failure of structure;

.6 supports of cast iron or threaded pipe are not permitted;

.7 seismic control measures are not to interfere with integrity of firestopping;

.8 equipment is to be bolted to structure, and bolts are to be fitted with isolation washers;

.9 number, size, type, and installation of anchor bolts are to be as recommended by anchor bolt manufacturer and seismic design consultant;

.10 where more than a 3 mm (1/8") differential exists between an anchor or attachment bolt diameter, an anchor and attachment point hole, or an isolator gap attachment bolt and equipment anchor attachment hole, pack air gap with Mason type 0.5 FastSteel reinforced epoxy putty;

.11 hung equipment and pipe hangers are to be fitted with a means of preventing upward movement, and non-isolated equipment and pipe hanger rods are to be fitted with oversized steel washers and nuts above and below hanger or equipment attachment point, locked tight to prevent uplift of equipment or hanger;

.12 where suspended equipment hanger rod length exceeds 50 rod diameters between structure and equipment attachment point, reinforce rods with angle iron to prevent bending due to uplift forces;

.13 seismic control measures are not to jeopardize noise and vibration isolation systems, and 6 mm (¼") to 9 mm (3/8") clearance during normal operation of equipment and systems is to be provided between seismic restraint and equipment;

.14 where hold-down bolts for seismic restraint equipment penetrate roofing membranes coordinate with roofing trade for installation of pitch pockets/"gum cups" and sealing compound to maintain water-tight integrity of roof;

.15 where friction type clamps are used for support of equipment and connecting services, secure clamps to steel work by means of welding or other positive means to prevent slippage or loosening of clamps due to seismic forces.

.9 Provide slack cable restraint assemblies for:

.1 steam piping 32 mm (1-¼") dia. and larger;

.2 fuel gas, fuel oil, medical gas, compressed air and service piping 25 mm (1") dia. and larger;

.3 piping 32 mm (1-¼") dia. and larger located in boiler, fan, chiller, and similar equipment rooms;

.4 horizontal and vertical piping 65 mm (2-½") dia. and larger;

.5 ductwork and duct mounted equipment;

.6 isolated and non-isolated ceiling hung fans, tanks, equipment, etc.;

.7 generator exhaust system(s).

.10 Installation requirements for slack cable restraints include following:

.1 connect slack cable restraints to ceiling hung equipment in such a way that axial projection of wires passes through the centre of gravity of the equipment;

.2 orient restraint wires on ceiling hung equipment at approximately 90º to each other (in plan), and tie back to the ceiling slab at an angle not exceeding 45º to slab;

.3 install cables using appropriate grommets, shackles, and other hardware to ensure alignment of restraints and to avoid bending cables at connection points, and, where feasible, wrap cables directly around pipes as opposed to using collars;

.4 for piping systems, provide transverse slack cable restraints at a maximum spacing of 12.5 m (40'), and longitudinal restraints at 25 m (80') maximum spacing, or as limited by anchor/slack cable performance;

.5 for piping less than 250 mm (10") dia., reduce transverse restraint spacing to 6 m (20'), and note that smaller piping may be rigidly tied to larger piping for restraint, but not the reverse;

.6 vary adjacent spacing of restraints on a piping run by 10% to 30% to avoid coincident resonance;

.7 transverse bracing for one pipe section may also act as longitudinal bracing for piping connected perpendicular to it if bracing is installed within 600 mm (24") of elbow or tee, and if connected piping is same or smaller dia., and note that branch lines are not to be used to restrain main lines;

.8 provide flexibility in piping joints or sleeves where piping penetrates building seismic or expansion joints;

.9 wherever possible, support weight of vertical piping risers at a point or points above the centre of gravity of riser, and provide lateral guides at top and bottom of riser, and at intermediate points not to exceed the transverse spacing specified above for horizontal pipes, with guide clearance not exceeding 3 m (10');

.10 install restraints at least 50 mm (2") clear of other equipment and services;

.11 adjust restraint cables such that they are not visibly slack, or such that flexibility is approximately 40 mm (1-½") under thumb pressure for a 1.5 m (5') cable length, with an equivalent ratio for other cable lengths, and adjust clearance of cable strap/spacer piece restraints so as not to exceed 6 mm (0.23");

.12 provide transverse and axial restraints within 4 m (12') of a vertical bend;

.13 at steel trusses, connect to top chords at panel points and follow truss manufacturer's instructions;

.14 diffusers and grilles mounted in t-bar ceilings or which are not positively secured to ductwork or structure are to be fitted with slack cable restraints to prevent them from falling in the event the ceiling t-bar grid is displaced;

.15 do not bridge vibration isolators with slack cable restraints;

.16 other approved restraint systems are conventional pipe guides, rigid restraint where piping passes through a block or concrete wall, or a cable strap and spacer piece attached to structure and used where piping is adjacent to a wall and conventional slack cable restraints cannot be used.

3.2 INSTALLATION OF FLEXIBLE PIPING CONNECTORS

.1 Supply flexible piping connectors for connections (including plumbing) to seismically restrained equipment. Hand connectors to appropriate piping trade at site for installation.

3.3 SITE INSPECTION AND LETTERS OF CERTIFICATION

.1 When seismic control products have been installed, arrange for seismic control product manufacturer and Seismic Consultant to examine installation of seismic control products and to certify in writing (separate letters) that products have been properly installed in accordance with

governing Codes and Regulations, and recommendations and instructions. Seismic Consultant is to apply his professional stamp to the letter.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Nameplates.

.2 Tags.

.3 Pipe Markers.

1.2 REFERENCES

.1 ASME A13.1 – Scheme for the Identification of Piping Systems.

1.3 SUBMITTALS

.1 Section 01 33 00: Submittals.

.2 Submit list of wording, symbols, letter size, and colour coding for mechanical identification.

.3 Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

.4 Product Data: Provide manufacturers catalogue literature for each product required.

.5 Samples: Submit two labels, tags samples to Consultant for approval.

.6 Manufacturer's Installation Instructions: Indicate special procedures, and installation.

1.4 CLOSEOUT SUBMITTALS

.1 Section 01 77 00: Project Closeout.

.2 Record actual locations of tagged valves.

PART 2 - PRODUCTS

2.1 MECHANICAL WORK IDENTIFICATION MATERIALS

.1 Confirm with the Owner if an existing mechanical work identification system is in place and, if so, match accordingly.

.2 If an existing mechanical work identification system is not in place, the following is to be used:

.1 Equipment nameplates are to be minimum 1.6 mm (1/16") thick 2-ply laminated coloured plastic plates, minimum 12 mm x 50 mm (½" x 2") for smaller items such as damper motors and control valves, minimum 25 mm x 65 mm (1" x 2-½") for equipment, and minimum 50 mm x 100 mm (2" x 4") for control panels and similar items. Additional requirements are as follows:

.1 unless otherwise specified or required, each nameplate is to be white, complete with bevelled edges and black engraved wording to completely identify equipment and its use with no abbreviations;

.2 wording is generally to be as per drawings, i.e. Fan EF-1, and is to include equipment service and building area/zone served, but must be reviewed prior to engraving;

.3 supply stainless steel screws for securing nameplates in place;

.4 nameplates for equipment suspended above floor level or generally not within easy viewing from floor level are to be increased in size so as to be easily readable from floor level.

.2 Valve tags are to be coloured, 40 mm (1-½") square, 2-ply laminated plastic with bevelled edges, red-white, green-white, yellow-black, etc., to match piping identification colour, each complete with a 3.2 mm (1/8") diameter by 100 mm (4") long brass plated steel bead chain, and four lines of engraved maximum size identification wording, i.e.:

VALVE V12
200 mm (8")
CHILL. WATER
NORMALLY
OPEN

.3 Standard pipe identification is to be equal to Smillie McAdams Summerlin Ltd., Brady or Primark Manufacturing Inc. vinyl plastic with indoor/outdoor type vinyl ink lettering and directional arrows, as follows:

.1 for pipe less than or equal to 150 mm (6") diameter, coiled type snap-on markers of a length to wrap completely around pipe or pipe insulation;

.2 for pipe larger than 150 mm (6") diameter, saddle type strap-on markers with 2 opposite identification locations and complete with nylon cable ties.

.4 Identification wording and colours for pipe identification materials are to be as follows:

Pipe Service	Identification Colour	Legend
domestic cold water	green	DOM. COLD WATER
domestic hot water supply	green	DOM. HW SUPPLY
domestic hot water recirculation	green	DOM. HW RECIRC.
tempered domestic water	green	TEMP. DOM. WATER
chilled drinking water	green	CH. DRINK WTR.
storm drainage	green	STORM
sanitary drainage	green	SAN.
plumbing vent	green	SAN. VENT
acid sanitary drainage	yellow	ACID DRAIN
acid drainage vent	yellow	ACID VENT
fire protection standpipe	red	F.P. STANDPIPE
fire protection sprinklers	red	F.P. SPRINKLER
natural gas	to Code	to Code, c/w pressure
natural gas vent	to Code	to Code
propane gas	to Code	to Code, c/w pressure
propane gas vent	to Code	to Code

Pipe Service	Identification Colour	Legend
fuel oil supply	yellow	FUEL OIL SUPPLY
fuel oil return	yellow	FUEL OIL RETURN
fuel oil vent	yellow	FUEL OIL VENT
heating water supply	yellow	HTG. WTR. SUPPLY
heating water return	yellow	HTG. WTR. RETURN
heating water drain	yellow	HTG. WTR. DRAIN
glycol heating supply	yellow	GLY. HTG. SUPPLY
glycol heating return	yellow	GLY. HTG. RETURN
glycol heating drain	yellow	GLY. HTG. DRAIN
glycol heat reclaim return	yellow	GLY. HTG. RECLAIM R.
glycol heat reclaim supply	yellow	GLY. HTG. RECLAIM S.
heat pump geothermal loop – source side supply	green	GEO. LOOP SOURCE SUPPLY
heat pump geothermal loop – source side return	green	GEO. LOOP SOURCE RETURN
heat pump geothermal loop – load side supply	green	GEO. LOOP LOAD SUPPLY
Heat pump geothermal loop – load side return	green	GEO. LOOP LOAD RETURN
condenser water supply	green	COND. WTR. SUPPLY
condenser water return	green	COND. WTR. RETURN
chilled water supply	green	CH. WTR. SUPPLY
chilled water return	green	CH. WTR. RETURN
chilled water drain	green	CH. WTR. DRAIN
low pressure steam	yellow	….kPa STEAM
medium pressure steam	yellow	….kPa STEAM
high pressure steam	yellow	….kPa STEAM
low pressure condensate	yellow	L.P. CONDENSATE
medium pressure condensate	yellow	M.P. CONDENSATE
high pressure condensate	yellow	H.P. CONDENSATE
pumped condensate	yellow	PUMPED CONDENSATE
steam vent	yellow	STEAM VENT
boiler feedwater	yellow	BLR. FEEDWATER

Pipe Service	Identification Colour	Legend
boiler blowdown	yellow	BLR. BLOW-OFF
refrigerant suction	yellow	REFRIG. SUCTION
refrigerant liquid	yellow	REFRIG. LIQUID
refrigerant hot gas	yellow	REFRIG. HOT GAS
diesel engine exhaust	yellow	ENGINE EXHAUST
gasoline	yellow	GASOLINE
distilled water	green	DISTILL. WATER
demineralized water	green	DEMIN. WATER
compressed air (< 700 kPa)	green	….kPa COMP. AIR
compressed air (>700 kPa)	yellow	….kPa COMP. AIR
control air	green	CONTROL AIR

.5 Colours for pipe identification legends and directional arrows are to be as follows:

Identification Colour	Legend and Arrow Colour
yellow	black
green	white
red	white

.6 Duct identification is to be custom made Mylar stencils with 50 mm (2") high lettering to accurately describe duct service, i.e. "AHU-1 SUPPLY", complete with a directional arrow, and coloured ink with ink pads and roller applicators. Ink colour is generally to be black but must contrast with lettering background.

PART 3 - EXECUTION

3.1 PREPARATION

.1 Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

.1 Identify new exposed piping and ductwork as per Part 2 of this Section in locations as follows:

.1 at every end of every piping or duct run;

.2 adjacent to each valve, strainer, damper and similar accessory;

.3 at each piece of connecting equipment;

.4 on both sides of every pipe and duct passing through a floor, wall or partition, unless otherwise specified;

.5 at 6 m (20') intervals on pipe and duct runs exceeding 6 m (20') in length;

.6 at least once in each room, and at least once on pipe and duct runs less than 6 m (20') in length.

.2 Unless otherwise specified identify new concealed piping and ductwork as per Part 2 of this Section in locations as follows:

.1 at points where pipes or ducts enter and leave rooms, shafts, pipe chases, furred spaces, and similar areas;

.2 at maximum 6 m (20') intervals on piping and ductwork above suspended accessible ceilings, and at least once in each room;

.3 at each access door location;

.4 at each piece of connected equipment, automatic valve, etc.

.3 Provide an identification nameplate for equipment provided as part of this project, including items such as control valves, motorized dampers, instruments, and similar products. Secure nameplates in place, approximately at eye level if possible, with stainless steel screws unless such a practice is prohibitive, in which case use epoxy cement applied to cleaned surfaces. Locate nameplates in the most conspicuous and readable location.

.4 Paint new natural and/or propane gas piping with primer and 2 coats of yellow paint in accordance with Code requirements. Identify piping at intervals as specified above.

.5 Provide an identification nameplate for each motor starter or disconnect switch located in a motor control centre or on a motor starter panel, and on each individually mounted starter provided as part of mechanical work, and on each disconnect switch provided as part of the electrical work for motorized equipment provided as part of mechanical work.

.6 For electrically traced mechanical work, identification wording is to include "ELECTRICALLY TRACED".

.7 Tag valves and prepare a valve tag chart in accordance with following requirements:

.1 attach a valve tag to each new valve, except for valves located immediately at equipment they control;

.2 prepare a digital valve tag chart to list tagged valves, with, for each valve, the tag number, location, valve size, piping service, and valve attitude (normally open or normally closed);

.3 if an existing valve tag chart is available at site, valve tag numbering is to be an extension of existing numbering and new valve tag chart is to incorporate existing chart;

.4 include a copy of valve tag chart in each copy of operating and maintenance instruction manuals.

.8 Where shut-off valves, control dampers, sensors, and similar items which will or may need maintenance and/or repair are located above accessible suspended ceilings, provide round coloured ceiling tacks in ceiling panel material, or stickers equal to Brady "Quick Dot" on ceiling grid material to indicate locations of items. Unless otherwise specified, ceiling tack or sticker colours are to be as follows:

.1 HVAC piping valves and equipment: yellow

.2 fire protection valves and equipment: red

.3 plumbing valves and equipment: green

.4 HVAC ductwork dampers and equipment: blue

.5 control system hardware and equipment: orange

END OF SECTION

Updated through ADD#14

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 This Section specifies mechanical system testing, adjusting, and balancing requirements that are common to mechanical work Sections of the Specification and it is a supplement to each Section and is to be read accordingly.

1.2 DEFINITIONS

.1 “Agency” – means agency to perform testing, adjusting, and balancing work.

.2 “TAB” – means testing, adjusting, and balancing to determine and confirm quantitative performance of equipment and systems and to regulate specified fluid flow rate and air patterns at terminal equipment, e.g., reduce fan speed, throttling, etc.

.3 “hydronic systems” – includes heating water, chilled water, glycol-water solution, condenser water, and any similar system.

.4 “air systems” – includes outside air, supply air, return air, exhaust air, and relief air systems.

.5 “flow rate tolerance” – means allowable percentage variation, minus to plus, of actual flow rate values in Contract Documents.

.6 “report forms” – means test data sheets arranged for collecting test data in logical order for submission and review, and these forms, when reviewed and accepted, should also form permanent record to be used as basis for required future testing, adjusting, and balancing.

.7 “terminal” – means point where controlled fluid enters or leaves the distribution system, and these are supply inlets on water terminals, supply outlets on air terminals, return outlets on water terminals, and exhaust or return inlets on air terminals such as registers, grilles, diffusers, louvers, and hoods.

.8 “main” – means duct or pipe containing system’s major or entire fluid flow.

.9 “submain” – means duct or pipe containing part of the systems’ capacity and serving 2 or more branch mains.

.10 “branch main” – means duct or pipe servicing 2 or more terminals.

.11 “branch” – means duct or pipe serving a single terminal.

1.3 SUBMITTALS

.1 Within 30 days of work commencing at site, submit name and qualifications of proposed testing and balancing agency in accordance with requirements of article entitled Quality Assurance below.

.2 Submit sample test forms, if other than those standard forms prepared by Associated Air Balance Council (AABC) or National Environmental Balancing Bureau (NEBB), are proposed for use.

.3 Submit a TAB plan by Agency to indicate Agency’s evaluation of mechanical drawings with respect to service routing and location or lack of balancing devices. Include set of drawings used and marked-up by Agency to prepare report.

1.4 CLOSEOUT SUBMITTALS

.1 Submit a report by Agency after each site visit made by Agency during construction phase of this Project.

.2 Submit a draft report, as specified in Part 3 of this Section.

.3 Submit a final report, as specified in Part 3 of this Section.

.4 Submit a testing and balancing warranty as specified in Part 3 of this Section.

.5 Submit reports listing observations and results of post construction site visits as specified in Part 3 of this Section.

1.5 QUALITY ASSURANCE

.1 Employ services of an independent testing, adjusting, and balancing agency meeting qualifications specified below, to be single source of responsibility to test, adjust, and balance building mechanical systems to produce design objectives. Agency is to have successfully completed testing, adjusting, and balancing of mechanical systems for a minimum of 5 projects similar to this Project within past 3 years, and is to be certified as an independent agency in required categories by one of following:

.1 AABC – Associated Air Balance Council;

.2 NEBB – National Environmental Balancing Bureau.

.2 NBCTA certification in lieu of the above noted organizations is not permitted.

.3 Testing, adjusting, and balancing of complete mechanical systems is to be performed over entire operating range of each system in accordance with one of following publications:

.1 National Standards for a Total System Balance published by Associated Air Balance Council;

.2 Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems published by National Environmental Balancing Bureau;

.3 Chapter 37, Testing, Adjusting, and Balancing of ASHRAE Handbook HVAC Applications.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 SCOPE OF WORK

.1 Perform total mechanical systems testing, adjusting, and balancing. Requirements include measurement and establishment of fluid quantities of mechanical systems as required to meet design specifications and comfort conditions, and recording and reporting results.

.2 Mechanical systems to be tested, adjusted, and balanced include:

.1 TAB of domestic water systems (all piping extended from Municipal main) is to include:

.1 domestic hot water recirculation piping;

.2 tempered water piping flows.

.2 TAB of fuel oil system is to include supply and return oil flows as applicable, and is to be in accordance with requirements of CAN/CSA B139.

.3 TAB of heating systems is to include piping and equipment fluid temperatures, flows and control, and if TAB is not done during heating season, a follow-up site visit during heating season will be required to confirm proper flows and temperatures, and any required system "fine tuning".

.4 TAB of cooling systems is also to include piping and equipment fluid temperatures, flows and control, and if TAB is not done during cooling season, a follow-up site visit during cooling season will be required to confirm proper flows and temperatures, and any required system "fine tuning".

.5 TAB of air handling systems is to include equipment and ductwork air temperatures, capacities, and flows.

3.2 TESTING, ADJUSTING, AND BALANCING

.1 Conform to following:

.1 as soon as possible after award of Contract, Agency is to carefully examine a set of mechanical drawings with respect to routing of services and location of balancing devices, and is to issue a report listing results of the evaluation;

.2 set of drawings examined by Agency is to be returned with evaluation report, with red line mark-ups to indicate locations for duct system test plugs, and required revision work such as relocation of balancing devices and locations for additional devices;

.3 after review of mechanical work drawings and specification, Agency is to visit site at frequent, regular intervals during construction of mechanical systems, to observe routing of services, locations of testing and balancing devices, workmanship, and anything else that will affect testing, adjusting, and balancing;

.4 after each site visit, Agency is to report results of site visit indicating date and time of visit, and detailed recommendations for any corrective work required to ensure proper adjusting and balancing;

.5 testing, adjusting, and balancing is not to begin until:

.1 building construction work is substantially complete and doors have been installed;

.2 mechanical systems are complete in all respects, and have been checked, started, adjusted, and then successfully performance tested.

.6 mechanical systems to be tested, adjusted and balanced are to be maintained in full, normal operation during each day of testing, adjusting, and balancing;

.7 obtain copies of reviewed shop drawings of applicable mechanical plant equipment and terminals, and temperature control diagrams and sequences;

.8 Agency is to walk each system from system "head end" equipment to terminal units to determine variations of installation from design, and system installation trades will accompany Agency;

.9 Agency is to check valves and dampers for correct and locked position, and temperature control systems for completeness of installation before starting equipment;

.10 wherever possible, Agency is to lock balancing devices in place at proper setting, and permanently mark settings on devices;

.11 Agency is to leak test ductwork as specified in Section entitled HVAC Air Distribution in accordance with requirements of SMACNA "HVAC Air Duct Leak Test Manual", coordinate work with work of aforementioned Sections, provide detailed sketch(es) to Sheet Metal

Contractor and Consultant identifying ductwork not in accordance with acceptable leakage values specified in aforementioned Sections, and retest corrected ductwork;

.12 Agency is to balance systems with due regard to objectionable noise which is to be a factor when adjusting fan speeds and performing terminal work such as adjusting air quantities, and should objectionable noise occur at design conditions, Agency is to immediately report problem and submit data, including sound readings, to permit an accurate assessment of noise problem to be made;

.13 Agency is to check supply air handling system mixing plenums for stratification, and where variation of mixed air temperature across coils is found to be in excess of ±5% of design requirements, Agency is to report problem and issue a detail sketch of plenum baffle(s) required to eliminate stratification;

.14 Agency is to perform testing, adjusting, and balancing to within ±5% of design values, and make and record measurements which are within ±2% of actual values;

.15 for air handling systems equipped with air filters, test and balance systems with simulated 50% loaded (dirty) filters by providing a false pressure drop;

.16 test, adjust and balance air conditioning systems during summer season and heating systems during winter season, including at least a period of operation at outside conditions within 2.8°C (5°F) wet bulb temperature of maximum summer design condition, and within 5.5°C (10°C) dry bulb temperature of minimum winter design condition, and take final temperature readings during seasonal operation.

.2 Prepare reports as indicated below.

.1 Upon completion of testing, adjusting, and balancing procedures, prepare draft reports on AABC or NEBB forms. Draft reports may be hand written, but must be complete, factual, accurate, and legible. Organize and format draft reports in same manner specified for final reports and submit for review.

.2 Upon verification and approval of draft reports, prepare final reports organized and formatted as specified below. Use units of measurement (SI or Imperial) as used on Project Documents.

.3 Report forms are to be those standard forms prepared by the referenced standard for each respective item and system to be tested, adjusted, and balanced. Report forms complete with schematic systems diagrams and other data are to be consolidated in electronic format as a PDF. PDF file to be indexed and organized into sections, as it applies to the project, as follows:

.1 General Information and Summary;

.2 Air Systems;

.3 Hydronic Systems;

.4 Temperature Control Systems;

.5 Special Systems.

.4 Agency is to provide following minimum information, forms, and data in report:

.1 inside cover sheet to identify Agency, Contractor, and Project, including addresses, and contact names and telephone numbers and a listing of instrumentation used for procedures along with proof of calibration;

.2 remainder of report is to contain appropriate forms containing as a minimum, information indicated on standard AABC or NEBB report forms prepared for each respective item and system;

.3 Agency is to include for each system to be tested, adjusted and balanced, a neatly drawn, identified (system designation, plant equipment location, and area served) schematic "as-built" diagram indicating and identifying equipment, terminals, and accessories;

.4 Agency is to include report sheets indicating building comfort test readings for all rooms.

.3 After final testing and balancing report has been submitted, Agency is to visit site with Contractor and Consultant to spot check results indicated on balancing report. Agency is to supply labour, ladders, and instruments to complete spot checks. If results of spot checks do not, on a consistent basis, agree with final report, spot check procedures will stop and Agency is to then rebalance systems involved, resubmit final report, and again perform spot checks with Contractor and Consultant.

.4 When final report has been accepted, Contractor is to submit to Owner, in name of Owner, a certificate equal to AABC National Guaranty Certification or a NEBB Quality Assurance Program Bond, and in addition, Contractor is to submit a written extended warranty from Agency covering one full heating season and one full cooling season, during which time any balancing problems which occur, with exception of minor revision work done during scheduled site visits, will, at no cost, be investigated by Agency and reported on to Owner, and if it is determined that problems are a result of improper testing, adjusting, and balancing, they are to be immediately corrected without additional cost to Owner.

.5 After acceptance of final report, Agency is to perform post testing and balancing site visits in accordance with following requirements:

.1 post testing and balancing site visits are to be made:

.1 once during first month of building operation;

.2 once during third month of building operation;

.3 once between fourth and tenth months in a season opposite to first and third month visit.

.2 during each return visit and accompanied by Owner’s representative, Agency is to spot rebalance terminal units as required to suit building occupants and eliminate complaints;

.3 Agency is to schedule each visit with Contractor and Owner, and inform Consultant;

.4 after each follow-up site visit, Agency is to issue to Contractor and Consultant a report indicating any corrective work performed during visit, abnormal conditions and complaints encountered, and recommended corrective action.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 This Section specifies insulation requirements common to Mechanical Divisions work Sections and it is a supplement to each Section and is to be read accordingly.

1.2 DEFINITIONS

.1 "concealed" – means mechanical services and equipment above suspended ceilings, in non-accessible chases, in accessible pipe spaces, and furred-in spaces.

.2 "exposed" – means exposed to normal view during normal conditions and operations.

.3 "mineral fibre" – includes glass fibre, rock wool, and slag wool.

.4 "domestic water" or "potable water" – means piping extended from building Municipal supply main.

1.3 SUBMITTALS

.1 At least 4 weeks prior to insulation work commencing, submit a sample of each type of insulation (and insulation accessories and finish), in applied form, for review. Mount samples on a plywood board. Identify each product with manufacturer’s name and insulation type, and proposed use of insulation. When sample board has been approved, mechanical insulation work is to conform to approved sample board.

.2 Submit a product data sheet for each insulation system product.

.3 Submit a fabrication drawing for each custom made cover to indicate material and fabrication details, and a 300 mm (12") square sample of proposed cover material.

.4 Submit a colour chart for coloured lagging adhesive for canvas jacketed insulation.

1.4 CLOSEOUT SUBMITTALS

.1 In accordance with Part 3 of this Section, submit a letter from fire rated duct wrap supplier to certifying duct wrap has been properly installed.

1.5 QUALITY ASSURANCE

.1 Mechanical insulation is to be applied by a licensed journeyman insulation mechanic, or by an apprentice under direct, daily, on-site supervision of a journeyman mechanic.

.2 Do not apply insulation unless leakage tests have been satisfactorily completed.

.3 Ensure surfaces to be insulated are clean and dry.

.4 Ensure ambient temperature is minimum 13°C (55°F) for at least 1 day prior to application of insulation, and for duration of insulation work, and relative humidity is and will be at a level such that mildew will not form on insulation materials.

.5 Company with sub-contract for mechanical insulation work is to be a member in good standing of Thermal Insulation Association of Canada.

.6 Insulation materials must be stored on site in a proper and dry storage area. Any wet insulation material is to be removed from site.

PART 2 - PRODUCTS

2.1 FIRE HAZARD RATINGS

.1 Unless otherwise specified, insulation system materials inside building must have a fire hazard rating of not more than 25 for flame spread and 50 for smoke developed when tested in accordance with CAN/ULC-S102, Surface Burning Characteristics of Building Materials and Assemblies.

2.2 THERMAL PERFORMANCE

.1 Unless otherwise specified, thermal performance of insulation is to meet or exceed values given in Tables entitled Minimum Piping Insulation Thickness Heating and Hot Water Systems and Minimum Piping Insulation Thickness Cooling Systems, as stated in ANSI/ASHRAE/IES Standard 90.1 version referenced in Ontario Building Code.

2.3 PIPE INSULATION MATERIALS

.1 Horizontal pipe insulation at hangers and supports are to be equal to Belform Insulation Ltd. "Koolphen K-Block" insulated pipe support inserts consisting of minimum 150 mm (6") long, pre-moulded, rigid, sectional phenolic foam insulation (of same thickness as adjoining insulation) with a reinforced foil and kraft paper vapour barrier jacket and a captive galvanized steel saddle.

.2 Flexible foam elastomeric is to be closed cell, sleeve type, longitudinally split self-seal, foamed plastic pipe insulation with a water vapour transmission rating of 0.10 in accordance with ASTM E96, Procedure B, and required installation accessories.

.1 Manufacturers:

.1 Armacell AP/Armaflex SS;

.2 IK Insulation Group K-Flex "LS" Self-Seal Pipe Insulation.

.3 Closed cell foamed glass is to be Owens Corning "FOAMGLASS", expanded, sectional, rigid sleeve type insulation with a liquid or vapour permeability rating (as per ASTM C240) of 0.00, and a factory applied "PITTWRAP SSII" self-sealing jacket and protective metal cladding.

.4 Premoulded mineral wool is to be rigid, sectional, sleeve type, non-combustible, longitudinally split mineral wool, or basalt pipe insulation with a reinforced vapour barrier jacket.

.1 Manufacturers:

.1 Roxul "Techton 1200";

.2 IIG (Johns Manville Inc.) MinWool-1200;

.3 Paroc 1200.

.5 Fire rated pre-moulded mineral wool is to be non-combustible, fire-rated, rigid, sectional, longitudinally split mineral wool or basalt pipe insulation with a reinforced vapour barrier jacket and compatible with CAN/ULC-S115 and CAN/ULC-S101 firestopping.

.1 Manufacturers:

.1 Roxul "Techton 1200";

.2 IIG (Johns Manville Inc.) MinWool-1200;

.3 Paroc 1200.

.6 Pre-moulded mineral fibre is to be rigid, sectional, sleeve type insulation to ASTM C547, with a factory applied vapour barrier jacket.

.1 Manufacturers:

.1 Johns Manville Inc. "Micro-Lok AP-T Plus";

.2 Knauf Fiber Glass "Pipe Insulation" with "ASJ-SSL" jacket;

.3 Manson Insulation Inc. "ALLEY K APT";

.4 Owens Corning “Fiberglas” Pipe Insulation.

.7 Blanket mineral fibre is to be blanket type roll insulation to CGSB 51-GP-11M, 24 kg/m3 (1-½ lb/ft³) density, with a factory applied vapour barrier facing.

.1 Manufacturers:

.1 Johns Manville Inc. Microlite FSK Duct Wrap Type 150;

.2 Knauf Fiber Glass Blanket Insulation FSK Duct Wrap Type III;

.3 Manson Insulation Inc. ALLEY WRAP FSK Duct Wrap Type III;

.4 Certainteed Corporation Softtouch FSK Duct Wrap Type 150.

.8 Pre-moulded weatherproof jacketed mineral fibre is to be Knauf Insulation "Redi-Klad 1000" sectional, sleeve type pipe insulation with a self-sealing weather-proof jacket and a 100 mm (4") butt joint sealing strip with each section.

2.4 BARRIER-FREE LAVATORY PIPING INSULATION KITS

.1 Removable, flexible, reusable, white moulded plastic insulation kits for barrier-free lavatory drain piping and potable water supplies exposed under lavatory.

.2 Manufacturers:

.1 Truebo "Lav-Guard 2" E-Z Series;

.2 Zeston "SNAP-TRAP";

.3 McGuire Manufacturing Co. Inc. "ProWrap".

2.5 EQUIPMENT INSULATION MATERIALS

.1 Blanket mineral fibre is to be blanket type roll form insulation to ASTM C553, 24 kg/m3 (1-½ lb/ft³) density, with a factory applied vapour barrier facing.

.1 Manufacturers:

.1 Johns Manville Inc. Microlite FSK Duct Wrap Type 150;

.2 Knauf Fiber Glass Blanket Insulation FSK Duct Wrap Type III;

.3 Manson Insulation Inc. ALLEY WRAP FSK Duct Wrap Type III;

.4 Certainteed Corporation Softtouch FSK Duct Wrap Type 150.

.2 Semi-rigid mineral fibre board is to be roll form, moulded insulation to ASTM C1393, with a factory applied vapour barrier facing consisting of laminated aluminum foil and kraft paper.

.1 Manufacturers:

.1 Knauf Fiber Glass Pipe and Tank Insulation;

.2 Manson Insulation Inc. "AK FLEX";

.3 Johns Manville Inc. Pipe and Tank Insulation “Micro-Flex”;

.4 Multi-Glass Insulation Ltd. "MULTI-FLEX MF";

.5 Owens Corning Pipe and Tank Insulation;

.6 Glass-Cell Fabricators Ltd. "R-Flex".

.3 Semi-rigid mineral wool blanket is to be equal to Roxul "Enerwrap MA 960" flexible, black fibrous scrim faced mineral wool blanket insulation to ASTM C553.

.4 Closed cell foamed glass is to be Owens Corning "FOAMGLAS" expanded, rigid board and block type insulation with a liquid or vapour permeability rating (as per ASTM C240) of 0.00.

2.6 REMOVABLE/REUSABLE INSULATION COVERS

.1 Valve, etc. covers are to be NO SWEAT reusable insulation wraps with vapour barrier jacket and self-sealing ends and longitudinal seam, with a length to suit the application and an insulation thickness equal to adjoining insulation.

.2 Custom manufactured equipment covers conforming to shape of item to be insulated, designed to be easily removable and replaceable to suit use and maintenance procedures of particular item, and to provide adequate personnel protection. Covers are to be complete with minimum 95 kg/m3 (6 lb/ft³) density ceramic fibre insulation sewn between minimum 542.5 g/m2 (1.8 oz/ft²) weight silicone impregnated fibreglass fabric in a quilted pattern using double stitches made with Kelvar or Teflon coated fibreglass thread. Overlap flaps are to be secured using laces, snaps, or Velcro double stitched in place.

.3 Manufacturers:

.1 Crossby Dewar Inc.;

.2 Insufab Systems Inc.;

.3 ADL Insulflex Inc.;

.4 Firwin Corp.;

.5 GlassCell Isofab Inc.

2.7 DUCTWORK SYSTEM INSULATION MATERIALS

.1 Rigid mineral fibre board is to be pre-formed board type insulation to ASTM C612, 48 kg/m3 (3 lb/ft³) density, with a factory applied reinforced aluminum foil and kraft paper facing.

.1 Manufacturers:

.1 Knauf Fiber Glass Insulation Board with FSK facing;

.2 Manson Insulation Inc. "AK BOARD FSK";

.3 Johns Manville Inc. Type 814 "Spin-Glas";

.4 Owens Corning 703.

.2 Semi-rigid mineral fibre board is to be roll form insulation to ASTM C1393, consisting of cut strips of rigid mineral board insulation glued to an aluminium foil and kraft paper facing.

.1 Manufacturers:

.1 Multi-Glass Insulation Ltd. "Multi-Flex MKF";

.2 Glass-Cell Fabricators Ltd. "R-FLEX";

.3 Owens Corning Pipe and Tank Insulation;

.4 Johns Manville Inc. Pipe and Tank Insulation.

.3 Blanket mineral fibre is to be blanket type roll form insulation to ASTM C553, 24 kg/m3 (1-½ lb/ft3) density, 40 mm (1-½") thick, with a factory applied vapour barrier facing.

.1 Manufacturers:

.1 Johns Manville Inc. Microlite FSK Duct Wrap Type 150;

.2 Knauf Fiber Glass Blanket Insulation FSK Duct Wrap Type III;

.3 Manson Insulation Inc. ALLEY WRAP FSK Duct Wrap Type III;

.4 Certainteed Corporation Softtouch FSK Duct Wrap Type 150.

.4 Pre-moulded calcium silicate is to be rigid block and sheet insulation.

.1 Manufacturers:

.1 Johns Manville Inc. "Thermo-12 Gold";

.2 Industrial Insulation Group "Thermo-12 Gold".

.5 Flexible foam elastomeric sheet is to be sheet form, CFC free, closed cell, self-adhering elastomeric nitrile rubber insulation with a water vapour permeability rating of 0.08 in accordance with ASTM E96 Procedure A.

.1 Manufacturers:

.1 Armacell "AP/Armaflex SA";

.2 IK Insulation Group "K-Flex Duct Wrap", S2S.

.6 Extruded polystyrene tapered insulation – equal to Soprema Sopra-ISO Tapered, closed cell polyisocyanurate foam core with organic facers reinforced with glass fibres, 172 kPa compressive strength as per ASTM D1621, 32 kg/m3 density, 50 mm minimum thickness, 2% slope. Thickness shall increase if width of duct work is larger than 1200 mm to maintain 2% slope.

2.8 FIRE RATED DUCT WRAP

.1 Flexible, non-combustible, blanket type mineral fibre duct wrap completely encapsulated in reinforced foil, suitable for installation with zero clearance to combustibles (for grease ducts), and ULC tested and listed (ULC Designs FRD-17 & 23 for ventilation ducts, ULC Design FRD-19 for kitchen exhaust/grease duct) to facilitate a 2 hour fire resistance rating (76 mm (3") thick) to kitchen grease exhaust duct in accordance with requirements of NFPA 96, and/or a 1 hour or 2 hour fire resistance rating (38 mm (1-½") thick) to ventilation or pressurization ductwork in accordance with requirements of ISO 6944.

.2 Manufacturers:

.1 3M Fire Barrier Duct Wrap 615;

.2 CL4 Inc. "CL4Fire";

.3 Unifrax Corp. "FyreWrap Elite 1.5";

.4 Morgan Thermal Ceramics "FireMaster FastWrap XL".

2.9 INSULATING COATINGS

.1 Equal to Robson Thermal Manufacturing Ltd. insulating coatings as follows:

.1 anti-condensation coating, "No Sweat-FX";

.2 thermal insulating coating, "ThermaLite".

2.10 INSULATION FASTENINGS

.1 Wire – minimum 15 gauge galvanized annealed wire.

.2 Wire with Mesh – minimum 15 gauge galvanized annealed wire factory woven into 25 mm (1") hexagonal mesh.

.3 Aluminium Banding – equal to ITW Insulation Systems Canada "FABSTRAPS" minimum 12 mm (½") wide, 0.6 mm (1/16") thick aluminium strapping.

.4 Stainless Steel Banding – equal to ITW Insulation Systems Canada "FABSTAPS" 0.6 mm (1/16") thick, minimum 12 mm (½") wide type 304 stainless steel strapping.

.5 Duct Insulation Fasteners – weld-on 2 mm (3/32") diameter zinc coated steel spindles of suitable length, complete with minimum 40 mm (1-½") square plastic or zinc plated steel self-locking washers.

.6 Tape Sealant – equal to MACtac Canada Ltd. self-adhesive insulation tapes, types PAF, FSK, ASJ, or SWV as required to match surface being sealed.

.7 Mineral Fibre Insulation Adhesive – clear, pressure sensitive, brush consistency adhesive, suitable for a temperature range of -20°C to 82°C (-4°F to 180°F), compatible with type of material to be secured, and WHMIS classified as non-hazardous.

.8 Flexible Elastomeric Insulation Adhesive – Armacell "Armaflex" #520 air-drying contact adhesive.

.9 Closed Cell Foamed Glass Insulation Adhesive – Pittsburgh Corning PC88 multi-purpose 2-component adhesive.

.10 Lagging Adhesive – white, brush consistency, ULC listed and labelled, 25/50 fire/smoke rated lagging adhesive for canvas jacket fabric, suitable for colour tinting, complete with fungicide and washable when dry.

.11 Screws – No. 10 stainless steel sheet metal screws.

2.11 INSULATION JACKETS AND FINISHES

.1 Canvas Jacket Material – ULC listed and labelled, 25/50 fire/smoke rated, roll form, minimum 170 g (6 oz).

.2 Roll Form Sheet and Fitting Covers – minimum 15 mm (1/2") thick white PVC, 25/50 fire/smoke rated tested in accordance with CAN/ULC-S102, complete with installation and sealing accessories.

.1 Manufacturers:

.1 Proto Corp. "LoSMOKE";

.2 The Sure-Fit System "SMOKE-LESS 25/50";

.3 Johns Manville Inc. "Zeston" 300.

.3 Rigid Aluminium Jacket – equal to ITW Insulation Systems Canada "Lock-on" 0.406 mm (0.016") thick embossed aluminum jacket material to ASTM B209, factory cut to size and complete with polysurlyn moisture barrier and continuous modified Pittsburgh Z-Lock, butt straps with "Fabstraps" to weatherproof the end to end joints, and 2-piece epoxy coated pressed aluminum fittings with weather locking edges.

.4 Stainless Steel Jacket – equal to ITW Insulation Systems Canada "Lock-on" 0.254 mm (0.010") thick type 304 embossed stainless steel jacket material to ASTM A240, factory cut to size and complete with moisture barrier and continuous modified Pittsburgh Z-Lock, butt straps with

"Fabstraps" to cover end to end joints, and 2-piece pressed stainless steel fittings with weather locking edges.

.5 Adhesive backed flexible aluminium is to be MFM Building Products Corp. "Flex-Clad 400" roll form sheet material with an aggressive rubberized asphalt adhesive backing, high density polyethylene reinforcement, and an embossed aluminum facing.

.6 Heat resistant, trowel consistency thermal insulating and finishing cement to CAN/CGSB 51.12, and suitable for the application.

.7 Foamed glass insulation protective coating is to be Pittsburgh Corning "PITTCOTE 300e" flexible acrylic latex weather barrier coating, white unless otherwise specified.

.8 UV and moisture resistant flexible foam insulation with protective jacket equal to Armacell “ArmaFlex Shield".

.9 Self adhesive multilayer jacketing - equal to 3M Ventureclad 1577CW. Multi-ply laminate flexible jacketing, acrylic adhesive, zero permeability vapor barrier, 480 N/mm tensile strength, 22N/25 mm peel adhesion strength, 15.2 kPa shear adhesion after 72 hours, 147 N puncture resistance, 0.2 mm thickness.

[OR]

.10 Self adhesive multilayer jacketing - equal to 3M Ventureclad 1579GCW series. Multi-ply laminate flexible jacketing, acrylic adhesive, zero permeability vapor barrier.

PART 3 - EXECUTION

3.1 GENERAL INSULATION APPLICATION REQUIREMENTS

.1 Unless otherwise specified, do not insulate following:

.1 factory insulated equipment and piping;

.2 heating piping within radiation unit enclosures, including blank filler sections of enclosures;

.3 heating piping in soffits and/or overhang spaces and connected to bare element radiation in spaces;

.4 branch potable water piping located under counters to serve counter mounted plumbing fixtures and fittings, except barrier-free lavatories;

.5 exposed chrome plated potable water angle supplies from concealed piping to plumbing fixtures and fittings, except barrier-free lavatories;

.6 heated liquid system pump casings, valves, strainers and similar accessories;

.7 heating system expansion tanks;

.8 fire protection pump casings;

.9 manufactured expansion joints and flexible connections;

.10 acoustically lined ductwork and/or equipment;

.11 factory insulated flexible branch ductwork;

.12 fire protection system water storage tanks;

.13 piping unions, except for unions in "cold" category piping.

.2 Install insulation directly over pipes and ducts, not over hangers and supports.

.3 Install piping insulation and jacket continuous through pipe openings and sleeves.

.4 Install duct insulation continuous through walls, partitions, and similar surfaces except at fire dampers.

.5 When insulating "cold" piping and equipment, extend insulation up valve bodies and other such projections as far as possible, and protect insulation jacketing from the action of condensation at its junction with metal.

.6 Insulate, vapour seal, and finish seismic restraints, braces, anchors, hanger rods, and similar hardware directly connected to "cold" piping and/or equipment, for a distance of 300 mm (12") clear of adjacent pipe or equipment finish, to match piping and/or equipment insulation.

.7 When insulating vertical piping risers 75 mm (3") diameter and larger, use insulation support rings welded directly above lowest pipe fitting, and thereafter at 4.5 m (14.7') centres and at each valve and flange. Insulate as per Thermal Insulation Association of Canada National Insulation Standards, Figure No. 9.

.8 Where piping and/or equipment is traced with electric heating cable, ensure cable has been tested and accepted prior to application of insulation, and ensure cable is not damaged or displaced during the application of insulation.

.9 Where existing insulation work is damaged as a result of mechanical work, repair damaged insulation work to Project work standards.

.10 Where mineral fibre rigid sleeve type insulation is terminated at valves, equipment, unions, etc., neatly cover exposed end of insulation with a purpose made PVC cover on "cold" piping, and with canvas jacket material on "hot" piping.

.11 Carefully and neatly gouge out insulation for proper fit where there is interference between weld bead, mechanical joints, etc., and insulation. Bevel away from studs and nuts to permit their removal without damage to insulation, and closely and neatly trim around extending parts of pipe saddles.

.12 Where thermometers, gauges, and similar instruments occur in insulated piping, and where access to heat transfer piping balancing valve ports and similar items are required, create a neat, properly sized hole in insulation and provide a suitable grommet in the opening.

3.2 INSULATION FOR HORIZONTAL PIPE AT HANGERS AND SUPPORTS

.1 At each hanger and support location for piping 50 mm (2") diameter and larger and scheduled to be insulated, except where roller hangers and/or supports are required, and unless otherwise specified, supply a factory fabricated section of phenolic foam pipe insulation with integral vapour barrier jacket and captive galvanized steel shield. Supply insulation sections to piping installers for installation as pipe is erected.

.2 For 100 mm (4") diameter and larger heating system piping where roller type hangers and supports are provided, a steel saddle will be tack welded to pipe at each roller hanger or support location. Pack saddle voids with loose mineral wool insulation.

3.3 PIPE INSULATION REQUIREMENTS – MINERAL FIBRE

.1 Insulate following pipe inside building and above ground with mineral fibre insulation of thickness indicated:

.1 domestic cold water piping, less than 100 mm (4") dia. – 25 mm (1") thick;

.2 domestic cold water piping, greater than or equal to 100 mm (4") dia. – 40 mm (1-½") thick;

.3 domestic hot water piping, less than 40 mm (1-½") dia. – 25 mm (1") thick;

.4 domestic hot water piping, greater than or equal to 40 mm (1½") dia. – 40 mm (1-½") thick;

.5 tempered domestic water piping, supply and return, less than 40 mm (1-½") dia. – 25 mm (1") thick;

.6 tempered domestic water piping, supply and return, greater than or equal to 40 mm (1-½") dia. – 50 mm (2") thick;

.7 storm drainage piping from roof drains to the point where main vertical risers extend straight down, without offsets, and connect to horizontal underground mains – 25 mm (1") thick;

.8 condensate drainage piping from fan coil unit or any other air conditioning system/unit drain pans to main vertical drain risers or to indirect drainage point – 25 mm (1") thick;

.9 drainage piping from refrigerated drinking fountains to nearest 75 mm (3") dia. or larger drain pipe – 25 mm (1") thick;

.10 chilled water piping, supply and return, less than 100 mm (4") dia. – 25 mm (1") thick;

.11 chilled water piping, supply and return, greater than or equal to 100 mm (4") dia. – 40 mm (1-½") thick;

.12 chilled glycol solution piping, supply and return, less than 100 mm (4") dia. – 25 mm (1") thick;

.13 chilled glycol solution piping, supply and return, greater than or equal to 100 mm (4") dia. – 40 mm (1-½") thick;

.14 hot water heating piping, supply and return, less than 40 mm (1-½") dia. – 40 mm (1-½") thick;

.15 hot water heating piping, supply and return, greater than or equal to 40 mm (1-½") dia. – 50 mm (2") thick;

.16 glycol solution heating or heat reclaim piping, supply and return, less than 40 mm (1-½") dia. – 40 mm (1-½") thick;

.17 glycol solution heating or heat reclaim piping, supply and return, greater than or equal to 40 mm (1-½") dia. – 50 mm (2") thick;

.18 low pressure (to 140 kPa (20 psi)) steam piping, less than 100 mm (4") dia. – 65 mm (2-½") thick;

.19 low pressure (to 140 kPa (20 psi)) steam piping, greater than or equal to 100 mm (4") dia. – 80 mm (3") thick;

.20 medium pressure (140 kPa to 415 kPa (20 psi to 60 psi)) steam piping, less than 40 mm (1-½") dia. – 100 mm (4") thick;

.21 medium pressure (140 kPa to 415 kPa (20 psi to 60 psi)) steam piping, greater than or equal to 40 mm (1-½") dia. – 112 mm (4-½") thick;

.22 low pressure condensate piping, less than 40 mm (1-½") dia. – 40 mm (1-½") thick;

.23 low pressure condensate piping, greater than or equal to 40 mm (1-½") dia. – 50 mm (2") thick;

.24 medium pressure condensate piping, less than 40 mm (1-½") dia. – 40 mm (1-½") thick;

.25 medium pressure condensate piping, greater than or equal to 40 mm (1-½") dia. – 50 mm (2") thick;

.26 boiler feedwater piping complete – 25 mm (1") thick;

.27 boiler blowdown piping complete – 40 mm (1-½") thick;

.28 chilled domestic cold water piping from remote water cooler(s) to drinking fountain(s) – 40 mm (1-½") thick;

.29 piping indicated to be traced with electric heating cable – minimum 50 mm (2") thick;

.30 drum drip(s) in dry zone standpipe and/or sprinkler system piping – 50 mm (2") thick;

.31 air compressor set fresh air intake piping – 25 mm (1") thick;

.32 heat pump equipment earthloop piping – 25 mm (1") thick.

.2 Secure overlap flap of the sectional insulation jacket tightly in place. Cover section to section butt joints with tape sealant.

.3 Insulate fittings with sectional pipe insulation mitred to fit tightly, and cover butt joints with tape sealant, or, alternatively, wrap fittings with blanket mineral fibre insulation to a thickness and insulating value equal to the sectional insulation, secure in place with adhesive and/or wire, and cover with PVC fitting covers.

.4 Unless otherwise specified, insulate unions, valves, strainers, and similar piping system accessories in "cold" piping with cut and tightly fitted segments of sectional pipe insulation with joints covered with tape sealant, or, alternatively, wrap piping union, valve, strainer, etc., with blanket mineral fibre and cover with PVC covers as for paragraph above.

.5 Terminate sectional insulation approximately 50 mm (2") from flange or coupling on each side of flange or coupling. Cover flange or coupling with a minimum 50 mm (2") thickness of blanket mineral fibre insulation wide enough to butt tightly to ends of adjacent sectional insulation. Secure blanket insulation in place and cover with a purpose made PVC coupling cover.

.6 Drum drips in dry zone sprinkler and/or standpipe system piping will be traced with electric heating cable as part of electrical work, and are generally not shown on drawing(s). Confirm number and size of drum drips required with trade providing piping and include for insulation to suit. Wherever possible drum drips will be located in heated areas.

.7 Take special care at concealed water rough-in piping at plumbing fixtures to ensure piping is properly insulated. If necessary due to space limitations, use 12 mm (½") thick sectional pipe insulation in lieu of 25 mm (1") thick insulation.

.8 Insulate seismic restraint hardware such as hanger rods, braces, anchors, etc., directly connected to "cold" category piping and equipment for a distance of 300 mm (12") from piping or equipment with insulation and finish to match pipe or equipment insulation. Coat seismic restraint hardware for a distance of 300 mm (12") from the termination of insulation with Robson Thermal "NO-SWEAT-FX" water based anti-condensation coating.

3.4 PIPE INSULATION REQUIREMENTS – MINERAL WOOL

.1 Insulate following pipe inside building and above ground with high temperature mineral wool insulation of thickness indicated:

.1 high pressure (above 415 kPa (60 psi)) steam piping, less than 40 mm (1-½") dia. – 100 mm (4") thick;

.2 high pressure (above 415 kPa (60 psi)) steam piping, greater than or equal to 40 mm (1-½") dia. – 115 mm (4-½") thick;

.3 high pressure condensate piping – 50 mm (2") thick;

.4 engine-generator set exhaust system piping – 75 mm (3") thick.

.2 Generally, install insulation on piping as specified above for mineral fibre insulation.

.3 Generally, install insulation on fittings as specified above for mineral fibre insulation but cover with canvas, not PVC fitting covers.

3.5 PIPE INSULATION REQUIREMENTS – FLEXIBLE FOAM ELASTOMERIC

.1 Install flexible elastomeric pipe insulation in strict accordance with manufacturer’s published instructions to suit the application, and using adhesive, joint sealants, and finish to produce a water-

tight installation. Insulate following pipe with flexible elastomeric pipe insulation of thickness indicated:

.1 refrigerant piping inside and outside building – 25 mm (1") thick.

3.6 PIPE INSULATION REQUIREMENTS – CLOSED CELL FOAMED GLASS

.1 Install closed cell foamed glass insulation in strict accordance with manufacturer's published instructions to suit the application, and using adhesive, joint sealants, and jacketing to produce a water-tight installation. Insulate following pipe with closed cell foamed glass of thickness indicated:

.1 piping located outside building and indicated to be heat traced – minimum 50 mm (2") thick.

3.7 PIPE INSULATION REQUIREMENTS – FIRE RATED INSULATION

.1 Where pipe (inside building and above ground) which is to be insulated as specified above penetrates fire rated construction, provide fire-rated, non-combustible sectional insulation on portion of pipe in fire barrier and for a distance of 50 mm (2") on either side of fire barrier. Insulation thickness is to be as specified, but in any case minimum 25 mm (1").

3.8 INSTALLATION OF WEATHER-PROOF JACKETED INSULATION

.1 Install sectional weather-proof jacketed pipe insulation in strict accordance with manufacturer's instructions to produce a water-tight weather-proof installation. Insulate fittings with blanket type glass fibre insulation of a thickness and insulating value equal to the sectional insulation and secured in place with adhesive and wire. Jacket fittings with manufactured aluminium fitting covers sealed water-tight. Insulate following pipe with weather-proof jacketed insulation:

.1 [ ];

.2 [ ].

3.9 INSTALLATION OF BARRIER FREE LAVATORY INSULATION KITS

.1 Provide manufactured insulation kits to cover exposed drainage and water piping under barrier free lavatories.

3.10 EQUIPMENT INSULATION REQUIREMENTS – BLANKET TYPE MINERAL FIBRE

.1 Insulate following equipment with mineral fibre blanket type insulation of thickness indicated:

.1 chilled water and/or domestic cold water pump casings – 40 mm (1-½") thick;

.2 roof drain sumps where inside the building – 25 mm (1") thick;

.3 water meter(s) – 40 mm (1-½") thick;

.4 top of radiant ceiling panels – per manufacturer's recommendation or minimum 50 mm (2") thick, whichever is greater.

.2 Unless otherwise noted, wrap equipment to a thickness and insulating value equal to an equivalent thickness of rigid sectional pipe insulation. Laminate insulation in place with a full coverage of adhesive and secure with wire. Apply a jacket of insulation vapour barrier material secured in place with adhesive or sealant tape.

.3 Cover roof drain sumps with purpose made PVC fitting covers.

.4 Lay fibreglass blanket on radiant ceiling panels after testing is complete.

3.11 EQUIPMENT INSULATION REQUIREMENTS – SEMI-RIGID MINERAL FIBRE

.1 Insulate following equipment with semi-rigid mineral fibre board insulation of thickness indicated:

.1 refrigeration machine water chiller(s) and suction elbow(s) – 50 mm (2") thick;

.2 uninsulated domestic hot water storage tank(s) – 40 mm (1-½") thick;

.3 shell and tube type heat exchangers – 40 mm (1-½") thick;

.4 condensate receiver(s) – 40 mm (1-½") thick;

.5 flash tanks – 40 mm (1-½") thick;

.6 hot well tank – 40 mm (1-½") thick;

.7 deaerating feedwater heater – 40 mm (1-½") thick;

.8 blow-down tank – 40 mm (1-½") thick;

.9 chilled water or chilled glycol solution storage tank – 50 mm (2") thick;

.10 heating main air separator – 40 mm (1-½") thick;

.11 chilled water expansion tank – 40 mm (1-½") thick.

.2 Install insulation as required to fit shape and contour of equipment. Secure insulation in place with adhesive, and with aluminum straps on 450 mm (18") centres. Apply a 6 mm (¼") thick skim coat of insulating cement, then, when insulating cement has dried, apply a 6 mm (¼") thick coat of cement trowelled smooth.

.3 For "cold" equipment, prime insulation with suitable sealer and apply a jacket of glass thread reinforced foil and kraft paper vapour barrier jacket material laminated in place with a full coverage of adhesive.

.4 Provide removable and replaceable insulated metal covers for equipment with removable heads to permit heads to be removed and replaced without damaging adjacent insulation work.

3.12 EQUIPMENT INSULATION REQUIREMENTS – SEMI-RIGID MINERAL WOOL

.1 Insulate following equipment with calcium silicate equipment insulation of thickness indicated:

.1 engine-generator set exhaust system silencer(s) – 75 mm (3") thick;

.2 uninsulated boiler breeching where inside the building – 75 mm (3") thick.

.2 Cut or mitre insulation (or use factory scored type insulation) to fit shape and contour of equipment and secure insulation in place with aluminum straps on 450 mm (18") centres. Point joints, mitres, scores and gaps with insulating cement. Apply a 12 mm (½") thick coat of insulating cement and trowel smooth.

3.13 EQUIPMENT INSULATION REQUIREMENTS – CLOSED CELL FOAMED GLASS

.1 Insulate following equipment with closed cell foam glass insulation of thickness indicated:

.1 [ ];

.2 [ ].

.2 Install insulation in strict accordance with manufacturer’s published instructions using adhesive, wrap, sealant, etc., to secure insulation in place, to secure and seal joints, and to produce a 100% water-tight installation.

3.14 EQUIPMENT INSULATION REQUIREMENTS – REMOVABLE/REUSABLE TYPE

.1 Provide custom designed and manufactured removable and reusable insulation covers for following:

.1 plate type heat exchanger(s);

.2 150 mm (6") dia. and larger piping strainers, backflow preventers, etc.;

.3 diesel engine exhaust manifolds;

.4 150 mm (6") dia. and larger steam traps and similar equipment.

.2 Provide "wrap type" removable and reusable insulation covers for "cold" circuit balancing valves, backflow preventers, and similar items, and for steam traps and similar items requiring service in piping less than 150 mm (6") dia.

3.15 DUCTWORK INSULATION REQUIREMENTS – MINERAL FIBRE

.1 Insulate following ductwork systems inside building and above ground with mineral fibre insulation of thickness indicated:

.1 Outdoor air and combustion air intake ductwork, casings and plenums from fresh air intakes to and including mixing plenums or sections, or, if mixing plenums or sections are not provided, to first heating coil, or if both mixing plenums or sections and heating coil sections are not provided, and fresh air is not tempered, then the fresh air ductwork system complete – minimum 40 mm (1-½") thick as required;

.2 mixed supply air or preheated supply air casings, plenums and sections to and including the fan section where not factory insulated – minimum 25 mm (1") thick rigid board or minimum 40 mm (1-½") thick flexible blanket as required;

.3 supply air ductwork outward from fans, except for supply ductwork exposed in area it serves – minimum 25 mm (1") thick rigid board or minimum 40 mm (1-½") thick flexible blanket as required;

.4 exhaust discharge ductwork for a distance of 3 m (10') downstream (back) from exhaust openings to atmosphere, including any exhaust plenums within the 3 m (10') distance – minimum 25 mm (1") thick rigid board or minimum 40 mm (1-½") thick flexible blanket as required;

.5 any other ductwork, casings, plenums, or sections specified or detailed on drawings to be insulated – thickness as specified.

.2 Provide rigid board type insulation for casings, plenums, and exposed rectangular ductwork. Provide blanket type insulation for round ductwork and concealed rectangular ductwork.

.3 Liberally apply adhesive to surfaces of exposed rectangular ducts and/or casings. Accurately and neatly press insulation into adhesive with tightly fitted butt joints. Provide pin and washer insulation fasteners at 300 mm (12") centres on bottom and side surfaces. Secure and seal joints with 75 mm (3") wide tape sealant. Additional installation requirements as follows:

.1 at trapeze hanger locations, install insulation between duct and hanger;

.2 provide drywall type metal corner beads on edges of ductwork, casings and plenums in equipment rooms, service corridors, and any other area where insulation is subject to accidental damage, and secure in place with tape sealant.

.4 Liberally apply adhesive to surfaces of concealed rectangular or oval ductwork, and wrap insulation around duct with a top butt joint and tight section to section butt joints. Provide pin and washer insulation fasteners at 300 mm (12") centres on bottom surfaces. Secure and seal joints with 75 mm (3") tape sealant. At each trapeze type duct hanger, provide a 100 mm (4") wide full length piece of rigid mineral fibre board insulation between duct and hanger.

.5 Accurately cut sections of insulation to fit tightly and completely around exposed and concealed round or oval ductwork. Liberally apply adhesive to surfaces of duct, and wrap insulation around duct with a top butt joint and tight section to section butt joints. Seal joints with tape sealant. At duct hanger locations install insulation between duct and hanger. At each hanger location for concealed ductwork where flexible blanket insulation is used, provide a 100 mm (4") wide full circumference strip of semi-rigid board type duct insulation between duct and hanger.

.6 Insulation application requirements common to all types of rigid ductwork are as follows:

.1 at duct connection flanges, insulate flanges with neatly cut strips of rigid insulation material secured with adhesive to side surfaces of flange with a top strip to cover exposed edges of the side strips, then butt the flat surface duct insulation up tight to flange insulation, or, alternatively, increase insulation thickness to depth of flange and cover top of flanges with tape sealant;

.2 installation of fastener pins and washers is to be concurrent with duct insulation application;

.3 cut insulation fastener pins almost flush to washer and cover with neatly cut pieces of tape sealant;

.4 accurately and neatly cut and fit insulation at duct accessories such as damper operators (with standoff mounting) and pitot tube access covers;

.5 prior to concealment of insulation by either construction finishes or canvas jacket material, patch vapour barrier damage by means of tape sealant.

3.16 DUCTWORK INSULATION REQUIREMENTS – FLEXIBLE ELASTOMERIC

.1 Insulate exposed exterior ductwork (except outdoor air intake ductwork) and associated plenums and/or casings outside building with minimum 75 mm (3”) thick flexible elastomeric sheet insulation as required, applied in 2 minimum 40 mm (1 ½”) thick layers with staggered tightly butted joints.

.2 Install with adhesive in strict accordance with manufacturer’s instructions to produce a weather-proof installation. Ensure sheet metal work joints are sealed watertight prior to applying insulation.

.3 Provide Calcium Silicate insulation between ductwork and duct supports. Tightly butt flexible elastomeric insulation to Calcium Silicate insulation. Cover Calcium Silicate insulation with a continuous sheet of self-adhesive multilayer jacketing which overlaps 75 mm past the Calcium Silicate insulation to the adjacent flexible elastomeric insulation.

.4 Provide extruded polystyrene tapered insulation between flexible elastomeric insulation and jacketing to allow for water runoff on all exterior duct work.

3.17 DUCTWORK INSULATION REQUIREMENTS – CALCIUM SILICATE

.1 Insulate following kitchen exhaust ductwork with minimum 40 mm (1-½") thick calcium silicate block insulation:

.1 kitchen exhaust ductwork from exhaust hood to masonry shaft – 2 hour rating;

.2 stairwell pressurization ductwork from fan to stairwell – 1 hour rating;

.3 Trauma Room and Operating Room supply and exhaust ductwork complete – 1 hour rating.

.2 Secure insulation in place with adhesive and with wire on 450 mm (18") centres. Point gaps and joints with insulating cement. Where ductwork is exposed, cover insulation with wire mesh secured to wire and with edges laced together and apply a coat of finishing cement trowelled smooth. Use drywall type metal corner bead for duct edges where finishing cement is applied.

3.18 DUCT WRAP REQUIREMENTS – FIRE RATED MATERIAL

.1 Provide blanket type fire rated duct wrap system material for following ductwork to produce fire rating indicated:

.1 kitchen exhaust ductwork from exhaust hood to masonry shaft – 2 hour rating;

.2 stairwell pressurization ductwork from fan to stairwell – 1 hour rating;

.3 Trauma Room and Operating Room supply and exhaust ductwork complete – 1 hour rating.

.2 Install duct wrap material in accordance with ULC design requirements and supplier's/manufacturer's instructions.

.3 Coordinate installation of duct wrap with installation of ductwork.

.4 Arrange and pay for duct wrap supplier to examine completed duct wrap system at site. Submit a letter from supplier to certifying duct wrap system has been properly installed.

3.19 APPLICATION OF INSULATING COATINGS

.1 Apply, in accordance with manufacturer's instruction, insulating coatings to following bare metal surfaces:

.1 paint bare metal surfaces clear of "cold" piping and/or equipment insulation for a distance of from 300 mm (12") to 600 mm (24") clear of pipe or equipment insulation, with "No Sweat-FX" anti-condensation coating;

.2 paint bare metal surfaces associated with mechanical systems with an operating temperature 60°C (140°F) with "ThermaLite" insulating coating.

.2 Apply coatings with a brush. Remove any splatter or excess coating from adjacent surfaces.

3.20 INSULATION FINISH REQUIREMENTS

.1 Unless otherwise shown and/or specified, jacket exposed mineral fibre insulation, and calcium silicate duct insulation work inside building with canvas secured in place with a full covering coat of lagging adhesive. Accurately cut canvas with scissors or a knife. Do not rip or tear canvas to size. Remove lagging adhesive splatter from adjacent uninsulated surfaces.

.2 Unless otherwise shown or specified, jacket exposed mineral fibre insulation listed below with canvas jacket secured in place with a full covering coat of coloured lagging adhesive. Accurately cut canvas with scissors or a knife. Do not rip or tear canvas to size. Remove lagging adhesive splatter from adjacent surfaces. Insulated services to receive coloured lagging adhesive are as follows:

.1 Chilled Water Piping;

.2 Chilled Glycol Piping

.3 Condenser Water Piping;

.4 Domestic Cold Water Piping;

.5 Domestic Hot Water Piping;

.6 Domestic Hot Water Recirculation Piping;

.7 High Temperature Heating Water Piping;

.8 High Temperature Heating Glycol Piping;

.9 Heating Water Piping;

.10 Condensate Drain Piping;

.11 Low Pressure Steam Piping;

.12 High Pressure Steam Piping;

.13 Indoor Ductwork;

.14 [ ].

.3 Jacket exposed pipe insulation work inside building with white sheet PVC and fitting covers. Install sheet PVC and fitting covers tightly in place with overlapped circumferential and longitudinal joints arranged to shed water. Seal joints to produce a neat water-tight installation. Provide slip-type expansion joints where required by manufacturer's instructions.

.4 Install rigid aluminum jacket material tightly in place with overlapped circumferential joints positioned to shed water and covered with butt straps supplied with the jacket. Provide aluminum jacket for following insulation:

.1 Chilled Water Piping;

.2 Chilled Glycol Piping

.3 Condenser Water Piping;

.4 High Temperature Heating Water Piping;

.5 High Temperature Heating Glycol Piping;

.6 Heating Water Piping;

.7 Condensate Drain Piping;

.8 Refrigerant Piping;

.9 Outdoor Ductwork;

.10 [ ].

.5 Install adhesive backed flexible aluminum to cleaned and primed metal surfaces which are between -23°C and 74°C (-10°F and 165°F) in strict accordance with manufacturer's published instructions and details, including shingle type overlap joints to shed water, and use of a hand roller to concentrate pressure on seams. Provide adhesive backed flexible aluminum jacket for following insulation:

.1 Chilled Water Piping;

.2 Chilled Glycol Piping

.3 Condenser Water Piping;

.4 High Temperature Heating Water Piping;

.5 High Temperature Heating Glycol Piping;

.6 Heating Water Piping;

.7 Condensate Drain Piping;

.8 Refrigerant Piping;

.9 Outdoor Ductwork;

.10 [ ].

.6 Install rigid stainless steel jacket material tightly in place with overlapped circumferential joints positioned to shed water and covered with butt straps supplied with jacket. Provide stainless steel jacket for following:

.1 Chilled Water Piping;

.2 Chilled Glycol Piping

.3 Condenser Water Piping;

.4 High Temperature Heating Water Piping;

.5 High Temperature Heating Glycol Piping;

.6 Heating Water Piping;

.7 Condensate Drain Piping;

.8 Refrigerant Piping;

.9 Outdoor Ductwork;

.10 [ ].

.7 Apply 2 heavy coats of "PITTCOTE 300e" coating with 24 hr between coats to foamed glass insulation exposed above grade.

.8 Apply 2 coats (with 24 hr between coats) of specified coating to flexible elastomeric insulation outside building.

.9 Install 3M Ventureclad series [1577CW] [1579GCW] on insulated ductwork and ensure supports are installed on the outside of the jacketing. Jacketing shall be finished as [Flat White] [Aluminum] [Aluminum Embossed]. Provide necessary insulation and jacketing materials at the time of duct work installation. Do not penetrate jacketing or install jacketing around duct supports. Provide 24GA G90 38 mm x 38 mm steel angle to protect all corners of rectangular ductwork and install between insulation and jacketing. Steel angle shall be continuous on entire duct work run. Provide additional steel angle between jacketing and duct support. Ensure jacketing is continuous with minimum 75 mm (or as required by manufacturer) overlapping on all joints. Provide jacketing on the following duct work:

.1 Exposed exterior duct work including outdoor air intake duct work, plenums and casings installed outside;

.2 Exposed interior insulated duct work;

.3 Interior outdoor air intake duct work, plenums, and casings;

.4 Single wall plenum casings (intake or exhaust) field insulated;

.5 Wherever indicated on drawings;

.10 Install 3M Ventureclad series [1577CW] [1579GCW] on exposed piping and ensure supports are installed on the outside of the jacketing. Do not penetrate or install jacketing around pipe supports. Jacketing shall be finished as [Flat White] [Aluminum] [Aluminum Embossed]. Provide galvanized insulation shield between insulation and jacketing at support points. Ensure jacketing is continuous with minimum 75 mm (or as required by manufacturer) overlapping on all joints. Provide jacketing on the following piping:

.1 Chilled water;

.2 Chilled glycol;

.3 High Temperature Heating Water;

.4 High Temperature Heating Glycol;

.5 Heating Water;

.6 Heating glycol;

.7 Low pressure steam (<104 kPa);

.8 Low pressure steam (<104 kPa) condensate;

.9 Domestic cold water piping;

.10 Domestic hot water piping;

.11 Coil condensate drain piping;

.12 Wherever indicated on drawings.

END OF SECTION

Updated through ADD#14

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 This Section specifies commissioning requirements that are common to Mechanical Divisions work Sections and it is a supplement to each Section and is to be read accordingly. When requirements of this Section contradict requirements of Division 00 or Division 01, conditions of Division 00 or Division 01 to take precedence.

1.2 REFERENCES

.1 Refer to commissioning requirements specified in Division 01.

1.3 COMMISSIONING AGENT INVOLVEMENT VERSUS WARRANTY OBLIGATIONS

.1 Involvement of Commissioning Agent performing duties as described in this Section is not in any way to void or alter any Contractual warranty obligations.

1.4 SUBMITTALS

.1 Submit to Commissioning Agent, at same time as submittal to the Consultant, one copy of each shop drawing or product data sheet associated with equipment or systems to be commissioned.

.2 Submit for review, a Commissioning Plan with schedule, commissioning procedures for commissioning events, and a copy of Commissioning Agent's commissioning data sheets for equipment/systems to be commissioned.

.3 Submit a list of commissioning instruments and for each instrument, indicate purpose of instrument and include a recent calibration certificate.

.4 Submit equipment and system manufacturer's start-up and test report sheets for review a minimum of 1 month prior to equipment and system start-up procedures.

1.5 CLOSEOUT SUBMITTALS

.1 After start-up and successful pre-functional performance testing and submittal of completed forms, submit, for each system or subsystem, a letter confirming pre-functional performance testing has been successfully completed and system or subsystem is ready for functional performance testing and commissioning process to commence.

1.6 DEFINITIONS

.1 Commissioning: process of demonstrating to Owner and Consultant, for purpose of final acceptance, by means of successful and documented functional performance testing, that systems and/or subsystems are capable of being operated and maintained to perform in accordance with requirements of Contract Documents, all as further described below.

.2 Commissioning Agent: commissioning authority who will supervise commissioning process, and who will recommend final acceptance of commissioned mechanical work.

.3 Start-Up and Adjusting: process of equipment manufacturer's/supplier's technical personnel, with Contractor, starting and operating equipment and systems, making any required adjustments, documenting process, and submitting manufacturer's/supplier's start-up reports to confirm equipment has been properly installed and is operational as intended.

.4 Pre-Functional Performance Testing: testing, adjusting and operating of components, equipment, systems and/or subsystems, by Contractor, after start-up but before functional performance testing, to confirm components, equipment, systems and/or subsystems operate in accordance with requirements of Contract Documents, including modes and sequences of control and monitoring, interlocks, and responses to emergency conditions, and including submittal of pre-functional performance testing documentation sheets.

.5 Functional Performance Testing: a repeat of successful pre-functional performance testing by Contractor, in presence of Commissioning Agent and the Consultant with completed Commissioning Agent's commissioning documentation sheets to document, validate and verify equipment, systems and subsystems are complete in all respects, function correctly, and are ready for acceptance.

.6 Commissioning Documentation Sheets: prepared sheets for pre-functional performance testing and for functional performance testing supplied by Commissioning Agent for each piece of equipment/system to be commissioned, each sheet or set of sheets complete with Project name and number, date of commissioning, equipment/system involved, equipment/system name and model number, equipment tag in accordance with drawings, and, for each commissioning procedure listed, a column giving expected data in accordance with Contract Documents, a column to fill in observed data during commissioning, and space for signatures of Contractor and Commissioning Agent.

.7 Systems Operating Manual: a manual prepared by Commissioning Agent to present an overview of building mechanical systems and equipment to be used by building maintenance personnel to assist them in daily operation of systems.

.8 Validate: to confirm by examination and witnessing tests correctness of equipment and system operation.

1.7 QUALITY ASSURANCE

.1 Commissioning work is to be in accordance with requirements of following:

.1 CSA Z320, Building Commissioning Standard and Check Sheets;

.2 ASHRAE Guideline 0, The Commissioning Process;

.3 ASHRAE Guideline 1.1, The HVAC Commissioning Process;

.4 ASHRAE Guideline 1.5, Commissioning Smoke Control Systems;

.5 Owner designated Commissioning Providert.

1.8 COMMISSIONING OBJECTIVES

.1 Objectives of commissioning process:

.1 to support quality management by means of monitoring and checking installation;

.2 to verify equipment/system performance by means of commissioning of completed installation;

.3 to move completed equipment/systems from "static completion" state to "dynamic" operating state so as to transfer a complete and properly operating installation from Contractor to Owner.

1.9 TESTING EQUIPMENT

.1 Supply instruments and test equipment required to conduct start-up, testing and commissioning procedures.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 COMMISSIONING

.1 Commission work in accordance with requirements of this Section and as required by Commissioning Agent.

.2 Prerequisites to successful completion of functional performance testing:

.1 submittal of signed start-up and test reports;

.2 completion of system testing, adjusting and balancing (TAB), and acceptance of TAB reports;

.3 permanent electrical and control connections of equipment;

.4 successful completion and documentation of pre-functional performance testing;

.5 submittal of letters to the Consultant certifying systems and subsystems have been started, tested, adjusted, successfully pre-functional performance tested, are ready for functional performance testing, and are in accordance with requirements of Contract Documents. BAS is fully programmed, graphics completed, and in AUTO.

3.2 PHASING OF COMMISSIONING

.1 If Project will be constructed in phases, phase commissioning accordingly to suit progress and phases of Work.

3.3 DEFICIENCIES LISTED DURING COMMISSIONING

.1 Correct deficiencies listed by the Consultant and Commissioning Agent during commissioning process within 15 calendar days of notification unless agreed otherwise with the Consultant, and when deficiencies have been corrected, notify the Consultant and Commissioning Agent immediately.

3.4 SYSTEMS TO BE COMMISSIONED

.1 Mechanical systems to be commissioned include, but are not to be limited to, systems described below. Specific commissioning procedures are to be as directed by Commissioning Agent.

.2 Commissioning of drainage systems includes:

.1 commissioning of drainage pumps and controls by means of tests recommended by manufacturer to confirm proper operation and performance;

.2 commissioning of equipment such as interceptors and backflow preventers.

.3 Commissioning of fire protection systems will be considered complete upon preparation and submittal by Contractor of completion certificates required by applicable NFPA Standards, demonstration of proper system operation to local Fire Chief and any other authorities, including

Owner's insurance underwriter as required, and coordination and cooperation with fire alarm system commissioning procedures, in particular smoke control systems and other such fan system control sequences.

.4 Commissioning of water systems (all piping extended from Municipal main) includes:

.1 commissioning of pumps and controls;

.2 commissioning of water heaters;

.3 commissioning of piping specialties such as backflow preventers, mixing valves, and similar components;

.4 commissioning of trap seal primer units, including adjustment of water flows and confirmation of water flow at each connected trap;

.5 commissioning of plumbing fixtures.

.5 Commissioning of compressed air system includes "head end" compressor equipment, pressure reducing equipment, and outlets.

.6 Commissioning of natural gas system includes pressure regulating equipment. Perform commissioning in accordance with requirements of CAN/CSA B149.1, and any supplemental requirements of governing authorities.

.7 Commissioning of propane gas system includes pressure regulating equipment. Perform commissioning in accordance with requirements of CAN/CSA B149.2, and any supplemental requirements of governing authorities.

.8 Perform commissioning of fuel oil system in accordance with requirements of CAN/CSA B139.

.9 Commissioning of heating systems includes piping, piping specialties, equipment, and control, as well as checking and validating temperature and flow documentation contained in TAB reports. If TAB is not done during heating season, a follow-up site visit during heating season will be required to confirm proper flows and temperatures, and any required system "fine tuning".

.10 Commissioning of cooling systems includes piping, piping specialties, equipment, and control, as well as checking and validating temperature and flow documentation contained in TAB reports. If TAB is not done during cooling season, a follow-up site visit during cooling season will be required to confirm proper flows and temperatures, and any required system "fine tuning".

.11 Commissioning of HVAC chemical treatment systems includes feed and monitoring equipment, and testing of system fluids to confirm proper concentration of chemical.

.12 Commissioning of air handling systems includes equipment, ductwork, ductwork specialties, controls, interlocks, and checking and validating air capacities and flows in accordance with TAB reports.

.13 Control work commissioning includes confirmation of proper operation of individual control components, and overall operation of controls in conjunction with operation of connected building systems, including heating season/cooling season testing requirements specified above.

.14 Commissioning of BAS includes confirmation of proper operation of components, input/output points, hardware and software, and demonstration of system performing required procedures.

.15 Commissioning of special usage room controls includes confirmation of proper operation of individual components, and proper operation of overall control system, all in accordance with governing Codes and Standards.

.16 Commissioning of noise and vibration control equipment includes noise and vibration measurements to confirm proper operation of equipment.

3.5 COMMISSIONING PROCESS

.1 Perform commissioning process in stages and include, but not be limited to, following:

.1 Stage 1: Commissioning of equipment/systems as listed in this Section, which is a prerequisite to an application for Substantial Performance of the Work and includes supervising and validating results of functional performance testing, and submittal of reviewed Systems Operating Manual.

.2 Stage 2: Commissioning work performed 12 months after issue of a Certificate of Substantial Performance and which includes supervision of Contractor's "fine tuning" of equipment/systems through seasonal occupancy, and any other such work to achieve optimal comfort and performance conditions.

.3 Stage 3: Successful completion of satisfactory equipment/system operation during 1st month after issue of a Certificate of Total Performance of the Work.

.4 Stage 4: Successful completion of satisfactory equipment/system operation during 3rd month after issue of a Certificate of Total Performance of the Work.

.5 Stage 5: Successful seasonal testing of building.

3.6 RESPONSIBILITIES OF CONTRACTOR

.1 During construction phase, Contractor is to:

.1 prepare and submit an installation schedule which includes a time schedule for each activity with lead and lag time allowed and indicated, shop drawing and working detail drawing submissions, and major equipment factory testing and delivery dates;

.2 prepare and submit a commissioning schedule which is to include a time schedule coordinated with installation schedule referred to above and Commissioning Agent, and allowances for additional time for re-tests as may be required, and update schedule on a monthly basis as required;

.3 when requested by Commissioning Agent, arrange site commissioning meetings with Owner, the Consultant, and applicable subcontractors present, to be chaired by Commissioning Agent who will also prepare and distribute meeting minutes;

.4 promptly correct reported deficient work, and report when corrective work is complete;

.5 where required by Codes and/or Specification, retain equipment manufacturers/suppliers or independent 3rd parties to certify correct installation of equipment/systems;

.6 under supervision of equipment manufacturers/suppliers, start-up and adjust equipment to design requirements, and submit start-up sheets which include equipment data such as manufacturer and model number, serial number where applicable, and performance parameters, all signed by equipment manufacturer/supplier and Contractor;

.7 complete Commissioning Agent's commissioning data sheets for multiple items of smaller equipment such as air terminal boxes, fan coil units, backflow preventers, etc., submit sheets to Commissioning Agent, accompany Commissioning Agent for an on-site check of 30% of data sheet information for each type of equipment, and perform any corrective action required as a result of site checks;

.8 perform system testing, adjusting and balancing and, when complete, issue a copy of final report to Commissioning Agent for review and a site check of results, and perform any corrective work required as a result of site checks by Commissioning Agent;

.9 in accordance with updated commissioning schedule and actual progress at site, certify in writing to the Consultant and Commissioning Agent that equipment and/or systems are complete, have been checked, started and adjusted, successfully pre-functional performance tested and documented, and are ready for functional performance testing and commissioning procedures, giving the Consultant and Commissioning Agent a minimum of 5 working days' notice;

.10 perform system and subsystem functional performance testing under supervision of Commissioning Agent, and submit to the Consultant and Commissioning Agent, completed and signed functional performance testing and commissioning data sheets (issued by Commissioning Agent) and also signed by Commissioning Agent.

.2 During post construction phase, Contractor is to:

.1 optimize system operation in accordance with building occupant’s needs and comments using System Operation Manual prepared by Commissioning Agent as reference;

.2 complete commissioning procedures, activities, and performance verification procedures that were delayed or not concluded during construction phase;

.3 accompanied by Commissioning Agent, complete system checks and "fine tuning" with signed documentation as follows:

.1 once during 1st month of building operation;

.2 once during 3rd month of building operation;

.3 once between 4th and 10th months in a season opposite to 1st and 3rd month visits.

.4 correct deficiencies revealed by system checks described above, and, where required, involve equipment manufacturers/suppliers during corrective actions, and report completion of corrective work;

.5 3 months after Substantial Completion conduct a question and answer session(s) at building with Owner’s operating and maintenance personnel, with duration of session(s) dictated by number of questions and concerns that have to be addressed.

END OF SECTION

PART 1 - GENERAL

1.1 SUBMITTALS

.1 Submit shop drawings/product data sheets for products specified in Part 2 of this Section except pipe and fittings.

1.2 QUALITY ASSURANCE

.1 Fire hydrants and connecting piping are to be in accordance with Municipal requirements, and following Codes and Standards:

.1 ANSI/AWWA C502, Dry Barrel Fire Hydrants;

.2 ANSI/AWWA C900, AWWA Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings;

.3 FM 1510, Fire Hydrants (dry barrel type) For Private Fire Service;

.4 CAN/ULC S520, Fire Hydrants;

.5 CSA B137.2, PVC Injection-Moulded Gasketed Fittings for Pressure Applications;

.6 CSA B137.3, Rigid Polyvinylchloride (PVC) Pipe and Fittings for Pressure Applications;

.7 AWWA C509, Resilient Seated Gate Valves for Water-Supply Service.

PART 2 - PRODUCTS

2.1 PIPE, FITTINGS, AND JOINTS

.1 ULC listed, rigid, Class 200, DR14, 1380 kPa (200 psi) pressure rated bell and spigot pattern PVC pipe and CSA certified fittings to CSA and ANSI/AWWA Standards, complete with gasket joints, mechanical restraints, and a mechanical restraint collar for each thrust block required as per Part 3 of this Section.

2.2 FIRE HYDRANTS

.1 FM approved and ULC listed compression type, dry top, non-freeze hydrants manufactured to meet or exceed requirements of ANSI/AWWA and CAN/ULC Standards, designed for a 1035 kPa (150 psi) service pressure and a hydrostatic test pressure of 2070 kPa (300 psi), and complete with:

.1 flanged intermediate section painted with a bituminous black or epoxy coating, and with a length to suit the depth of the underground water main;

.2 Two 65 mm (2-½") dia. hose connections, each with a cap and chain and threaded to suit local Fire Department and pumper connection requirements;

.3 a bronze operating nut which opens in a counter-clock-wise direction, and a 140 mm (5-½") dia. compression type main valve;

.4 bronze to bronze interface between removable parts of main valve assembly and hydrant body;

.5 hydrant barrel complete with breakaway section at the ground line, with exposed bolts and nuts of rust and corrosion resistant alloy;

.6 150 mm (6") dia. elbow inlet connection to suit underground piping;

.7 2 coats of weatherproof epoxy enamel with colour(s) to local Municipal requirements.

.2 Manufacturers:

.1 Clow Canada M67 "Brigadier";

.2 Mueller Canada "Centurion".

2.3 FIRE HYDRANT SHUT-OFF VALVES

.1 Resilient seated, 1380 kPa (200 psi) rated, non-rising stem, FM approved and ULC listed wedge gate valves to AWWA C509, each with hub ends suitable for mechanical joint pipe connection, and an adjustable cast iron valve box (length to suit) with cover.

.2 Manufacturers:

.1 Clow Canada #F-6100 Series valve with box and cover;

.2 Mueller Canada #2360 Series with box and cover.

PART 3 - EXECUTION

3.1 MUNICIPAL SERVICE CONNECTION

.1 Make required arrangements with the Municipality for installation water service piping from Municipal main to property line.

.2 Pay all charges levied by Municipality for service connection work.

3.2 INSTALLATION

.1 Provide fire hydrants. Confirm exact locations and orientations with Consultant prior to roughing-in.

.2 Equip each hydrant with a shut-off valve and connect with piping. Provide rigid PVC piping.

.3 Conform to municipal installation standards, including provision of concrete thrust blocks at piping elbows and similar fittings.

.4 Set each valve box cover flush with finished grade in a formed 300 mm x 300 mm x 100 mm (12" x 12" x 4") thick concrete pad with a sack rubbed finish.

.5 Regardless of what is specified elsewhere in this Specification regarding provision of concrete, provide thrust block and valve box pad concrete.

3.3 SYSTEM STARTUP

.1 When installation is complete, remove hydrant nozzle caps and fully open to completely flush assembly and to test operation.

3.4 PROTECTION

.1 Touch-up paint any damaged hydrant finish.

END OF SECTION

PART 1 - GENERAL

1.1 SUBMITTALS

.1 Submit shop drawings/product data sheets to regulatory authority for review and approval prior to submitting to the Consultant. Conform to following requirements:

.1 submit shop drawings/product data sheets for all products specified in this Section except pipe and fittings.

.2 sprinklers shall be referred to on drawings and product submittals and be specifically identified by the manufacturer's listed model or series designation. Trade names and other abbreviated listings are not allowed.

.3 submit complete CAD layout drawings indicating source of water supply with test flow and pressure, "head-end" equipment piping schematic, pipe routing and sizing, and zones, all signed and sealed by a qualified professional mechanical engineer registered in jurisdiction of the work as specified below.

.4 submit copies of all calculations, including hydraulic calculations, stamped and signed by same engineer who signs layout drawings, and a listing of all design data used in preparing the calculations, system layout and sizing, including occupancy-hazard design requirements.

.5 in addition to submitting shop drawings to regulatory authority as specified above, shop drawings must be approved by Owner’s insurer prior to being submitted to the Consultant for review.

1.2 CLOSEOUT SUBMITTALS

.1 Submit a complete sprinkler system test certificate as specified in Part 3 of this Section.

1.3 SPARE PARTS

.1 Fill spare sprinkler head cabinet complete with spare heads.

1.4 QUALITY ASSURANCE

.1 Fire protection sprinkler system work is to be in accordance with following Codes and Standards:

.1 NFPA 13, Standard for the Installation of Sprinkler Systems.

.2 CSA B137.2, Polyvinylchloride (PVC) Injection-Moulded Gasketed Fittings for Pressure Applications.

.3 CSA B137.3, Rigid Polyvinylchloride (PVC) Pipe for Pressure Applications.

.4 ASTM A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.

.5 ASTM A135, Standard Specification for Electric-Resistance-Welded Steel Pipe.

.6 ASTM A234, Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.

.7 ASTM A536, Standard Specification for Ductile Castings.

.8 ASTM A795, Standard Specification for Black and Hot-Dipped Zinc Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use.

.9 ANSI/ASME B16.4, Grey Iron Threaded Fittings (Classes 125 and 250).

.10 CAN/CSA B64.10, Backflow Preventers and Vacuum Breakers.

.2 Fire protection sprinkler work is to be performed by a sprinkler company who is a member in good standing of the Canadian Automatic Sprinkler Association. Site personnel are to be licensed in jurisdiction of the work and under the continuous supervision of a foreman who is an experienced fire protection system installer and a journeyman pipe fitter licensed in jurisdiction of the work.

.3 Check and verify dimensions and conditions at site and ensure work can be performed as indicated. Coordinate work with trades at site and accept responsibility for and cost of adjusting piping and/or spacing to avoid interference with other building components.

.4 Verify working condition of existing sprinkler system equipment which has direct interface with project work and is to remain. Replace with new equipment where necessary.

.5 System components must be ULC listed and labelled.

.6 All grooved couplings, and fittings, valves and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.

.7 All castings used for coupling housings, fittings, valve bodies, etc., shall be date stamped for quality assurance and traceability.

1.5 DESIGN REQUIREMENTS

.1 Fire protection sprinkler work is to be designed in accordance with NFPA 13 and Provincial Standards, and, where required, local building and fire department requirements and standards of Owner's Insurer. If water supply flow and pressure test data is not available, conduct Municipal main water flow and pressure tests at nearest fire hydrant to obtain criteria to be used in system design. Include hydrant location and flow and pressure test data with system design calculations.

.2 Include for a qualified mechanical professional engineer registered and licensed in the jurisdiction of the work to design the fire protection standpipe work. For requirements regarding Contractor retained engineers, refer to Section 20 05 10 – Mechanical Work General Instructions.

.3 Sprinkler /System Occupancy – Hazard Design requirements: In accordance with NFPA 13 occupancy-hazard density requirements, unless otherwise specified.

PART 2 - PRODUCTS

2.1 PIPE, FITTINGS, AND JOINTS

.1 Pipe, fittings, and joints are to be as follows, with exceptions as specified in Part 3 of this Section:

.1 PVC

.1 Class 200, DR14, rigid, hub and spigot pattern PVC pipe and CSA certified fittings to CAN/CSA B137.2 and B137.3 and complete with gasketed joints.

.2 Schedule 40 Steel – Grooved Coupling Joints

.1 Schedule 40 mild black carbon steel, ASTM A53, Grade B, complete with grooved ends and mechanical fittings and couplings equal to Victaulic "FireLock" fittings and Victaulic Style 009N, 107H, and 107N QuickVic and 005 rigid coupling joints. Strap type outlet fittings such as Victaulic "Snap-Let" are not acceptable.

.3 Schedule 40 Steel – Screwed and Welded Joints

.1 Schedule 40 mild black carbon steel, ASTM A53, Grade B. Screwed piping complete with Class 125 cast iron screwed fittings to ANSI/ASME B16.4. Welded piping complete with factory made seamless carbon steel butt welding fittings to ASTM A234, Grade WPB, long sweep pattern wherever possible.

.4 Schedule 10 Steel – Grooved Coupling Joints

.1 Schedule 10 mild black carbon steel, ASTM A53, Grade B, complete with grooved ends and fittings and couplings equal to Victaulic "FireLock" fittings and Victaulic Style 009N, 107H, and 107N QuickVic and 005 rigid coupling joints.

.5 Schedule 10 Steel – Screwed Joints

.1 Schedule 10 mild black carbon steel, ASTM A53, Grade B, complete with mill or site threaded ends, Class 125 cast iron screwed fittings to ANSI/ASME B16.4, and screwed joints.

.6 "Lightwall" Steel – Grooved Coupling Joints

.1 Commercial quality. "Lightwall" rolled mild carbon steel pipe to ASTM A135, Grade A, complete with a galvanized exterior, grooved ends, and fittings and couplings equal to Victaulic "Fire Lock" grooved fittings and Victaulic Style 009N QuickVic or 005 rigid coupling joints.

.7 "Lightwall" Steel – Screwed Joints

.1 Commercial quality, "Lightwall" rolled mild carbon steel pipe to ASTM A135, Grade A, ULC listed, mill or site threaded, complete with galvanized exterior, Class 125 cast iron screwed fittings to ANSI/ASME B16.4, and screwed joints.

.8 Flexible Pipe – Equal to Victaulic "VicFlex"

.1 The drop system shall consist of a braided type 304 stainless steel flexible tube, zinc plated steel 1" NPT Male threaded nipple for connection to branch-line piping, and a zinc plated steel reducer with a 1/2" or 3/4" NPT female thread for connection to the sprinkler head.

.2 Option: Victaulic FireLock IGS Groove Style 108 coupling for connection to branch-line piping, and a zinc plated steel reducer with a female thread for connection to the sprinkler head.

.3 The drop shall include a cULus/FM approved Series AH2 braided hose with a bend radius to 2" to allow for proper installation in confined spaces.

.4 The hose shall be listed for:

.1 (4) bends at 31" length.

.2 (5) bends at 36" length.

.3 (8) bends at 48" length.

.4 (10) bends at 60" length.

.5 (12) bends at 72" length.

.5 Union joints shall be provided for; ease of installation, prevention of hose torque stresses and on site changing of factory 5.75" straight reducing nipple in reduced spaces under obstructions (optional reducing nipples; 4.83" or 6.57" reducing 90 and 9" or 13" straight reducer x ½ or ¾" outlet) All VicFlex assemblies and related accessories to be installed as per the guidelines and listings in Victaulic submittal 10.85.

.6 On T Bar ceiling grid with drop in tile application, the flexible drop shall attach to the ceiling grid using a one-piece open gate Series AB1 bracket. The bracket shall allow installation before the ceiling tile is in place.

.7 On T Bar ceiling grid designed for hard lid drywall application; the flexible drop shall attach to the ceiling grid using a one-piece open gate Series AB2 bracket. The bracket shall allow for the vertical adjustment of the reducer/head from below the drywall, post drywall installation.

.8 On Hat Furring Channel grid with hard lid drywall application; the flexible drop shall attach to the ceiling grid using a one-piece open gate Series AB4 bracket. The bracket shall allow for the vertical adjustment of the reducer/head from below the drywall, post drywall installation.

.9 The braided drop system shall be cULus listed and FM Approved for sprinkler services to 175 psi (1206 kPa).

.10 For dry sprinkler heads Victaulic VicFlex dry sprinkler model VS1. The sprinkler shall provide a vertical or horizontal flexible connection with a bend radius to 2” and allow for up to 4 bends. The sprinkler body shall be die cast brass with brass deflector, supplied finished to match application and to architectural direction, and glass bulb with glycerin solution. The product shall consist of a braided type 300 stainless steel flexible hose with a swivel type branch line threaded connection, EPDM gasket seal, with PTFE-coated Beryllium Nickel and stainless-steel spring-seal assembly. The bracket shall be open gate or metal strap to provide for sprinkler placement and alignment. The flexible dry sprinkler and bracket system is UL listed for sprinkler services to 175 psi.

.9 Copper – Solder Joint

.1 Type "L" hard drawn seamless copper to ASTM B88, complete with copper solder type fittings to ASME/ANSI B16.18 and soldered joints.

.10 CPVC Pipe

.1 Equal to IPEX BlazeMaster solvent weld, orange, SDR 13.5 pipe and Schedule 80 fittings, ULC listed for use in wet pipe automatic sprinkler systems, with a flame spread rating less than 25 and a smoke developed rating less than 50 when tested in accordance with CAN/ULC S102.2, and in accordance with NFPA 13 requirements.

.2 Victaulic Standard Mechanical Couplings: Manufactured in two segments of cast ductile iron, conforming to ASTM A-536, Grade 65-45-12. Gaskets shall be pressure-responsive synthetic rubber, grade to suit the intended service, conforming to ASTM D-2000. Mechanical Coupling bolts shall be zinc plated (ASTM B-633) heat treated carbon steel track head conforming to ASTM A-449 and ASTM A-183. Couplings shall comply with ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications.

.3 Rigid Type: Coupling housings with offsetting, angle-pattern bolt pads shall be used to provide system rigidity and support and hanging in accordance with NFPA 13. Couplings shall be fully installed at visual pad-to-pad offset contact. Couplings that require exact gapping of bolt pads at specific torque ratings are not permitted.

.4 Flexible Type: Use in locations where vibration attenuation and stress relief are required. Victaulic Style 177 (Quick-Vic™), Installation ready flexible coupling.

2.2 SERVICE MAIN DOUBLE CHECK VALVE ASSEMBLIES

.1 Minimum 1205 kPa (175 psi) rated dual check valve backflow preventer assembly to CAN/CSA B64, complete with tight-closing resilient seated shut-off valves, test cocks and strainer.

.2 Manufacturers:

.1 Watts Industries Canada.

.2 Zurn/Wilkins.

.3 Apollo Valves (Conbraco Industries).

2.3 SHUT-OFF VALVES

.1 Minimum 2070 kPa (300 psi) rated full port brass or bronze body screwed ball valves and lug body or grooved end type butterfly valves.

.2 Butterfly valves shall include a pressure responsive seat, and the stem shall be offset from the disc centerline to provide complete 360-degree circumferential seating.

.3 Basis of Design: Victaulic Style 705.

.4 OS&Y Gate Valves: 1725 kPa (250 psi), grooved ends. Ductile iron body, yoke, and handwheel conforming to ASTM A-536; EPDM coated ASTM A-126-B cast iron disc; ASTM B16 brass rising stem; flanged and epoxy coated ductile iron bonnet; EPDM O-ring stem seals and body gasket. Victaulic Series 771H (Grooved ends) and Series 771F (Grooved x Flanged).

.5 Supervised closed applications:

.1 Basis of Design: Victaulic Series 707C supervised closed butterfly valve.

2.4 CHECK VALVES

.1 Minimum 1725 kPa (250 psi) resilient seat check valves, suitable for vertical or horizontal installations.

.2 Basis of Design: Victaulic Series 717.

.3 Check valves associated with Fire Department connections and fire pump test connections are to be tapped for site installation of a 20 mm (¾") diameter ball drip.

2.5 BALL DRIPS

.1 Equal to National Fire Equipment Ltd. Model #A58, 20 mm (¾") diameter automatic ball drip.

2.6 SHUT-OFF VALVE SUPERVISORY SWITCHES

.1 Tamper-proof supervisory switches, each arranged to activate a fire alarm system trouble alarm condition if the valve is closed or tampered with, each suitable in all respects for the application, and each complete with all required mounting and connection hardware.

.2 Actuator housings shall be weatherproof.

2.7 FIRE DEPARTMENT CONNECTIONS

.1 Wall mounting polished brass clapper type dual inlet Fire Department connection with two 65 mm (2-½") diameter inlets threaded to Fire Department hose requirements and equipped with caps and chains, an outlet sized as shown, and a faceplate.

.2 Faceplate is to be polished brass and complete with "AUTO-SPKR" "STANDPIPE" cast-in raised lettering.

.3 Exposed metal parts of Fire Department connection are to be chrome plated.

.4 At the low point near each fire department connection, install a 90-degree elbow with drain connection to allow for system drainage to prevent freezing.

.5 Basis of Design: Victaulic #10-DR.

2.8 SPRINKLER MAIN "LOSS OF PRESSURE" ALARM SENSORS

.1 Piping mounted adjustable pressure sensor designed to actuate an alarm upon sensing a loss of pressure in the fire protection main. Switch is to be low voltage or line voltage as required.

2.9 WATER FLOW ALARM SWITCHES

.1 Pipe mounting water flow alarm switch, minimum 1725 kPa (250 psi) rated, designed to actuate two 7 A rated (at 125/250 VAC) SPDT snap action switches when water flow exceeds 0.758 L/sec. (10 Imp gpm), complete with a tamper-proof cover with conduit connection opening, a piping saddle and U-bolt, and an automatic rest pneumatic retard device with field adjustable (0 to 70 second) switch actuation delay to reduce false alarms caused by a single or series of transient water flow surges.

2.10 ELECTRIC BELL

.1 Equal to Potter PAC or PDC

.2 Surface wall mounted red steel electric bell available in VAC or VDC voltages. Mounted on a standard 4” square electrical box for indoor use or on a model BBK-1 or HC-BB weatherproof backbox for outdoor applications. UL and cUL listed.

2.11 SPRINKLER HEADS

.1 Sprinkler heads, unless otherwise specified, are to be as scheduled in Part 3 of this Section.

.2 Sprinkler body shall be die-cast, with a hex-shaped wrench boss integrally cast into the sprinkler body to reduce the risk of damage during installation. Wrenches shall be provided by the sprinkler manufacturer that directly engage the wrench boss.

.3 For locations where corrosive resistant coatings are required, body shall be coated with UL listed and FM approved anti-corrosion VC-250 coating (silver coloring).

.4 Sprinkler heads for healthcare facilities are to be quick response type.

.5 Provide quick response sprinkler heads unless standard response required to suit the hazard class.

.6 Recessed sprinkler heads in finished areas are to be chrome plated unless otherwise specified. Concealed sprinkler head ceiling plates are to match ceiling colour.

.7 Where exposed pendent heads occur in areas with suspended ceilings, they are to be complete with [chrome plated] escutcheon plates. Similarly, sidewall heads with concealed piping are to be complete with [chrome plated] escutcheon plates.

.8 Sprinkler heads which are exposed in areas where they may be subject to damage are to be complete with wire guards, [chrome plated] in finished areas.

.9 Escutcheons and guards shall be listed, supplied, and approved for use with the sprinkler by the sprinkler manufacturer.

.10 Sprinkler heads located in areas or over equipment where high ambient temperature is present are to be, unless otherwise specified, 74°C (165°F) heads. All other heads, unless otherwise specified or required, are to be 57°C (135°F) rated.

.11 Manufacturers:

.1 Victaulic Co.

.2 Tyco Fire Suppression & Building Products.

.3 The Viking Corporation.

.4 The Reliable Automatic Sprinkler Co.

2.12 SPARE SPRINKLER HEAD CABINETS

.1 Surface wall mounting, red enamelled steel, identified cabinet with hinged door, shelves with holes for mounting sprinkler heads, a wrench or wrenches suitable for each type of sprinkler head, and a full complement of spare sprinkler heads.

.2 Cabinet is to be sized to accommodate a minimum of 4 spare heads for each type of head used on the project, however, each cabinet is to be full of spare heads.

2.13 INDICATOR POST AND VALVES

.1 Cast iron, bronze trim, resilient seat, OS&Y gate valve with non-rising stem in accordance with AWWA 200W, minimum 1380 kPa (200 psi) cold water rated and complete with a square operating nut and ends to suit connecting piping.

.2 Adjustable indicator post assembly with a cast iron valve box of a length to suit valve depth and flange bolted to the valve, a cast iron lower barrel bolted to the valve box and of a length to suit valve location, and a cast iron upper housing bolted to the lower barrel and complete with wrench and operating mechanism with steel extension shaft and coupling nut sized to suit, operating handle, and valve "OPEN" and "CLOSED" identification visible through a clear polycarbonate window.

PART 3 - EXECUTION

3.1 MONITORING OF SYSTEMS

.1 Daily monitor and supervise existing sprinkler system serving renovated areas to ensure that each respective system is left in proper operating condition at end of each working day. Include for but not be limited to performing following:

.1 Under presence of Owner’s representative, check each morning and evening (start and end of work) of each day, sprinkler system to ensure that it is in proper working condition.

.2 If portions of sprinkler system are not in proper working order, provide temporary provisions subject to approval of local fire authority or local governing authority, to ensure that proper sprinkler coverage is provided and/or provide supervisory personnel to monitor areas where sprinkler system is not operational.

.3 Document and sign off with Owner’s representative signing off also, each respective daily check condition.

.4 Ensure that work to sprinkler system does not affect portion of system serving areas outside of renovation areas.

3.2 DEMOLITION

.1 Refer to demolition requirements specified in Section 20 05 05 – Selective Demolition for Mechanical.

3.3 PIPING INSTALLATION REQUIREMENTS

.1 Provide required sprinkler system piping.

.2 Perform piping work in accordance with requirements of NFPA 13, governing regulations, and "Reviewed" shop drawings.

.3 Piping, unless otherwise specified, is as follows:

.1 for underground piping inside or outside building – Class 200, DR14 rigid PVC, braced and secured at bends and tees with concrete blocks in accordance with Municipal standards and details.

.2 for piping inside building and above ground except as noted below – Schedule 40 grooved end black steel with Victaulic or equal fittings and coupling joints, or, for piping to and including 50 mm (2") diameter, screwed fittings and joints, or, for piping 65 mm (2-½") diameter and larger, welding fittings and welded joints.

.3 for wet system piping inside building and above ground – at your option, CPVC sprinkler pipe and fittings.

.4 for piping downstream of "head end" alarm valve(s) and equipment – Schedule 10 or "Lightwall" black steel pipe with Victaulic or equal fittings and coupling joints or screwed fittings and joints.

.5 for branch piping to heads in suspended ceilings, etc. – at your option, flexible piping installed in accordance with manufacturer's instructions.

.6 for branch piping to heads in MRI suites – copper pipe, fittings, and sprinkler head adapters with stainless steel hangers and support hardware.

.4 Exceptions to piping requirements specified above are as follows:

.1 dry pipe zone steel piping, fittings, unions, couplings and flanges are to be galvanized.

.2 wet zone steel piping, fittings, unions, couplings and flanges for sprinkler work exposed to weather either inside or outside building (including parking garages), are to be galvanized.

.3 PVC piping is not to be used above grade.

.4 ferrous pipe hangers, supports, and similar hardware used for galvanized steel piping are to be electro-galvanized.

.5 Pipe sizes, pipe routing, sprinkler head quantities and locations, and layout of work shown on drawings are to assist during the tendering period. Ensure adequate head coverage, head quantities and pipe sizing as specified in Part 1 of this Section. Do not reduce size of sprinkler main or re-route the main unless approved by consultant.

.6 Pipe, fittings, couplings, flanges and similar components are to be clean after erection is complete. Wire brush clean any ferrous pipe, fitting, coupling, flange, hanger, support and similar component which exhibits rust and carefully coat with suitably coloured primer.

.7 Where sprinklers are not protected by a dry system and may be subject to freezing, provide non-freeze, glycol-water solution filled sprinkler piping. Install piping complete with a CSA certified reduced pressure backflow preventer, valves, and glycol solution fill facilities in accordance with requirements of Chapter 3 of NFPA 13. Fill piping with a solution of 50% Union Carbide Canada Ltd. "UCAR THERMO-FLUID 17" or Dow Chemical Co. "Dowtherm SR1" propylene glycol with corrosion inhibitors, and 50% clean water. Prior to filling piping, check the specific gravity of the solution using a hydrometer with proper scale. Specific gravity is to be approximately 1.069 at 15.6°C.

.8 When sprinkler work is complete, test system components and overall system(s) and submit completed test certificate and other documentation in accordance with Chapter 8 of NFPA 13.

.9 Grooved joints shall be installed in accordance with the manufacturer's latest published installation instructions. Grooved ends shall be clean and free from indentations, projections, and roll marks. Gaskets shall be molded and produced by the coupling manufacturer and shall be verified as suitable for the intended service. A factory-trained field representative of the mechanical joint manufacturer shall provide on-site training for contractor's field personnel in the proper use of grooving tools and installation of grooved piping products. The factory-trained representative shall

periodically review the product installation and ensure best practices are being followed. Contractor shall remove and replace any improperly installed products.

3.4 INSTALLATION OF DOUBLE CHECK VALVE ASSEMBLY

.1 Provide a double check valve assembly in sprinkler main inside the building.

.2 Equip assembly with inlet and outlet shut-off valves with supervisory switches as specified below.

.3 Support each end of assembly from floor by means of flanged pipe supports with saddles.

3.5 INSTALLATION OF SHUT-OFF VALVES AND CHECK VALVES

.1 Provide shut-off valves and check valves in piping where shown and wherever else required.

.2 Locate valves for easy operation and maintenance.

.3 Confirm exact locations prior to roughing-in.

3.6 INSTALLATION OF SHUT-OFF VALVE SUPERVISORY SWITCHES

.1 Equip each shut-off valve with a supervisory switch.

.2 Identify each supervised valve with a 150 mm (6") square, engraved, laminated red-white plastic tag to correspond with supervised valve numbering specified and/or shown as part of the electrical work fire alarm system.

3.7 INSTALLATION OF FIRE DEPARTMENT CONNECTION

.1 Provide an exterior Fire Department connection. Confirm exact location prior to roughing-in. Confirm finish prior to ordering.

.2 Equip connection with a check valve. Equip check valve with a ball drip to drain piping between Fire Department connection and check valve and extend drainage piping from outlet of ball drip to nearest suitable floor drain.

3.8 INSTALLATION OF LOSS OF PRESSURE SENSOR

.1 Supply and mount a pressure sensor in the fire protection piping main to activate a "LOSS OF PRESSURE" trouble alarm should Municipal water service pressure fall below the acceptable level.

.2 Locate sensor for easy access and maintenance and set alarm pressure to suit site conditions. Confirm setting on site.

.3 Identify pressure sensor and its normal setting with a 150 mm (6") square red-white laminated plastic tag engraved to read "LOSS OF WATER PRESSURE SENSOR - NORMAL SETTING 210 kPa". Confirm wording prior to engraving.

3.9 INSTALLATION OF FLOW ALARM SWITCHES

.1 Provide water flow alarm switches in accessible locations in zone piping.

.2 Adjust to suit site water pressure conditions. Check and test operation.

.3 Identify each switch with a 150 mm (6") square red-white laminated engraved plastic tag. Confirm wording prior to engraving.

3.10 INSTALLATION OF SPRINKLER HEADS

.1 Provide required sprinkler heads in accordance with following schedule:

Application	Sprinkler Head Type
Healthcare Facility Type I rooms/areas as per CAN/CSA-Z317.2, Table 1, HVAC Design Criteria, first two columns	Victaulic V38/V39 or Tyco Series RFII "Royal Flush II" concealed pendent
Healthcare Facility Type II rooms/area as per CAN/CSA-Z317.2, Table 1, HVAC Design Criteria, first two columns	Victaulic V27 or Tyco Series TY-FRB recessed pendent
Healthcare Facility Type III rooms/areas as per CAN/CSA-Z317.2, Table 1, HVAC Design Criteria, first two columns	Victaulic V27 or Tyco Series TY-FRB recessed pendent
Healthcare patient unit without a suspended ceiling but with a ceiling bulkhead	Victaulic V27 or Tyco Series TY-FRB recessed horizontal sidewall Victaulic V38/V39 or Tyco Series RFII "Royal Flush II" concealed pendent or Victaulic V27 or Tyco Series TY-FRB recessed pendent in bottom of bulkhead if bulkhead is greater than 200 mm (8") deep
Healthcare Facility mental health room/areas	Tyco "RAVEN" institutional, tamper-resistant pendent or horizontal sidewall as required
Healthcare Facility MRI Suite	Reliable Model F4FR-NF non-ferrous concealed pendent
Rooms/areas with a suspended ceiling	Victaulic V38/V39 or Tyco Series RFII "Royal Flush II" concealed pendent Victaulic V27 or Tyco Series TY-FRB recessed pendent Victaulic V27 or Tyco Series TY-FRB pendent with escutcheon plates
Rooms/areas without a suspended ceiling	Victaulic V27 or Tyco Series TY-FRB pendent
Elevator shafts	Victaulic V27 or Tyco Series TY-FRB horizontal sidewall
Unheated exterior stairwells	Victaulic V36 or Tyco Series DS-1 dry pipe horizontal sidewall Victaulic V36 or Tyco Series DS-3 wet pipe horizontal sidewall

Application	Sprinkler Head Type
Air handling system outdoor air and relief air plenums (unheated)	Tyco Series DS-3 ECOH dry horizontal sidewalls in wet piping Victaulic V27 or Tyco Series TY-FRB upright or horizontal sidewall in dry pipe or anti-freeze piping
Unheated and unfinished areas	Victaulic V36 or Tyco Series DS-3 ECOH dry horizontal sidewall in wet piping Victaulic V27 or Tyco Series TY-FRB upright or horizontal sidewall in dry pipe or anti-freeze piping
Heated areas with overhead doors	Victaulic V27 or Tyco Series TY-FRB horizontal sidewall
Unheated parking garage	Victaulic V34 or Tyco Series EC-11 or EC-14 ECOH upright or Victaulic V27 or Series TY-FRB upright for dry piping
Heated parking garage	Victaulic V34 or Tyco Series EC-11 or EC-14 ECOH upright or Victaulic V27 or Series TY-FRB upright for wet piping
Parking garage ramp	Victaulic V34 or Tyco Series EC-11 or EC-14 ECOH upright or Series TY-FRB upright or Victaulic V27 or Series ELO SW-20 or SW-24 ECOH sidewall
At non-rated windows in rated walls	Tyco Model WS horizontal and pendent vertical sidewall

.2 Sprinkler head manufacturers indicated on schedule are for type indication purposes. Manufacturers are listed in Part 2 of this Section.

.3 Provide quick response type sprinkler heads for healthcare facilities.

.4 Coordinate sprinkler head locations with all drawings, including architectural reflected ceiling plan drawings, and, where applicable, electrical drawings. Coordinate sprinkler head locations in areas with suspended ceilings with the location of lighting, grilles, diffusers, and similar items recessed in or surface mounted on the ceiling as per the reflected ceiling plans. In areas with lay-in tile, centre the sprinkler head both ways in the lay-in tile wherever possible. Confirm locations prior to roughing-in.

.5 Maintain maximum headroom in areas with no ceilings.

.6 Provide guards for heads where they are subject to damage.

.7 Provide high temperature heads in equipment rooms and similar areas over heat producing or generating equipment.

3.11 INSTALLATION OF SPARE SPRINKLER HEAD CABINETS

.1 Supply a full complement (to fill cabinet) of spare sprinkler heads of types used (minimum 4 of each type) and place in a wall mounting storage cabinet located adjacent to sprinkler system "head end" equipment where later directed.

3.12 INSTALLATION OF INDICATOR POST VALVES

.1 Provide a shut-off valve in underground sprinkler main piping outside building. Equip valve with a valve box and an indicator post assembly.

.2 Confirm valve box length and steel shaft length prior to ordering and confirm exact location prior to roughing-in.

.3 When installation is complete, check and test operation of assembly and adjusts as required.

END OF SECTION

SEE ADD#2 Q#27 & 28

Deleted through ADD#16,Q#369

PART 1 - GENERAL

1.1 SUBMITTALS

.1 Submit shop drawings/product data sheets as follows:

.1 for all products specified in this section except pipe and fittings;

.2 submit complete CAD layout drawings indicating "head-end" equipment, piping schematic, pipe routing and sizing, zones, activation devices, and wiring schematics, all signed and stamped by a professional engineer registered in the jurisdiction of the work;

.3 submit copies of all calculations and a listing of all design data used in preparing the calculations, system layout and sizing, signed and stamped by the design engineer as specified above.

1.2 CLOSEOUT SUBMITTALS

.1 Submit weekly inspection reports by the system design engineer as specified below in the article entitled Quality Assurance.

.2 Submit an inspection and test report and certification by the system manufacturer’s design engineer confirming that the system is properly installed, has been tested, and is in proper operating condition, all as specified in Part 3 of this section.

.3 Training attendance records.

1.3 MAINTENANCE MATERIAL SUBMITTALS

.1 Submit three identified keys for the fire suppression agent release panel door prior to Substantial Performance.

1.4 QUALITY ASSURANCE

.1 Carbon dioxide fire suppression system work is to be in accordance with the following Codes and Standards:

.1 NFPA 12, Carbon Dioxide Fire Extinguishing System;

.2 ASTM A106, Standard Specification for Seamless Carbon Steel Pipe for High Temperature Service;

.3 ANSI B16.3, Malleable Iron Threaded Fittings;

.4 ANSI B16.11, Forged Steel Fittings, Socket Welding and Threaded;

.5 CAN/ULC-S524, Standard for the Installation of Fire Alarm Systems;

.6 CSA C22.1, Canadian Electrical Code.

.2 System installation personnel are to be licensed journeyman pipe fitters in the employ of the system manufacturer and under constant on-site supervision of a competent supervisor.

.3 The system manufacturer’s design engineer is to conduct weekly inspections during the course of the work, and submit an inspection report after each site visit. The design engineer is also to perform final inspection/start-up/programming and submit certification as specified in Part 3 of this section.

1.5 DESIGN REQUIREMENTS

.1 The system is to be designed by a professional engineer registered and licensed in the jurisdiction of the work and in the employ of the system manufacturer. The design engineer is to sign and stamp all shop drawings (not product data sheets) and design calculations.

.2 The fire suppression system is to utilize carbon dioxide gas and is to be in accordance with requirements of NFPA 12.

.3 The system is to be a permanent, piped, fixed discharge nozzle type system designed for total flooding of the gas to provide a sufficient amount of fire suppression agent to obtain a uniform (minimum) design concentration throughout the protected area while taking into account such factors as un-closable openings, "rundown" time of fans, time required for dampers to close, and any other feature of the facility that could affect gas concentration. Design concentration is to be by volume at 21°C (70°F).

.4 The system is to include but not be limited to the following main components:

.1 agent release control panel with addressable input and output modules;

.2 smoke detectors, located at maximum 37 m² (400 ft²) intervals and connected in cross-zoned circuits;

.3 a manual pull station and manual abort station at each protected area exit;

.4 audible alarm signals;

.5 visual alarm signal(s);

.6 charged cylinder(s) of carbon dioxide in re-chargeable cylinders designed to hold pressurized carbon dioxide in liquid form at atmospheric temperatures corresponding to a normal pressure of 5860 kPa (40 000 psi) at 21°C (15°F), with manifold if required, cylinder bracket(s), valve actuator(s), discharge hose/check valve assemblies, and orifice union/nipple assembly;

.7 motorized dampers;

.8 gas distribution piping system with discharge nozzles.

1.6 DESCRIPTION OF SYSTEM OPERATION

.1 Activation of any single smoke detector in any detection zone is to:

.1 transmit a first stage alarm signal to the carbon dioxide release control panel;

.2 transmit an alarm signal from the release control panel to the building fire alarm system control panel;

.3 energize a lamp on the activated smoke detector.

.2 Activation of a second smoke detector in any detector zone is to:

.1 transmit an alarm signal to the release control panel and from the release panel to the fire alarm control panel;

.2 energize auxiliary contacts for ventilation equipment shutdown and closure of motorized dampers;

.3 initiate a programmable release time delay in the release panel;

.4 initiate opening of room relief/smoke damper;

.5 actuate a local electronic alarm horn signal.

.3 Upon completion of the release panel time delay the system is to:

.1 cause a discharge signal to sound;

.2 actuate the room electronic horn to cause a second distinct signal to sound;

.3 actuate visual alarms at room entrances and within the room;

.4 energize the control solenoid for cylinder(s), thereby releasing carbon dioxide into the room;

.5 after the room relief/smoke damper has been open for a predetermined period of time, the release panel is to close the damper.

.4 The manual pull station section of the manual pull station/abort switch at each room exit, when activated, is to immediately release carbon dioxide, cause all audible and visual signal to activate, and all other system functions as if two cross-zoned smoke detectors had been activated. The manual abort section, if operated before carbon dioxide release, will interrupt the discharge of carbon dioxide.

.5 The system is to be electrically supervised and monitored for integrity of conductors, and is to be complete with:

.1 addressable interface between the carbon dioxide release control panel and the fire alarm system control panel;

.2 output signals and devices to shutdown associated room ventilation equipment;

.3 addressable communication techniques for local data acquisition and control;

.4 active/interrogative features whereby each system device is repetitively scanned, causing a signal to be transmitted to the release panel to indicate that initiating devices and signalling appliance circuit wiring is functional, with loss of signal at the release panel resulting in a trouble indication as specified herein for the particular input.

.6 System components are to be CSA certified and UL and/or ULC listed.

1.7 SYSTEM FEATURES AND SEQUENCES

.1 Features and sequences of the microprocessor based system are to include but not be limited to the following:

.1 alarm and trouble signals from intelligent reporting devices are to be digitally encoded onto a looped multiplex communication system;

.2 digitized electronic circuits are to employ check digits or multiple polling;

.3 a single ground or open on any system initiating device is not to cause system malfunction, loss of operating power, or ability to report an alarm;

.4 alarm signals arriving at the release panel are not to be lost following a power failure or power outage until the alarm signal is processed and recorded;

.5 Operation of any automatic alarm initiating device is to cause the following:

.1 an alarm signal to be transmitted to the fire alarm system control panel;

.2 the addressable device address to be indicated on the control panel;

.3 system alarm LED to flash;

.4 local signal in the carbon dioxide release panel to sound;

.5 80 character LCD display to indicate all information associated with the alarm condition, including the type of alarm point and its location;

.6 the panel to log information associated within the release panel’s condition, along with the time and date of the occurrence;

.7 system output programs assigned via control-by-event equations to be activated by the particular point in alarm to be executed, and associated system outputs (alarm signals and/or relays) to be activated.

.6 Non-emergency user operations are to be as follows:

.1 log trouble and energize the related LED for user features which modify, bypass, or inhibit normal operation of the fire alarm system, and suppress the common trouble signal during delivery of alarm signalling;

.2 operation of programming functions to utilize menu displays to guide the user through either addressable devices disconnect or view shared display troubles and other field programmable features, and restriction of the use of program by password;

.3 operation of programming functions to allow setting of display time and date, and when system is normal, annunciate "System Normal";

.4 operation of ancillary bypass features to prevent alarm operation of ancillary relays and display a trouble condition;

.5 operation of reset pushbutton to return the system to normal after initiating devices have been returned to normal.

.7 Operation of an addressable supervisory input device will sound a momentary audible signal, display on the panel alphanumeric display, and display the type, condition, and location message for the first alarm immediately without the need for operator response if no fire alarms are present, then log subsequent supervisory events for display by emergency user selection. The panel is also to display the current total number of supervisory events and chronologically number each event, and is to be complete with supervisory alarm priority to capture the display from a trouble or monitor event, and energize a respective yellow LED.

.8 System and system component operational functions and features are to be as follows:

.1 The system is to provide a means for adjusting the sensitivity of any or all anolog intelligent smoke detectors from the carbon dioxide release panel keypad or from the keyboard of a video terminal. Sensitivity range is to be within the allowed ULC window.

.2 Each intelligent addressable detector may be independently selected and enabled as an alarm verified detector. The release panel is to keep count of each time each detector has entered the verification cycle, and these counts may be displayed and reset by proper operator commands.

.3 System point operations are to include the following features:

.1 any device in the system may be enabled or disabled through the release panel;

.2 any system output point may be turned on or off from the release panel keyboard.

.4 The system is to display the following point status diagnostic functions without the need for peripheral equipment, and each point is to be annunciated for parameters listed:

.1 device status;

.2 device type;

.3 custom device label;

.4 software zone label;

.5 device zone assignments;

.6 detector analog value;

.7 all program parameters.

.9 Upon a command from the release panel operator status report is to be generated listing the system status.

.10 The release panel is to contain a non-volatile memory history buffer capable of storing up to 400 system input/output/control activations. Each activation is to be stored and time and date stamped with actual time activation, until the operator requires that the contents be displayed, at which point the history buffer may be manually reviewed, one event at a time, and the actual number of activations may also be displayed and printed.

.11 The release panel is to automatically interrogate each intelligent smoke detector and analyze detector responses over a period of time. If any detector in the system responds with a reading that is below or above normal limits, the system will enter the trouble mode and the particular detector will be annunciated on the system display. This feature will not inhibit receipt of an alarm condition.

.12 Operation of the pushbutton is to return the system to its normal state after the activated alarm initiating device(s) have been returned to normal.

PART 2 - PRODUCTS

2.1 PIPE, FITTINGS, AND JOINTS

.1 Mild galvanized seamless steel pipe, ASTM A106, Grade C, Schedule 40, with 300 lb malleable iron screwed fittings to ANSI B16.3 and screwed joints downstream of the cylinder assembly union orifice, Schedule 80 with 20 685 kPa (3000 psi) screwed fittings to ANSI B16.11 and screwed joints for any piping upstream of the orifice union.

2.2 PIPE HANGERS AND SUPPORTS

.1 ULC listed galvanizes pipe hangers and supports as specified in Section 20 05 00 – Common Work Results for Mechanical.

2.3 ORIFICE UNION ASSEMBLIES

.1 Screwed, minimum 13 790 kPa (2000 psi) rated orifice union assembly threaded directly to manifold piping without the use of special adapters and designed to reduce pressure in the downstream piping. The assembly is to be permanently marked with the manufacturer’s name and orifice code.

2.4 DISCHARGE HOSE CHECK VALVES

.1 Flexible reinforced metallic discharge hose and check valve at the cylinder for connection to the manifold inlet.

2.5 FIRE SUPPRESSION AGENT

.1 Carbon dioxide.

2.6 STORAGE CYLINDERS

.1 DOT and TSSA approved and stamped stainless steel cylinders for vertical or horizontal mounting as required, factory filled with carbon dioxide, painted red and properly labelled, and complete with:

.1 a forged brass, pressure seat type valve and pressure gauge, and a factory set safety pressure relief device which relieves to atmosphere;

.2 one or two steel saddles (depending on cylinder length) with modular steel brackets to secure cylinders in the saddles and to permit bracketing or stacking of the cylinders as space conditions dictate.

2.7 VALVE ACTUATORS

.1 Continuous duty type, magnetic latch, 24 VDC brass valve actuators of stackable design with swivel connections to permit removal of actuators for maintenance or testing, and designed so that actuator operation will not require replacement of components.

2.8 DISCHARGE NOZZLES

.1 Baffle type permanently identified brass discharge nozzles, each sized for flow rates in accordance with system design flow calculations and complete with an inlet orifice plate with properly sized orifice machined in the nozzle body for a horizontal discharge pattern of carbon dioxide based on design coverage arrangements.

2.9 CARBON DIOXIDE RELEASE PANEL

.1 Surface wall mounting, 120 V, 60 Hz, 1-phase, microprocessor based control and annunciation panel with a NEMA 4 enamelled steel enclosure with lockable hinged door, backlit liquid crystal display, individual colour-coded system status LED's, and an alphanumeric key pad for field programming. The microprocessor is to communicate with and control the following:

.1 smoke detectors;

.2 addressable dry contacts in control and monitor modules;

.3 annunciator;

.4 printer;

.5 all other controlled devices.

.2 Programming and editing of the initial system program is to be achieved without special equipment and without interrupting the alarm monitoring functions of the panel.

.3 The microprocessor is to:

.1 communicate with, monitor and control all external interfaces with the control panel, and is to include an EPROM for system program storage, non-volatile memory for building specific program storage, and a "watch dog" timer circuit to detect and report microprocessor failure;

.2 contain and execute all control-by-event programs for specific action to be taken if an alarm condition is detected by the system, and such control-by-event programs are to be held in non-volatile memory and are not to be lost, even is system primary and secondary power failures occur;

.3 be complete with a real time clock for time annotation of system displays, printer, and history file, and time-of-day and date which is not to be lost if primary and secondary power supplies fail, and the real time clock may also be used to control non-fire functions at programmed time-of-day, day-of-week, and day-of-year.

.4 The addressable dry contact module is to connect one supervised initiating zone of conventional alarm initiating devices (any N.O. dry contact device) to one of the fire alarm panel SLC loops, and is to be complete with a LED that will flash under normal conditions, indicating that the monitor module is operational and in regular communication with the panel.

.5 The addressable two-wire detector module(s) are to connect one supervised initiating zone of conventional 2-wire smoke detectors or alarm initiating devices (any N.O. dry contact device), and each is to be complete with a LED that will flash under normal conditions, indicating that the monitor module is operational and in regular communication with the panel.

.6 The addressable control module is to supervise and control operation of one conventional signal circuit of compatible 24 VDC powered, polarized audio/visual signalling appliances. The control module signalling circuit is to be wired for Class A or B with up to 1 A of inductive signal, or 2 A of resistive signal operation, or as a dry contact (Form C) relay. The relay coil is to be magnetically latched to reduce wiring connection requirements, and to ensure that 100% of auxiliary relays or signals may be energized at the same time on the same pair of wires. The control module is to be suitable for pilot duty applications and rated for a minimum of 0.6 A at 30 VDC.

.7 The panel is to be complete with a very low frequency sweep earth detect circuit capable of detecting earth faults on sensitive addressable modules, and battery back-up power complete with:

.1 a 12 V Gel-Cell type maintenance free sealed battery of sufficient capacity to power the system for a minimum of 24 hours plus 30 minutes of alarms (including operation of all ancillary relays) upon failure of normal AC power;

.2 a battery charger for 24 hours of standby using dual-rate charging techniques for fast battery recharge, and capable of charging a completely discharged battery to 80% capacity within 12 hours;

.3 protection to prevent battery discharge through the charger;

.4 meters to indicate battery voltage and charging current.

2.10 SMOKE DETECTORS

.1 Addressable, intelligent, dual chamber, ionisation principle, ceiling mounting, interchangeable smoke detectors, each designed to plug into a separate, tamper-proof, twist-lock base containing an address switch. Each detector is to be connected to the agent release panel by means of two conductors, and is to be complete with:

.1 a power "ON" LED and an alarm LED, both arranged to flash under normal conditions and to be illuminated continuously to indicate an alarm condition;

.2 an output connection in the base to connect an external remote alarm LED;

.3 an internal identifying type code for the agent release panel or fire alarm panel to use to identify the detector as an ionisation smoke detector;

.4 the ability to measure products of combustion and, on command from the carbon dioxide release panel, send data to the panel representing analog level of products of combustion;

.5 a test means whereby detectors will simulate an alarm condition and report that condition to the release panel, with the test initiated at the detector itself by activating a magnetic switch or initiated remotely on command from the release panel.

.2 It is to be possible to set smoke detector sensitivity through the release panel and adjust sensitivity in the field by means of field programming of the system, and sensitivity may be automatically adjusted by the release panel on a time-of-day basis, or automatically by the fire alarm panel.

.3 Using software in the release panel, detectors are to automatically compensate for dust accumulation and other slow environmental changes that may affect their performance.

2.11 VISUAL ALARM STROBE LIGHTS

.1 Wall mounting 24 VDC strobe light fixture equal to GE/Edwards System Technology 891E Series, complete with a red Lexan housing and white translucent lens identified "FIRE".

2.12 AUDIBLE ALARM HORN

.1 Wall mounting 24 VDC alarm horn with electronic sounder capable of generating two different distinctive sounds upon receiving a signal from the agent release panel, and complete with all required mounting and connection hardware and accessories.

2.13 INTEGRATED MANUAL PULL STATION/ABORT SWITCH

.1 Integrated wall mounting device consisting of a suitably sized back box, a red front faceplate with device identification and clear operating instructions, and the following:

.1 a dual action manual release pull station;

.2 a momentary contact "dead man" type mushroom head pushbutton abort switch requiring constant pressure on the pushbutton to transfer a set of contacts;

.3 a white "POWER ON" LED and a red "CARBON DIOXIDE RELEASED" LED.

2.14 GAS SUPPRESSANT FLOW SWITCH

.1 Manifold mounting pressure type flow switch complete with all required mounting hardware and pipe fittings and designed to interface with the release panel to facilitate annunciation of carbon dioxide discharge.

2.15 DAMPERS

.1 Fire/Smoke Damper – Galvanized steel, low (Class 1) leakage, parallel blade dampers, ULC listed for 1½ hour fire rating, 121°C (250°F) temperature Class, and complete with:

.1 fabric reinforced silicone rubber blade edge seals and spring loaded zero clearance steel side seals;

.2 stainless steel bearings pressed into the damper frame;

.3 minimum 3.5 mm (1/8") thick galvanized steel wall sleeve with angle steel framework to secure the sleeve in place;

.4 motor and linkage mounted external to the sleeve, consisting of an open-close 24 V Belimo spring return (fail closed) damper actuator with mounting bracket and galvanized steel linkage.

.2 Backdraft Damper – Equal to Ruskin Model S2SS type 304 stainless steel backdraft damper with a 1.6 mm (1/16") thick channel frame, nylon bearings, and stainless steel linkage.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Provide a complete carbon dioxide fire suppression system to protect the area(s) indicated on the drawings.

.2 Install the system in strict accordance with reviewed shop drawings, the system manufacturer’s instructions, NFPA 12, and requirements of CAN/ULC-S524 and CSA C22.1.

.3 Piping: Install the flow switch (supplied loose) in manifold piping at the cylinder(s), and abide by the following piping requirements:

.1 install piping in accordance with reviewed shop drawings, securely supported, and arranged with close attention to the design layout since deviations may alter the design flow of fire suppression agent;

.2 bracket piping within 300 mm (12") of all discharge nozzles;

.3 ream all piping prior to erection, blow clear and swab with appropriate solvent to remove mill varnish and cutting oils;

.4 do not use multi-outlet fittings, other than tees, and reduce pipe sizes only in fittings;

.5 do not use flush bushings;

.6 assemble threaded joints using Teflon tape applied to male threads only;

.7 provide a dirt leg consisting of a tee and minimum 50 mm (2") long capped nipple at the end of each pipe run.

.4 Provide the required number of cylinders. Mount cylinder bracket assemblies to the wall to accommodate single row arrangement with supplied fasteners.

.5 Carefully coordinate the installation of nozzles with the location of other ceiling mounted items.

.6 As for nozzles, carefully coordinate the installation of smoke detectors with the location of other devices in the ceiling, and also coordinate with the location of equipment in the room. Secure detector bases to outlet boxes and plug-in detector heads when finishing work is complete.

.7 Strobe lights within the protected area are to be placed 2 m (6') above the highest floor level, or 150 mm (6") below the ceiling, whichever is lower. Strobe lights outside the protected area are to be located above the entering door frame(s).

.8 Supply combination fire/smoke dampers and a backdraft damper for openings as indicated and hand to the sheet metal trade at the site for installation. Supervise the installation.

3.2 WIRING

.1 Power wiring to the carbon dioxide release control panel will be done as part of the electrical work. Control wiring between the release panel and the fire alarm system control panel will be done as part of the electrical work.

.2 Do all wiring work between the release panel and system components, and all wiring between the release control panel and ventilation units for unit shut-down. Provide all relays, contacts, and related components. Install all wiring in metallic conduit in accordance with electrical work wiring requirements. Initiating device circuits are to be wired Class A. Power for initiating devices is to be from the release panel only.

.3 Provide liquid-tight flexible conduit for the final connections at the gas flow switch and cylinder solenoid valve.

.4 Wiring materials, boxes, etc., unless otherwise specified, are to be in accordance with the system manufacturer’s recommendations.

3.3 SITE TESTS AND INSPECTIONS

.1 As specified in Part 1 of this section the system design engineer is to make weekly site inspection of the work and submit inspection reports.

.2 When system installation is complete, the system manufacturer’s design engineer is to visit the site to examine the work, supervise pressure tests and a system operation test, do any release panel software programming required, and make any required adjustments.

.3 Obtain from the system manufacturer and submit to the [AHJ] [Consultant] a letter from the system design engineer stating that he/she has visited the site and reviewed the system installation and operation and that the system is in accordance with reviewed shop drawings and in proper operating condition.

3.4 TRAINING

.1 For general training requirements, refer to Section 20 05 10 – Mechanical Work General Instructions.

.2 Include for two site training sessions for a minimum of six people for 4 hours per session. Training is to be a full review of all components including but not limited to a full operation and maintenance demonstration, with abnormal events.

END OF SECTION

PART 1 - GENERAL

1.1 SUBMITTALS

.1 Submit shop drawings/product data sheets for all products specified in Part 2 of this section except pipe and fittings.

1.2 CLOSEOUT SUBMITTALS

.1 Submit a copy of the plumbing inspection certificate prior to application for Substantial Performance of the Work.

.2 Submit laboratory water purity test results indicating chlorine residual prior to application for Substantial Performance of the Work.

.3 Record Documentation

.1 Retain services of a land surveyor, registered in jurisdiction of the work, to maintain an accurate record of all underground site services. Surveyor is to measure, verify and record size, location, invert elevation, pipe material, and slope of site service piping and connected products on site.

.2 When site services work is complete, surveyor is to prepare an original signed and sealed drawing, using same size and format as Contract Drawings, indicating all site services as-built information. Submit a copy of drawing to the Consultant. Include this drawing with Contract as-built record drawings.

1.3 SOILS TEST REPORT

.1 Carefully examine soils test report and include for requirements applicable as a result of the report.

PART 2 - PRODUCTS

2.1 PIPE, FITTINGS, AND JOINTS

.1 Concrete

.1 Circular bell and spigot pattern pipe and fittings with rubber gasket joints to CAN/CSA A257 Series, produced by a member of Ontario Concrete Pipe Association in a plant which is currently approved under O.C.P.A. Plant Pre-qualification Program. Pipe less than or equal to 375 mm (15") dia. is to be non-reinforced Class 3. Pipe greater than 375 mm (15") dia. is to be reinforced Class III.

.2 PVC Sewer

.1 DR35 rigid, green PVC hub and spigot pattern sewer pipe and fittings to CAN/CSA B182.2, with gasket joints assembled with pipe lubricant.

.3 PVC Water Service

.1 ULC listed, rigid, Class 150, DR18, 1035 kPa (150 psi) pressure rated bell and spigot pattern PVC pipe to CAN/CSA B137.3, and CSA certified fittings to CAN/CSA B137.2, and AWWA C900, complete with gasket joints, and Ford "Uni-Flange" or equal restraint collars in accordance with Part 3 of this section.

.4 Soft Copper Water Service

.1 Type "K" soft copper to ASTM B88, supplied in a continuous coil with no joints if possible, and complete with, if joints are required, compression type flared joint couplings.

.5 Flexible Polyethylene

.1 Flexible polyethylene pipe to CAN/CSA B137.1, 690 kPa (100 psi) rated, complete with insertion type fittings secured with Series 300 stainless steel gear type clamps.

.6 Perforated Weeper Drainage Piping

.1 Flexible, 150 mm (6") dia. PVC perforated piping supplied in rolls and complete with a geodesic sock.

2.2 CATCH BASINS

.1 Pre-cast, water-tight reinforced concrete catch basins manufactured to ASTM C478 and Municipal standards, each sized and arranged to suit drainage pipe size and arrangement, and complete with:

.1 cast iron frame and cover to Municipal standards;

.2 required masonry work to raise top of catch basins flush with finished grade or pavement surfaces.

.2 Masonry work is to consist of cement mortar and clay or shale bricks to ASTM C32 Grade M5, or Oaks Precast Industries "MODULOC" or equal pre-cast interlocking concrete members and accessories.

2.3 MANHOLES

.1 Pre-cast, water-tight reinforced concrete manholes manufactured to ASTM C478 and Municipal standards, each sized and arranged to suit drainage pipe size and arrangement, and complete with:

.1 poured-in-place or pre-cast concrete base;

.2 cast-in-place "Safety" type aluminum steps on 300 mm (12") centres, each step coated with 2 coats of static asphalt paint;

.3 unperforated cast iron cover with lifting holes, and a matching frame;

.4 as required by manhole depth and safety regulations, cast-in-place hinged aluminum safety grating with SG 1 1 R-T6 aluminum alloy bearing bars, aluminum grate to CAN/CSA S157, and self-locking type stainless steel hinges and fasteners with galvanized steel safety chain and snap hook;

.5 required masonry work to raise top of manholes flush with finished grade.

.2 Masonry work is to consist of cement mortar and clay or shale bricks to ASTM C32 grade M5, or Oaks Precast Industries "MODULOC" or equal pre-cast interlocking concrete members and accessories.

2.4 WATER METER CHAMBER

.1 Pre-cast, water-tight reinforced concrete chamber manufactured to ASTM C478 and Municipal standards, each sized and arranged as shown and complete with:

.1 poured-in-place or pre-cast concrete base with a drain hole;

.2 cast-in-place "Safety" type aluminum steps on 300 mm (12") centres, each step coated with 2 coats of static asphalt paint;

.3 unperforated cast iron cover with lifting holes, and a matching frame;

.4 as required by chamber depth and safety regulations, cast-in-place hinged aluminum safety grating with SG 1 1 R-T6 aluminum alloy bearing bars, aluminum grate to CAN/CSA S157, and

self-locking type stainless steel hinges and fasteners with galvanized steel safety chain and snap hook;

.5 required masonry work to raise top of chamber flush with finished grade.

.2 Masonry work is to consist of cement mortar and clay or shale bricks to ASTM C32 grade M5, or Oaks Precast Industries "MODULOC" or equal pre-cast interlocking concrete members and accessories.

2.5 WATER METER

.1 Equal to Neptune Technologies Group (Canada) Ltd. "Neptune High Performance Turbine" tamper-proof, in-line serviceable meter suitable for connection of a remote automatic reading and billing unit and complete with a cast bronze main case, a roll-sealed magnetic drive register, and a turbine measuring element.

.2 Equip meter with a Neptune Technologies Group (Canada) Ltd. or equal "ARB-V" surface wall mounting automatic meter reading and billing unit with encoder register, polycarbonate housing, roll-sealed copper shell, and ABS plastic receptacle.

.3 Equip meter with Neptune Technologies (Canada) Ltd. or equal "Tricon" hardware for interface connection to building automation system for water flow and consumption monitoring.

2.6 WATER METER VALVES

.1 Shut-Off Valves

.1 Non-corrosive, minimum 1200 kPa (175 psi) cold water pressure rated, resilient seated, flanged butterfly valves, each complete with a coated cast iron lug type body, stainless steel shaft, bronze disc, and EPDM seat, and each suitable for domestic water bubble-tight dead end service with valve in position and either side of connecting piping removed. Equip butterfly valves less than or equal to 100 mm (4") dia. with lever handles. Equip butterfly valves greater than 100 mm (4") dia. with worm gear operators.

.2 Manufacturers:

.1 DeZurik #632L Series;

.2 Bray Valve and Controls Canada Series 34;

.3 Apollo Valves #143 Series;

.4 Centerline #L2000L or #G200L depending on size;

.5 Watts Industries (Canada) Inc. #BF-03.

.2 Check Valve

.1 Class 125, non-corrosive, 1380 kPa (200 psi) WOG rated horizontal swing type check valves, each approved for domestic water service and complete with flanged ends.

.2 Manufacturers:

.1 Toyo Valve Co.;

.2 Milwaukee Valve Co.;

.3 Kitz Corporation;

.4 Apollo Valves.

2.7 FIRE HYDRANTS

.1 FM approved and ULC listed, compression type, dry top, non-freeze hydrants manufactured to meet or exceed requirements of AWWA C502, designed for a 1035 kPa (150 psi) service pressure and a hydrostatic test pressure of 2070 kPa (300 psi), and complete with:

.1 flanged intermediate section painted with a bituminous black coating, and with a length to suit depth of underground water main;

.2 Two 65 mm (2-½") dia. hose connections, each with a cap and chain and threaded to CSA B89.2 (Ontario thread) to suit local Fire Department and pumper connection requirements;

.3 operating nut which opens in a counter-clockwise direction and a 140 mm (5-½") dia. compression type main valve;

.4 bronze to bronze interface between removable parts of main valve assembly and hydrant body;

.5 hydrant barrel complete with breakaway section at ground line, with exposed bolts and nuts of rust and corrosion resistant alloy;

.6 150 mm (6") dia. elbow inlet connection to suit underground piping;

.7 2 coats of weatherproof enamel with colour(s) to local Municipal requirements.

.2 Manufacturers:

.1 Clow Canada;

.2 Mueller Canada "Century".

2.8 FIRE HYDRANT SHUT-OFF VALVES

.1 Resilient seated, 1380 kPa (200 psi) rated, non-rising stem, FM approved and ULC listed wedge gate valves to AWWA C509, each with hub ends suitable for mechanical joint pipe connection, and an adjustable cast iron valve box (length to suit) with cover.

.2 Manufacturers:

.1 Clow Canada #F6100 Series valve with box and cover;

.2 Mueller #2360 Series with box and cover.

PART 3 - EXECUTION

3.1 DEMOLITION

.1 Perform required underground service piping demolition work. Refer to demolition requirements specified in Section 20 05 05 – Selective Demolition for Mechanical.

3.2 UNDERGROUND MUNICIPAL SERVICE CONNECTIONS

.1 Make required arrangements with Municipality for installation of underground service piping from Municipal main(s) to property line.

.2 Pay charges levied by Municipality for service connection work.

.3 Municipal charges for underground street service connection work will be paid out of a prime cost allowance. Submit original copies of invoices issued by Municipality for street service connection work.

3.3 EXCAVATION AND BACKFILL

.1 Refer to requirements specified in Section 20 05 00 – Common Work Results for Mechanical, and Section 31 23 00 – Excavation and Fill.

.2 Locate general reference points and take necessary precautions to prevent damage or destruction to these points. Be responsible for site services work lines, elevations, and measurements.

.3 Ensure locations of existing underground services, mechanical and electrical, are properly and accurately located and marked. Be responsible for any damage to existing services caused as a result of site services work.

.4 Excavate to a minimum of 150 mm (6") below bottom of pipe. Support pipe, unless otherwise specified, on a well compacted bed of dry, natural, undisturbed earth free from rocks or protrusions of any kind, or on compacted sand or granular B material as specified.

.5 Where unstable soil is present at bottom of trench, provide concrete saddles, pies, or other approved and suitable foundations.

.6 Retain and pay for the services of an independent testing agency to test and report on the compaction of backfill. Upon completion, obtain from testing agency and submit to the Consultant a signed and sealed report confirming all specified backfill compaction was achieved at all locations.

3.4 CONCRETE WORK

.1 Provide poured concrete work, including reinforcing and formwork, required for site services work.

.2 Concrete is to be minimum 20 700 kPa (3 000 psi) ready-mix concrete in accordance with CAN/CSA A23.1 and the Building Code.

3.5 DRAINAGE SERVICE PIPING INSTALLATION REQUIREMENTS

.1 Provide required underground drainage service piping to within 1.5 m (5') of building. Pipe, unless otherwise specified, is to be concrete or rigid PVC sewer pipe.

.2 Install and slope underground drainage piping to inverts or slopes indicated on drawings to facilitate straight and true gradients between points shown. Verify available slopes before installing pipes.

.3 At the end of each working day temporarily plug and/or cap open piping ends to prevent entry of debris or dirt.

3.6 WEEPER SYSTEM PIPING INSTALLATION REQUIREMENTS

.1 Provide sub-soil and building footing weeper system piping.

.2 Lay pipe on a 150 mm (6") bed of granular A material, then backfill 150 mm (6") above and around pipe with granular A material. Backfill remainder of trench as specified in this section.

3.7 CONNECTION OF BUILDING WEEPER SYSTEM PIPING

.1 Provide piping required to extend building weeper system piping into storm drainage piping system from connection point(s).

3.8 WATER SERVICE PIPING INSTALLATION REQUIREMENTS

.1 Provide required underground water service piping to within 1.5 m (5') of building.

.2 Piping, unless otherwise specified, is as follows:

.1 for service piping greater than or equal to 100 mm (4") dia. - rigid PVC;

.2 for service piping less than 100 mm (4") dia. - Type "K" soft copper;

.3 for distribution piping to exterior fixtures/outlets at grade level – flexible polyethylene, snaked in trench and in a continuous length wherever possible.

.3 Brace and secure underground water service pipe at bends, tees, and similar fittings with restraint devices, and provide concrete thrust blocks in accordance with Municipal or Provincial standards and details. Regardless of what is specified elsewhere in this Specification regarding provisions of concrete, provide thrust block concrete. Paint restraint devices with 2 coats of corrosion resistant black asphalt base coating and allow time to dry prior to backfilling.

.4 Lay pipes true to line and grade with bells upgrade. Fit sections together so, when complete, pipe has a smooth and uniform invert. Keep pipe thoroughly clean so jointed compound will adhere. Inspect pipe for defects before being lowered into trench.

.5 Slope piping so it can be completely drained.

.6 At the end of each working day, temporarily plug and/or cap all open piping ends to prevent entry of debris or dirt.

3.9 INSTALLATION OF MANHOLES

.1 Provide pre-cast concrete manholes. Properly bed each unit and set to required invert.

.2 Provide a reinforced pre-cast concrete base slab and bottom section for each manhole, or provide a poured-in-place concrete base. Ensure each manhole is sized to suit pipe size and arrangement. Conform to Municipal installation standards.

.3 Perform masonry work required to raise top of each assembly flush with finished grade level.

.4 When work is substantially complete, clean out each manhole.

3.10 INSTALLATION OF CATCH BASINS

.1 Provide pre-cast concrete catch basins. Properly bed each unit and set to required invert.

.2 Ensure each catch basin is sized to suit pipe size and arrangement. Conform to Municipal installation standards.

.3 Perform masonry work required to raise top of each assembly flush with finished grade level.

.4 When work is substantially complete, clean out each catch basin.

3.11 INSTALLATION OF WATER METER CHAMBER

.1 Provide a pre-cast concrete water meter chamber. Properly bed unit and set to required invert. Ensure base drain hole is placed over a granular A material soak-away area.

.2 Provide a reinforced pre-cast concrete base slab and bottom section for chamber. Ensure each chamber is properly sized and conforms to Municipal installation standards.

.3 Perform masonry work required to raise top of assembly flush with finished grade level.

.4 Provide PVC conduit with pull boxes as required and conductors from chamber to building for meter reading/BAS connections. Terminate conductors in a junction box.

.5 When work is substantially complete, clean out chamber.

3.12 SUPPLY OF WATER METER

.1 Supply domestic water service meter and hand (inside meter room) to trade installing the meter.

3.13 INSTALLATION OF WATER METER

.1 Provide domestic water service meter in meter pit. Secure meter in place on a concrete housekeeping pad and connect with piping, including a 3-valve bypass.

.2 Refer to drawing detail.

3.14 INSTALLATION OF FIRE HYDRANTS

.1 Provide fire hydrants. Confirm exact locations and orientations prior to roughing-in.

.2 Equip each hydrant with a shut-off valve and connect with piping. Piping is to be rigid PVC.

.3 Conform to Municipal installation standards, including provision of concrete thrust blocks at piping elbows and similar fittings.

.4 Set each valve box cover flush with finished grade in a formed 300 mm x 300 mm x 100 mm (12" x 12" x 4") thick concrete pad with a sack rubbed finish.

.5 Regardless of what is specified elsewhere in this Specification regarding provision of concrete, provide thrust block and valve box pad concrete.

.6 When installation is complete, remove hydrant nozzle caps and fully open to completely flush assembly and test operation.

.7 Touch-up paint any damaged hydrant finish.

3.15 TESTING AND INSPECTION OF SERVICES

.1 Prior to backfilling, test new service piping for leakage and flow in the presence of the Consultant and Plumbing Inspector. Give a minimum of 72 hours' notice for scheduled tests.

.2 Drainage Piping Leakage

.1 Perform infiltration or exfiltration tests on drainage piping as directed by the Consultant with leakage not to exceed values issued by the Consultant. Where leakage exceeds values issued, refit piping, and re-apply tests until acceptable results are obtained.

.3 Drainage Piping Flow

.1 When directed by the Consultant and/or Plumbing Inspector, perform ball flow tests on all drainage piping.

.4 Drainage Piping Interior Inspection

.1 Provide video inspection and documentation of drainage service piping after piping has been flushed and leakage tested. Give the Consultant a minimum of 72 hours' notice of inspections. Perform video inspections using an experienced specialist company in accordance with following requirements:

.1 video equipment specially designed for the purpose and videos are to be high-resolution colour videos recorded on DVD’s with audio documentation;

.2 each DVD is to be identified according to a piping segment marked on a site services drawing print by personnel performing the video work;

.3 report documenting all conditions discovered during video procedures is to be prepared by specialist company and submitted to the Consultant along with original video DVD's.

.5 Water Mains Leakage

.1 Leakage test new water mains using clean water at 1400 kPa (200 psi) for a minimum period of 8 hours with no pressure drop.

3.16 FLUSHING AND DISINFECTING WATER SERVICE PIPING

.1 Thoroughly flush domestic water service piping after leakage and flow testing is complete.

.2 Flush piping with clean water at a minimum velocity of 1.2 m/s (240 ft./min.) at 205 kPa (30 psi) minimum pressure until all foreign materials have been removed and flushed water is clear. Provide connections and pumps as required.

.3 When flushing is complete, disinfect piping with a solution of chlorine in accordance with AWWA C601.

.4 When disinfecting is complete, submit water samples to a certified laboratory for purity testing and, when testing indicates pure water in accordance with governing standards, submit a copy of test results and fill systems.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 Domestic water piping and valves are to comply with following codes, regulations, and standards (as applicable):

.1 applicable local codes and regulations;

.2 CAN/CSA B64, Backflow Preventers and Vacuum Breakers;

.3 CAN/CSA B125.1, Plumbing Supply Fittings;

.4 CAN/CSA B125.3, Plumbing Fittings;

.5 CAN/CSA B137 Series, Thermoplastic Pressure Piping Compendium;

.6 NSF/ANSI 14, Plastics Piping System Components and Related Materials;

.7 NSF/ANSI 61, Drinking Water System Components – Health Effects;

.8 NSF/ANSI 372, Drinking Water System Components – Lead Content.

1.2 SUBMITTALS

.1 Submit shop drawings/product data sheets for all products specified in Part 2 of this Section except for pipe, fittings, and chlorine solution.

1.3 CLOSEOUT SUBMITTALS

.1 Submit laboratory water purity test results indicating chlorine residual prior to application for Substantial Performance of the Work.

.2 Prior Substantial Performance of the Work, submit a minimum of 3 identified keys for key operated hydrants.

.3 Submit signed test results and inspection and test log cards for each backflow preventer as specified in Part 3 of this Section.

.4 Submit anchor drawing(s) to detail fabrication and installation of water piping anchors. Drawing(s) are to be prepared and stamped by a professional structural engineer registered and licensed in jurisdiction of the work.

.5 As specified in Part 3 of this Section, submit a letter from anchor design engineer stating anchor installation has been examined at site and anchors are properly fabricated and installed.

PART 2 - PRODUCTS

2.1 PIPE, FITTINGS, AND JOINTS

.1 PVC

.1 ULC listed, rigid, Class 150, DR18, 1035 kPa (150 psi) pressure rated bell and spigot pattern PVC pipe to CAN/CSA B137.3, and CSA certified fittings to CAN/CSA B137.2, and AWWA C900, complete with gasket joints, and Ford "Uni-Flange" or equal restraint collars as per Part 3 of this Section.

.2 Soft Copper

.1 Type "K" soft copper to ASTM B88, supplied in a continuous coil with no joints if possible, and complete with, if joints are required, compression type flared joint couplings.

.3 Stainless Steel

.1 Schedule 10S type 304 stainless steel, ASTM A312, factory or site roll grooved, complete with Victaulic or equal type 304 stainless steel roll grooved end fittings and, unless otherwise specified, Victaulic Style 807, 877 or 889 couplings and coupling gaskets equal to Victaulic Grade P fluoroelastomer.

.4 Copper - Solder Joint

.1 Type "L" hard drawn seamless copper to ASTM B88, complete with copper solder type fittings to ASME/ANSI B16.18 and soldered joints using The Canada Metal Co. Ltd. "SILVABRITE 100" or equal lead-free solder for cold water pipe, and 95% tin / 5% Antimony or "SILVABRITE 100" solder for other services.

.5 Copper - Pressure Coupled Joint

.1 Type "L" hard drawn seamless copper to ASTM B88 with Viega "ProPress with Smart Connect feature" copper fittings with EDPM seals, and pressure type crimped joints made by use of manufacturer recommended tool.

.6 Copper - Grooved

.1 Type "L" hard drawn seamless copper to ASTM B88 with Victaulic QuickVic Style 607 non-reducing, bolted connection type suitable and approved for application intended, 2” - 8" for copper tubing consisting of ductile iron cast housings, complete with a Grade P fluoroelastomer gasket of a pressure-responsive design, with plated nuts and bolts to secure unit together.

.7 Semi-Rigid Polyethylene Tubing

.1 Versa Fittings and Mfg. Inc. 12 mm (½") dia., high density, semi-rigid polyethylene tubing, 1380 kPa (200 psi) rated.

.8 For distribution piping and fittings from ½" to 4" inside buildings and aboveground, except for piping in vertical shafts, and penetrations through fire barriers. pipe and fittings have flame spread and smoke developed ratings less than 25/50 in accordance with CAN/ULC S102.2, and have working pressure ratings of 400 psi at 73°f and 100 psi at 180°F.

.9 CPVC

1. Ipex "Aquarise" CPVC pipe and fittings to CAN/CSA B137.6, 25/50 flame spread and smoke developed rated in accordance with CAN/ULC S102.2, and complete with primer/solvent weld joints.

2. Option: Fittings equal to Victaulic PGS-300 grooved piping system for schedule 40 and schedule 80 CPVC pipe per ASTM F441, 23447 minimum cell classification per ASTM D1784. Sizes 50 mm-300 mm (2”-12") consisting of ductile iron cast housings, complete with a grade “EHP” EPDM gasket of a pressure-responsive design, with plated nuts and bolts to secure unit together (Victaulic Style 357).

.10 Flexible Polyethylene

.1 Flexible polyethylene pipe to CAN/CSA B137.1, 690 kPa (100 psi) rated, complete with insertion type fittings secured with Series 300 stainless steel gear type clamps.

.11 Cross-Linked Polyethylene (PEX) Tubing

.1 Non-barrier type PEX piping in accordance with CAN/CSA B137.5, ASTM F876 and tested for compliance by an independent third-party agency, 25/50 flame spread/smoke developed rated when tested to CAN/ULC S102.2 and complete with brass inserts and crimp-ring or cold-expansion joint fittings and couplings.

2.2 SHUT-OFF VALVES

.1 Ball Valves

.1 Class 600, 4140 kPa (600 psi) WOG rated, lead-free, full port ball type valves, each complete with a forged brass body with solder ends, forged brass cap, blowout-proof stem, 304 stainless steel ball, "Teflon" or "PTFE" seat, and a removable lever handle. Valves in insulated piping are to be complete with stem extensions.

.2 Manufacturers:

.1 Toyo Valve Co.

.2 Milwaukee Valve Co.

.3 Kitz Corporation.

.4 Apollo Valves.

.5 Watts Industries (Canada) Inc.

.2 Butterfly Valves - Flanged Joint

.1 Non-corrosive, minimum 1200 kPa (175 psi) cold water pressure rated, resilient seated butterfly valves, each complete with a coated cast ductile iron lug type body, stainless steel shaft, bronze disc, and EPDM seat, and each suitable for domestic water bubble-tight dead end service with valve in position and either side of connecting piping removed. Butterfly valves to and including 100 mm (4") dia. are to be equipped with lever handles. Butterfly valves larger than 100 mm (4") dia. are to be equipped with worm gear operators.

.2 Manufacturers:

.1 DeZurik #632L Series;

.2 Kitz Corporation Code #6122EL/EG;

.3 Toyo Valve Co. #918BESL/EG;

.4 Bray Valve and Controls Canada Series 31;

.5 Apollo Valves #141 Series;

.6 Watts Industries (Canada) Inc. #BF-03.

.3 Butterfly Valves – Grooved End

.1 Equal to Victaulic Series 608N, for copper pipe rated to 300 psi and be both bi-directional and dead-end service capable to full rated pressure. Seat material shall be EPDM UL Classified in accordance with ANSI/NSF 61 for ambient +86°F and hot +180°F potable water service and ANSI/NSF 372.

.2 Victaulic Series 461, for stainless steel pipe rated to 300 psi and be both bi-directional and dead-end service capable to full rated pressure. Seat material shall be EPDM UL Classified in accordance with ANSI/NSF 61 for ambient +86°F and hot +180°F potable water service and ANSI/NSF 372.

2.3 CHECK VALVES

.1 Horizontal

.1 Lead-free, Class 125, bronze, 1380 kPa (200 psi) WOG rated horizontal swing type check valves with solder ends.

.2 Manufacturers:

.1 Toyo Valve Co. Fig. 237A-LF;

.2 Milwaukee Valve Co. #UP1509;

.3 Kitz Corporation Code 823;

.4 Apollo Valves #61LF Series.

.2 Vertical

.1 Equal to Kitz Corp. Code 826, lead-free, 1725 kPa (250 psi) WOG rated vertical lift check valve with soldering ends.

2.4 DRAIN VALVES

.1 Minimum 2070 kPa (300 psi) water rated, 20 mm (¾") dia., straight pattern full port bronze ball valves, each complete with a threaded outlet suitable for coupling connection of 20 mm (¾") dia. garden hose, and a cap and chain. Ball material to be 304 stainless steel.

.2 Manufacturers:

.1 Toyo Valve Co.

.2 Dahl Brothers Canada Ltd.

.3 Kitz Corporation.

.4 Apollo Valves.

.5 Watts Industries (Canada) Inc.

2.5 DOMESTIC HOT WATER PIPING BALANCING VALVES

.1 Equal to Victaulic Series 76X Low Lead Balancing Valve, lead-free and compliant with NSF-61 and NSF-372 for use in potable water applications, automatic flow limiting balancing valve (+/-5% over rated operating pressure range), complete with removable flow cartridge.

.2 Equal to Victaulic TA Series 78BL, solder or flange end type as required, ball valve style, lead-free and compliant with NSF-61 and NSF-372 for use in potable water applications, circuit balancing valves designed to facilitate precise flow measurement, precision flow balancing, and positive shut-off, complete with capped and valved drain connection, and valved ports for connection to a differential pressure meter.

2.6 PARTITION STOPS

.1 Equal to Dahl Brothers Canada Ltd. Fig. E2300 Series or equal lead-free partition stops with EDPM packing, slotted spindles, extension tubes, stainless steel access plates, and 3 identified keys.

2.7 PRESSURE REDUCING VALVES

.1 For piping less than or equal to 50 mm (2") diameter, lead-free, non-corrosive, non-ferrous direct spring acting pressure reducing valves to CAN/CSA B356, each factory set at 345 kPa (50 psi) unless otherwise specified or required, each field adjustable from 175 kPa (25 psi) to 520 kPa (75 psi) and each complete with an integral inlet strainer.

.1 Manufacturers:

.1 Apollo Valves #36HLF Series;

.2 Zurn/Wilkins #600XL Series;

.3 Watts Industries (Canada) Inc. #LF25AUB-Z3 Series;

.4 Cash-Acme EB-25 Series;

.5 Bermad Series 935-H.

.2 For piping greater than or equal to 65 mm (2-½") diameter, lead-free, non-corrosive pilot operated pressure reducing valve to CAN/CSA B356, factory set at required pressure, field adjustable, and complete with screwed or flanged connections, and brass body pilot valve with stainless steel seat.

.1 Manufacturers:

.1 Singer Valve #106 PR;

.2 Zurn/Wilkins #ZW209;

.3 Watts Industries (Canada) Inc. #LFM115 Series;

.4 Bermad Series 972.

2.8 DOMESTIC HOT WATER THERMOSTATIC MIXING VALVES

.1 Lawler Manufacturing Co. Inc. 800 Series "High-Low Thermostatic Mixer" factory assembled rough bronze thermostatic mixing valve assembly complete with rotatable union end inlet piping with check stops and stainless steel strainer screens, union outlet piping with thermometer connection, all sized as shown, and following:

.1 mixing valve with liquid motor, stainless steel piston and liner, tamper-resistant control adjustment, and 3-way protection against runaway temperatures, thermal shock, and scalding;

.2 dial type thermometer conforming to requirement specified in Section 20 05 00 – Common Work Results for Mechanical;

.3 ball type outlet shut-off valve conforming to valve requirements specified in this section;

.4 surface wall mounting enamelled steel cabinet with hinged door, key lock, and permanent identification;

.5 recessed wall mounting type 304 stainless steel cabinet with a #4 finish, hinged door, key lock, and permanent identification.

.2 Manufacturers:

.1 Lawler Manufacturing Co. Inc.;

.2 Leonard Valve Co.;

.3 Symmons Industries Inc.

2.9 CHLORINE

.1 Sodium hypochlorite to AWWA B300.

2.10 WATER METER

.1 Equal to Neptune Technology Group (Canada) Ltd. "Neptune T-10" tamper-proof, in line serviceable meter in accordance with requirements of AWWA C701 and NSF/ANSI 61, suitable for connection of a remote automatic reading and billing unit and complete with a cast bronze main case, a roll sealed register, and a positive displacement nutating disc measuring chamber.

.2 Equal to Neptune Technology Group (Canada) Ltd. "Neptune High Performance Turbine" tamper-proof, in-line serviceable meter in accordance with requirements of AWWA C701 and NSF/ANSI 61,

suitable for connection of a remote automatic reading and billing unit and complete with a cast bronze main case, a roll-sealed magnetic drive register, and a turbine measuring element.

.3 Equip meter with a Neptune Technology Group (Canada) Ltd. or equal "ARB-V" surface wall mounting automatic meter reading and billing unit with encoder register, polycarbonate housing, roll-sealed copper shell, and ABS plastic receptacle.

.4 Meter is also to be complete with Neptune Technology (Canada) Ltd. or equal "Tricon" hardware for interface connection to building automation system for water flow and consumption monitoring.

2.11 INTERIOR HOSE BIBBS

.1 Flush-Concealed

.1 Recessed, 92 mm (3-5/8") deep, recessed, encased wall hydrant with lockable bronze or stainless steel box with hinged cover identified "WATER", bronze interior parts, a screwdriver operated stop in the supply, key operated control valve, 20 mm (¾") dia. hose connection, and a vacuum breaker.

.2 Manufacturers:

.1 Watts Industries (Canada) Inc. #HY-330.

.2 Jay R. Smith #5509QT-CL-SAP;

.3 Zurn #Z1350;

.4 Mifab #MHY-55;

.2 Semi-Recessed - Finished Areas

.1 Anti-siphon type, 100 mm (4") deep hose bibb with stainless steel face with operating key, bronze interior parts, 20 mm (¾") dia. solder inlet, 20 mm (¾") dia. hose connection, and integral vacuum breaker.

.2 Manufacturers:

.1 Watts Industries (Canada) Inc. #HY-430.

.2 Jay R. Smith #5619-SAP-98;

.3 Zurn #Z1333 "ECOLOTROL";

.4 Mifab #MHY-30;

.3 Surface – Exposed – Cold Water – Unfinished Areas

.1 Brass or bronze hose bibb with hose end vacuum breaker.

.2 Manufacturers:

.1 Watts Industries (Canada) Inc. #SC8-1;

.2 Jay R. Smith #5609QT-SAP.

.3 Zurn/Wilkins # Z1341 with hose end vacuum breaker;

.4 Chicago Faucets #293-E27CP;

.4 Exposed – Unfinished Areas – Hot and Cold Water

.1 Mixing faucet for surface mounting.

.2 Manufacturers:

.1 Watts Industries (Canada) Inc. #HY-300-2-VB.

.2 Jay R. Smith #5560QT-LB-SAP;

.3 Zurn #Z841L1-RC;

.4 Delta Commercial #28T8083;

2.12 EXTERIOR NON-FREEZE WALL HYDRANTS

.1 Flush-Concealed

.1 Recessed, encased, self-draining hydrants, each complete with a copper casing, operating rod assembly to suit wall thickness, polished nickel bronze box with hinged locking cover, 20 mm (¾") dia. threaded hose connection outlet, vacuum breaker, and a loose tee handle operating key.

.2 Manufacturers:

.1 Watts Industries (Canada) Inc. #HY-725.

.2 Jay R. Smith #5519-98;

.3 Zurn #Z1320;

.4 Mifab #MHY-26;

.2 Semi-Recessed

.1 Self-draining hydrants, each complete with a copper casing, operating rod assembly to suit the wall thickness, 20 mm (¾") dia. threaded hose connection outlet, vacuum breaker, and a loose tee handle operating key.

.2 Manufacturers:

.1 Watts Industries (Canada) Inc. #HY-420.

.2 Jay R. Smith #5619-98;

.3 Zurn #Z1321;

.4 Mifab #MHY-16;

2.13 EXTERIOR NON-FREEZE GROUND HYDRANTS

.1 Flush

.1 Flush with grade mounting, encased head, self-draining bronze hydrants, each complete with a casing and operating rod assembly to suit the depth of piping bury, valve housing with drain port, grade box with hinged lockable cover and drain port, 20 mm (¾") dia. threaded hose connection, and a loose tee handle operating key.

.2 Manufacturers:

.1 Watts Industries (Canada) Inc. #HY-500.

.2 Jay R. Smith #5810-N-NV;

.3 Zurn #Z1360;

.4 Mifab #MHY-60;

.2 Exposed

.1 Self-draining exposed head bronze post hydrants, each complete with a casing and operating rod assembly to suit the height of hose outlet above grade and the depth of piping bury, valve

housing with drain port, 20 mm (¾") dia. threaded hose connection assembly with vacuum breaker and gravel guard, and a loose tee handle operating key.

.2 Manufacturers:

.1 Watts Industries (Canada) Inc. #HY-600.

.2 Jay R. Smith #5910-NV-H;

.3 Zurn #Z1385;

.4 Mifab #MHY-65;

2.14 NON-FREEZE ROOF HYDRANT

.1 Woodford Mfg. Model RHY2-MS non-freeze roof hydrant with 25 mm (1") diameter inlet connection, 20 mm (3/4") diameter hose end outlet with dual check backflow preventer, a 3.2 mm (1/8") diameter inlet connection drain hole to automatically drain hydrant when shut-off, a mounting system with cast iron support and under deck flange, and required mounting hardware and accessories.

2.15 FLOOR DRAIN TRAP SEAL PRIMERS

.1 Primer Valve Type

.1 Precision Plumbing Products Inc. Model P2-500 trap primer valve, constructed of brass, adjustable to high or low water pressures and complete with "O" ring seals, 12 mm (½") threaded inlet and outlet connections, and, for priming two traps from the same primer, a DU-2 dual outlet distribution unit.

.2 Primer Valve Type with Manifold

.1 Precision Plumbing Products Inc. Model P1-500 trap primer valve constructed as specified above for the Model P2-500 primer valve, complete with a Model DU-3 or DU-4, 3 or 4 outlet distribution unit for priming 3 or 4 traps, and at Model "YS-8" supply tube with combinations of Model DU-3 and DU-4 distribution units for priming from 5 to 6 traps.

.3 Electronic Type

.1 Precision Plumbing Products #PT Series surface wall mounting, CSA certified, 115 volt, 1-phase, 60 Hz., electronic, automatic trap priming manifolds, each sized to suit the number of drain traps or interceptors serviced, and each complete with:

.1 galvanized steel cabinet with door;

.2 20 mm (¾") dia. NPT copper pipe inlet with shut-off valve and water hammer arrestor;

.3 solenoid valve, an atmospheric vacuum breaker, and a discharge manifold with 12 mm (½") dia. compression type copper tube connections on 40 mm (1-½") centres with quantity to suit the number of items to be primed;

.4 control panel with circuit breaker, 5 ampere fuse, 24 hour timer, and manual override toggle switch.

2.16 SHOCK ABSORBERS

.1 Type 304 stainless steel piping shock absorbers, each complete with a nesting type bellows and a casing of sufficient displacement volume to dissipate kinetic energy generated in piping system, and each sized to suit connecting water pipe and equipment it is provided for.

.2 Manufacturers:

.1 Watts Industries (Canada) Inc. "SG" Series.

.2 Jay R. Smith 5000 Series "HYDROTROL";

.3 Zurn #Z1700 "SHOKTROL";

.4 Mifab "HAMMERGUARD" WHB Series;

2.17 WATER HAMMER ARRESTORS

.1 Piston type, sealed, all stainless steel construction, pressurized water hammer arrestors suitable for either vertical or horizontal installation, each complete with a pressurized compression chamber, welded nesting-type expansion bellows surrounded by non-toxic mineral oil, and a male treaded nipple connection.

.2 Manufacturers:

.1 Jay R. Smith 5000 Series;

.2 Precision Plumbing Products "SS" Series.

.3 Piston type, sealed, pressurized water hammer arrestors suitable for either horizontal or vertical installation, each complete with a hard drawn copper body, "O"-ring piston seals, an air charge, and an inlet opening equal to diameter of pipe in which arrestor is required.

.4 Manufacturers:

.1 Watts Industries (Canada) Inc. LF05 or LF15M2;

.2 Zurn #Z1260;

.3 Precision Plumbing Products Inc. SC Series;

.4 Mifab MWH Series.

2.18 BACKFLOW PREVENTERS

.1 Double Check Valve Assembly

.1 Minimum 1205 kPa (175 psi) rated lead-free dual check valve assembly backflow preventer to CAN/CSA B64 (including supplements), complete with tight-closing resilient seated shut-off valves, test cocks and strainer.

.2 Manufacturers:

.1 Watts Industries Canada;

.2 Zurn/Wilkins;

.3 Apollo Valves (Conbraco Industries).

.2 Reduced Pressure Zone Assembly

.1 Lead-free reduced pressure zone assembly backflow preventer in accordance with CAN/CSA B64 (including supplements), each of bronze or epoxy coated cast iron bronze fitted construction depending on size, and complete with inlet strainer, inlet and outlet shut-off valves, an intermediate relief valve, ball valve type test cocks, and a proper air gap fitting.

.2 Manufacturers:

.1 Watts Industries #LF009QT-S for 12 mm (½") size, #LF909QT-S for 20 mm to 50 mm (¾" to 2") size, and #LF909-NRS-S for 65 mm (2-½") and larger size;

.2 Zurn/Wilkins 975XL2 and 375 Series;

.3 “Apollo” Valves manufactured by Conbraco Industries Inc. Series 4ALF;

.4 Danfoss Flomatic Corp. Series RPZ.

2.19 PIPING EXPANSION COMPENSATORS AND GUIDES

.1 Pressurized type, selected to withstand system pressure and to suit calculated movement from -5°C (23°F) to maximum operating temperature plus 25% safety factor, complete with stainless steel bellows and shroud, copper tube sweat type female ends, anti-torque device, and proper and suitable alignment guides for both sides of each compensator.

.2 Manufacturers:

.1 Senior Flexonics Series HB;

.2 Hyspan Precision Products Series 8500.

2.20 PIPE ANCHORS

.1 Welded structural black steel anchors of a design, size, and type to securely anchor pipe at point shown. Each anchor is to withstand 150% axial thrust, and is to be designed and detailed by a professional structural engineer registered and licensed in jurisdiction of the work. Submit anchor design and fabrication shop drawings, stamped by design engineer.

2.21 LAVATORY SUPPLY FITTING TEMPERING VALVES

.1 Equal to Powers "HydroGuard" Series 490, model LM490 12 mm (½") dia. or model LM491 20 mm (¾") dia. as required, each CSA B125 certified, forged brass, tamper-proof thermostatic mixing valves, adjustable for water supply between 29°C and 49°C (85°F and 120°F), sized to suit number of lavatories in grouping, and complete with a stop and check valve and a lockable handle.

.2 Each mixing valve is to be complete with a stainless steel flush wall mounting cabinet with vandal-proof hinged door.

2.22 AIR VENTS

.1 Equal to ITT Hoffman Specialty No. 78 cast brass, 1035 kPa (150 psi) rated, 20 mm (¾") straight water main vent valves, each tapped at the top for a 3.2 mm (1/8") safety drain connection.

2.23 DOMESTIC WATER THERMAL EXPANSION TANK

.1 Pre-charged domestic water thermal expansion tank in accordance with Section VIII of the ASME Boiler and Pressure Code, carbon steel outer shell construction and complete with fixed butyl rubber bladder to prevent water from contacting shell interior, top NPT stainless steel system connection, 7.6 mm to 813 mm (0.301" to 32") charging valve connection and prime painted exterior.

.2 Manufacturers:

.1 Watts Industries (Canada) Inc. Series DETA;

.2 Zurn/Wilkins Model WTTA.

PART 3 - EXECUTION

3.1 DEMOLITION

.1 Refer to demolition requirements specified in Section 20 05 05 – Selective Demolition for Mechanical.

3.2 UNDERGROUND MUNICIPAL SERVICE CONNECTION

.1 Make required arrangements with Municipality for installation of domestic water service piping from Municipal main to property line.

.2 Pay charges levied by Municipality for service connection work.

.3 Municipal charges for underground street service connection work will be paid out of a prime cost allowance. Submit original copies of invoices issued by Municipality for street service connection work.

3.3 PIPING INSTALLATION REQUIREMENTS

.1 Provide required domestic water piping.

.2 Piping, unless otherwise specified, is as follows:

.1 for underground piping 100 mm (4") dia. and larger outside and/or inside the building – rigid PVC;

.2 for underground piping less than 100 mm (4") dia. inside building – Type "K" soft copper;

.3 for pipe 75 mm (3") dia. and larger inside building and above ground – Schedule 10 stainless steel;

.4 for 12 mm (½") dia. trap seal primer tubing located underground or in concrete or masonry construction – semi-rigid polyethylene;

.5 for pipe inside building and aboveground in sizes to 100 mm (4") dia., except in vertical shafts and through fire barriers – rigid CPVC;

.6 for branch hot and cold piping aboveground from mains and risers to fixtures and equipment where fire rated construction is not penetrated – at your option, PEX tubing installed and joined in strict accordance with manufacturer's instructions; when installed in unfinished areas, ensure piping is protected from ultra-violet light exposure.

.7 for underground piping outside building to fixtures/outlets at grade level – flexible polyethylene, snaked in the trench and in a continuous length wherever possible;

.8 for pipe inside building and aboveground in sizes to 100 mm (4") dia. – Type "L" hard copper with solder joints.

.1 Option: Type "L" hard copper with pressure coupled mechanical joints.

.2 Option: Type "L" hard copper with grooved end mechanical joints.

.1 Grooved pipe ends shall be clean and free from indentations, projections and roll marks in the area from pipe end to groove for proper gasket sealing. All couplings will meet Victaulic standards for visual inspection sizes 2" to 8". The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service as specified. Install in accordance with manufacturer's latest recommendations. A Victaulic factory trained representative shall periodically visit the job site and review the installation for best practices. The installing Contractor shall correct any identified deficiencies. Victaulic product that has been examined

and has not met the visual inspection criteria for proper installation must be corrected and re-examined by Victaulic prior to the completion of the project.

.3 Brace and secure underground water service pipe at bends, tees, and similar fittings with restraint devices, and provide concrete thrust blocks in accordance with Municipal standards and details. Regardless of what is specified elsewhere in this Specification regarding provisions of concrete, provide thrust block concrete. Paint restraint devices with 2 coats of corrosion resistant black asphalt base coating prior to backfilling.

.4 Lay pipes true to line and grade with bells upgrade. Fit sections together so that, when complete, pipe has a smooth and uniform invert. Keep pipe thoroughly clean so jointed compound will adhere. Inspect pipe for defects before being lowered into trench.

.5 Slope piping so it can be completely drained.

.6 Provide cast brass dielectric type adapters/unions at connections between ferrous and copper pipe or equipment.

3.4 INSTALLATION OF SHUT-OFF AND CHECK VALVES

.1 Refer to Part 3 of Section 20 05 00 – Common Work Results for Mechanical.

.2 For shut off valves installed on solder joint copper piping up to and including 75 mm (3") diameter, provide ball type valves, and for flanged joints copper or stainless steel piping larger than 75 mm (3") diameter provide butterfly type valves.

3.5 INSTALLATION OF DRAIN VALVES

.1 Provide a drain valve at the bottom of domestic water piping risers, at other piping low points, and wherever else shown.

.2 Locate drain valves so they are easily accessible.

3.6 INSTALLATION OF DOMESTIC HOT WATER PIPING BALANCING VALVES

.1 Provide balancing valves in domestic hot water recirculation piping where shown or required.

.1 for pipe 25 mm (3/4”) dia. and less ground – equal to Victaulic Series 76X

.2 for pipe greater than 25 mm (3/4”) dia. – equal to Victaulic TA Series 78BL

.2 Locate each valve so it is easily accessible.

3.7 INSTALLATION OF PARTITION STOPS

.1 Provide partition stops in domestic water piping to each group of suite washroom plumbing fixtures. Locate partition stops in piping near floor level in inconspicuous but accessible locations. Confirm exact locations prior to roughing-in.

3.8 INSTALLATION OF PRESSURE REDUCING VALVES

.1 Provide domestic water pressure reducing valves. Install so each valve is readily accessible. Whenever possible, provide pressure reducing valves factory pre-set to required pressures.

.2 Check and test operation, and adjust as required.

3.9 INSTALLATION OF DOMESTIC HOT WATER THERMOSTATIC MIXING VALVES

.1 Provide a domestic hot water thermostatic mixing valve assembly and wall mount.

.2 Adjust each valve to design requirements and check and test operation. Set maximum temperature limit stops.

.3 Identify each valve and its water temperature delivery setting with an engraved nameplate.

3.10 INSTALLATION OF WATER METER

.1 Provide domestic water service meter. Secure meter in place on a concrete housekeeping pad and connect with piping, including required valve by-pass.

.2 Installation of water meter must comply with local municipal requirement.

3.11 INSTALLATION OF HOSE BIBBS

.1 Provide hose bibbs.

.2 Unless otherwise shown, specified, or required, mount hose bibbs approximately 1 m (3') above floor. Confirm exact locations prior to roughing-in.

3.12 INSTALLATION OF EXTERIOR NON-FREEZE WALL HYDRANTS

.1 Provide non-freeze wall hydrants.

.2 Install hydrants level and plumb such that hose outlets are approximately 600 mm (2') above grade level. Confirm exact locations prior to roughing-in.

.3 Provide a shut-off valve inside building to each exterior non-freeze wall hydrant.

3.13 INSTALLATION OF EXTERIOR NON-FREEZE GROUND HYDRANTS

.1 Provide non-freeze ground hydrants. Confirm exact locations prior to roughing-in.

.2 Ensure length of piping to outlet box suits depth of underground piping, and underground piping elbow and valve housing is set in an envelope of clean sharp, 100% Proctor density compacted sand. Provide a length of small bore copper tubing from valve drain port into sand envelope.

.3 Provide a shut-off valve inside building to each ground hydrant.

3.14 INSTALLATION OF NON-FREEZE ROOF HYDRANT

.1 Provide non-freeze roof hydrants. Confirm exact locations prior to roughing-in.

.2 Coordinate installation with trades providing roof opening and roofing work to ensure a water-tight roof penetration.

.3 Provide 3.2 mm (1/8") diameter drain piping from inlet connection assembly inside building to a funnel floor drain or other suitable indirect connection location.

3.15 INSTALLATION OF TRAP SEAL PRIMERS

.1 Provide required accessible trap seal primers to automatically maintain a water seal in floor drain traps, whether shown on drawings or not.

.2 Water closet flush valves may be used for priming washroom floor drain traps if flush tube is properly tapped and primer tubing exposed in washroom is chrome plated.

.3 Provide trap primer valves to prime single or multiple (1 to 6) traps. Install trap primer valves in domestic cold water piping to frequently used plumbing fixtures. Where from 2 to 6 traps are to be

primed from same primer valve, provide appropriate supply and distribution tube assemblies. Ensure primer valves are accessible.

.4 Provide 115 volt, electronic, surface wall mounting trap primer assemblies for multiple (4 to 30) traps. Include for a 115 volt 15 ampere panel breaker and wiring in conduit from closest panelboards to primer assembly, all to wiring standards of Electrical Division. Adjust primer water flow and timing to suit number of traps served.

.5 Ensure trap primer piping is secured to floor drain primer tappings and not terminated through the tapping in the throat of the drain.

3.16 INSTALLATION OF SHOCK ABSORBERS

.1 Provide accessible shock absorbers in make-up water piping to equipment.

.2 Ensure size of each shock absorber is properly selected to suit size of water pipe and equipment pipe is connected to.

.3 Install down stream of backflow preventor.

3.17 INSTALLATION OF WATER HAMMER ARRESTORS

.1 Provide accessible water hammer arrestors in domestic water piping in locations as follows:

.1 in headers at groups of plumbing fixtures;

.2 at top of risers;

.3 at ends of long horizontal runs of piping;

.4 in piping connecting solenoid valves or equipment with integral solenoid valves;

.5 wherever else shown or required by Code.

.2 Install each unit in a piping tee either horizontally or vertically in the path of potential water shock in accordance with manufacturer’s instructions and details.

3.18 INSTALLATION OF BACKFLOW PREVENTERS

.1 Provide a reduced pressure zone assembly backflow preventer on incoming DCW service and in each direct domestic water connection to equipment other than plumbing fixtures and fittings.

.2 Provide a double check valve assembly backflow preventer on incoming DCW service. Provide a reduced pressure zone assembly backflow preventer in each direct domestic water connection to equipment other than plumbing fixtures and fittings.

.3 Locate each backflow preventer on floor or wall between 765 mm (30”) and maximum 1.5 m (60") above floor such that it is easily accessible for maintenance and testing.

.4 Equip each reduced pressure zone backflow preventer with an air gap fitting and pipe the reduced pressure zone water outlet to drain.

.5 Test operation of each backflow preventer in accordance with requirements of CAN/CSA B64 by personnel certified for such testing by governing authorities, and submit signed test results and a properly and clearly identified and marked inspection and test record card for each backflow preventer.

3.19 INSTALLATION OF EXPANSION COMPENSATORS, GUIDES, AND ANCHORS

.1 Provide expansion compensators in domestic water piping.

.2 Ensure pipe ends are properly aligned. Provide alignment guides on each side of expansion compensators, properly secured to building structure.

.3 Provide anchors to secure domestic water piping to structure. Locate anchors generally where shown but with exact locations to suit piping as installed and requirements of reviewed anchor shop drawings.

.4 When installation of anchors is complete, arrange, and pay for anchor design engineer to visit site to review anchor installation. Submit a letter from design engineer confirming each anchor is properly installed.

3.20 INSTALLATION OF LAVATORY SUPPLY FITTING TEMPERING VALVES

.1 Provide thermostatic water tempering valves for hot water supply to public washroom lavatory supply fittings. Conceal valves and piping.

.2 Provide a flush wall mount panel for each valve. Confirm exact location prior to roughing-in.

.3 Install in accordance with manufacturer’s instructions and set mixing valves to deliver 32°C (90°F) tempered water.

3.21 INSTALLATION OF AIR VENTS

.1 Provide accessible air vents in domestic water piping to prevent air binding.

.2 Extend copper indirect drain piping from top drain connection of each vent to nearest suitable drain.

.3 Locate exact vent locations on as-built record drawings.

3.22 INSTALLATION OF DOMESTIC WATER THERMAL EXPANSION TANKS

.1 Provide domestic water thermal expansion tanks.

.2 Unless otherwise specified, mount at least 450 mm (18") from cold water inlet to domestic water heater.

.3 Adjust pre-charge to match incoming water pressure after installation.

.4 Install in accordance with manufacturer’s instructions and as per local governing Codes and Regulations.

3.23 FLUSHING AND DISINFECTING PIPING

.1 Flush and disinfect all new and/or reworked domestic water piping after leakage testing is complete.

.2 Isolate new piping from existing piping prior to flushing and disinfecting procedures.

.3 Flush piping until all foreign materials have been removed and flushed water is clear. Provide connections and pumps as required. Open and close valves, faucets, hose outlets, and service connections to ensure thorough flushing.

.4 When flushing is complete, disinfect the piping with a solution of chlorine in accordance with AWWA C601.

.5 When disinfecting is complete, submit water samples to a certified laboratory for purity testing and, when testing indicates pure water in accordance with governing standards, submit a copy of test results and fill the systems.

END OF SECTION

SEE ADD#4
Q#109

PART 1 - GENERAL

1.1 SUBMITTALS

.1 Submit shop drawings/product data sheets for all equipment and associated hardware specified in this Section.

1.2 CLOSEOUT SUBMITTALS

.1 Submit manufacturer/supplier installation certification letters as specified in Part 3 of this Section.

.2 Submit, prior to Substantial Performance of the Work, start-up or test data specified in Part 3 of this Section.

PART 2 - PRODUCTS

2.1 COPPER SILVER IONIZATION SYSTEM FOR POTABLE WATER

.1 Description: Ion Chamber Cell(s):

.1 The ionization chamber cell will be constructed of Schedule 40 stainless steel (or) powder coated aluminum to meet fire building codes and international plumbing codes when applicable. CPVC Schedule 80 Chamber cells will be allowed when building fire codes do not apply to said facility potable water distribution network.

.2 The use of either Victaulic couplings or flange type connections

.3 When multiple chamber cells are required, such ion chamber cells must be installed in parallel to each other and not end to end as to prevent ionic re-deposition.

.4 Safety activation flow switch or flow meter as proposed by the manufacturer's recommendation and application process.

.5 Manufacturer will include a properly sized commercial grade flow meter. The flow meter will provide a 4-20 mA output signal to the automated ion controller for variable ionization process.

.6 Must identify type of waterproof engineering and pressure tolerance levels. Must also include the storage shelf life of the ionization chamber cells.

.7 Minimum operational water pressures of between 40 PSI to 200 PSI in any liquid water temperature or 33 degrees F (1 degree C) up to 176 degrees F (80 degrees C) for a period of no less than 12 consecutive hours.

.8 Having a water flow capacity of up to 45 GPM (170 LPM) each ion chamber cell

.9 Only one (1) ion chamber cell per automated 10-12 amps / 0-100 VDC drive or 10-12 amps / 0 VDC-180 VDC output.

.10 Electrode MSDS composition demonstrating alloy purity and trace elements present in the electrodes. Report must be by an independent 3rd party.

.11 Provide NSF61 documentation on all wetted components.

.12 Usage lifespan (warranty) of the ionization chamber cells must be associated to one (1) ion chamber cell only. Each chamber cell must be capable of treating no less than 20,000 US-GPD per day and last for a period of no less than 9 months.

.13 Replacement chamber cells "Spare cells" that extend the perceived warranty "lifespan" of an originally installed chamber cell will not be allowed.

.14 The internal electrodes will be composed of 99.99% pure copper (Cu) and 99.99% silver (Ag).

.15 The Cu and Ag alloy ratio will be no less than 90% Cu / 10% Ag and no more than 60% Cu / 40% Ag. The provider will indicate the composition of the proposed alloy.

.16 The solution will have less than 5 psi drop in water pressure post treatment.

.2 Description: Fully Automated PID (Computer & Software) Ion Controller

.1 Fully automated industrial grade (PID) copper silver ion generator capable of treating the required amount of daily potable water usage within the intended facility location.

.2 The copper silver ionization controller (s) must be able to generate via amperage set points between 0.2 - 0.4 ppm Cu and 0.02 - 0.04 ppm Ag within the DHW loop over existing pre-start-up.

.3 Manufacturers:

.1 AquaLyse / CSI Defender (Canada) by: ProCare Water Treatment Inc.

.2 EPI by Enrich Products Ionization (USA).

.3 Liquitech Inc. (USA).

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Provide copper-silver ionization system.

.2 Install system in accordance with manufacturer's instructions and recommendations, and make required piping connections.

.3 Coordinate installation with other trades making connections to equipment, namely control and power connections.

.4 For equipment/system start-up requirements, refer to Section 20 05 00 – Common Work Results for Mechanical. After installation is complete, charge system and test for leaks and test and adjust controls and safeties. Repair leaks and retest until no leaks occur. Replace any damaged or malfunctioning controls and equipment.

.5 For equipment/system manufacturer certification requirements, refer to Section 20 05 00 – Common Work Results for Mechanical. Submit a copy of the letter prior to Substantial Performance of the Work.

3.2 TRAINING

.1 Include for 4 hours of on-site training for 2 groups of 6 people. Training is to be a full review of all components including but not limited to a full operation and maintenance demonstration, with abnormal events.

END OF SECTION

PART 1 - GENERAL

1.1 SUBMITTALS

.1 Submit shop drawings/product data sheets for all products specified in this Section except pipe and fittings.

1.2 CLOSEOUT SUBMITTALS

.1 Submit a copy of plumbing inspection certificate prior to application for Substantial Performance of the Work.

.2 Submit letters from product manufacturers/suppliers to certify correct installation of products as specified in Part 3 of this section.

.3 Record Drawings: Indicate inverts of new below grade sanitary and storm piping on as-builts drawings.

PART 2 - PRODUCTS

2.1 PIPE, FITTINGS, AND JOINTS

.1 PVC Sewer

.1 DR35 rigid, green PVC hub and spigot pattern sewer pipe and fittings to CAN/CSA B182.2, with gasket joints assembled with pipe lubricant.

.2 DR35 rigid, PVC sewer pipe and fittings, with solvent weld joints, all certified to CSA B182.1 and colour-coded as per local governing codes, regulations and standards.

.2 PVC - DWV

.1 For Low Buildings: Equal to IPEX System 15 drain, waste and vent pipe and fittings to CAN/CSA B181.2, complete with a flame spread rating not more than 25 when tested to CAN/ULC S102.2, with solvent weld joints or MJ Grey mechanical joint couplings, and, for fire barrier penetration, approved firestop conforming to CAN/ULC S115.

.2 For High Buildings and Plenums: Equal to IPEX System XFR drain, waste and vent pipe and fittings to CAN/CSA B181.2, complete with a flame spread rating not more than 25 and a smoke developed classification not more than 50 when tested to CAN/ULC S102.2, with solvent weld joints or MJ Grey mechanical joint couplings, and, for fire barrier penetration, approved firestop conforming to CAN/ULC S115.

.3 Copper - Solder Joint

.1 Type DWV hard temper to ASTM B306, with forged copper solder type drainage fittings and 50% lead - 50% tin solder joints.

.4 Cast Iron

.1 Class 4000 cast iron pipe, fittings, and mechanical coupling joints to CAN/CSA B70.

.5 Copper-Victaulic Coupling Joint

.1 Type DWV hard temper to ASTM B306, with factory or site rolled grooved ends (with grooving rolls designed for copper) and Victaulic "Copper Connection" wrought copper or cast bronze fittings and Style 606 gasket type couplings.

.6 Galvanized Steel - Victaulic Coupling Joint

.1 Schedule 40 mild steel, galvanized, ASTM A53, factory or site rolled grooved, complete with Victaulic galvanized ductile iron grooved end fittings and, unless otherwise specified, Victaulic Style 77 hot dip galvanized mechanical joint couplings with Grade M gaskets.

.7 PVC Weeper Piping

.1 150 mm (6") dia. corrugated perforated PVC pipe with an integral geodesic sock, supplied in coils.

2.2 SHUT-OFF AND CHECK VALVES

.1 Shut-off Valves

.1 Class 600, 4140 kPa (600 psi) WOG rated full port ball valves, each complete with a forged brass body, blowout-proof stem, chrome plated solid brass ball, solder or screwed ends as required, and removable lever handle.

.2 Manufacturers:

.1 Toyo Valve Co. Fig. 5049A or Fig. 5044A;

.2 Milwaukee Valve Co. #BA-155 or #BA -125;

.3 Kitz Corporation Code 58 or Code 59;

.4 Victaulic Co. of Canada Ltd. Series 722;

.5 Apollo Valves # 77-100 or # 77-200;

.6 Watts Industries (Canada) Inc. #FBVS-3C.

.2 Check Valves

.1 Class 125, bronze, 1725 kPa (250 psi) WOG rated vertical lift check valve with solder or screwed ends as required, and, for horizontal piping, Class 125, bronze 1380 kPa (200 psi) WOG rated swing check valves with solder or screwed ends.

.2 Manufacturers:

.1 Toyo Valve Co. Fig. 231 or Fig. 236 or Fig. 237;

.2 Milwaukee Valve Co. #1510 or #510;

.3 Kitz Corporation Code 36 or Code 22 or Code 23.

2.3 VENT STACK COVERS

.1 Equal to Lexcor Model "Flash-Tite" seamless, spun aluminum, insulated vent stack covers with caps and a factory applied asphalt primer coating on top and bottom of flange.

.2 Each vent stack cover is to be complete with a vandal-proof cap.

2.4 CLEANOUTS

.1 Horizontal Piping

.1 TY pipe fitting with an extra heavy brass plug screwed into the fitting.

.2 Vertical Piping

.1 Bronze or copper cleanout tees in copper piping, each complete with a bronze ferrule, and, for cast iron piping, "BARRETT" type cast iron cleanout tees, each gas and water-tight and complete with a bolted cover.

.3 Urinal(s)

.1 Wall access cleanout assemblies, each complete with a tapered plug, threaded brass insert, urethane rubber seal, and polished stainless steel access cover with vandal-proof stainless steel securing screw.

.2 Manufacturers:

.1 Watts Industries (Canada) Ltd. #CO-590-RD.

.2 Jay R. Smith #SQ4-1819;

.3 Zurn #ZSS-1666-1;

.4 Mifab #C1440-RD;

2.5 FLOOR CLEANOUT TERMINATIONS

.1 Factory finished cast iron terminations, each adjustable and complete with a cast iron body with neoprene sleeve, solid, gasketed, polished nickel-bronze scoriated top access cover to suit floor finish, a seal plug, and captive, vandal-proof, stainless steel securing hardware.

.2 Manufacturers:

.1 Watts Industries (Canada) Ltd. # CO-200-R-1.

.2 Jay R. Smith #4020-F-C Series;

.3 Zurn # ZN-1602-SP Series;

.4 Mifab # C1100-XR-1 or #C1000-R-3;

.3 Cleanout terminations in areas with a tile or sheet vinyl floor finish are to be as above but with a square top in lieu of a round top.

2.6 FLOOR DRAINS, FUNNEL FLOOR DRAINS, AND HUB DRAINS

.1 Unless otherwise specified or indicated, floor drains are to be vandal-proof drains in accordance with drawing symbol list, each complete with a cast iron body and a trap seal primer connection. Cast iron components are to be factory finished with latex based paint coating.

.2 Floor drains in areas with a tile or sheet vinyl floor finish are to be as above but with a square grate in lieu of a round grate.

.3 Manufacturers:

.1 Watts Industries (Canada) Ltd.;

.2 Jay R. Smith Manufacturing Co.;

.3 Zurn Industries Ltd.;

.4 Mifab Inc.

2.7 ROOF DRAINS

.1 Unless otherwise specified or indicated, roof drains are to be cast iron body drains with aluminium domes, in accordance with the drawing symbol list. Cast iron components are to be factory finished with a latex based paint coating.

.2 Manufacturers:

.1 Watts Industries (Canada) Ltd.;

.2 Jay R. Smith Manufacturing Co.;

.3 Zurn Industries Ltd.;

.4 Mifab Inc.

2.8 DRAINAGE TRENCH FRAMES AND GRATING

.1 Welded, hot dipped galvanized, 45 mm x 45 mm x 6.4 mm (1-¾" x 1-¾" x ¼") carbon steel angle frame, 300 mm (12") wide, with anchor straps and lengths as required, and baked epoxy coated cast iron slotted grating in 600 mm (24") long sections.

.2 Manufacturers:

.1 Watts Industries (Canada) Ltd. #TD-910-B1-4;

.2 Jay R. Smith #2971VP.

.3 Zurn # Z796VP;

2.9 TRENCH DRAINS

.1 Modular, pre-sloped, polyester fibreglass construction interlocking sections of drainage channel with overlapping joints, drain pipe connection outlets as required, end caps and covers to suit the application, integral anchor tabs for grate anchoring and trench levelling, heavy-duty coated steel angle top frames, and heavy-duty coated cast iron slotted grate supplied in 600 mm (24") long sections.

.2 Manufacturers:

.1 Watts Industries (Canada) Inc. “Dead Level” Series;

.2 Jay. R. Smith #9810 Series.

.3 Zurn "Flow-Thru" System;

.4 ACO Systems Ltd. "ACOdrain";

2.10 INTERIOR CATCH BASIN FRAMES AND COVERS

.1 Heavy-duty, 508 mm (13") square, baked epoxy coated cast iron, non-removable, hinged slotted grate with coated steel frame with concrete anchors.

.2 Manufacturers:

.1 Watts Industries (Canada) Ltd. #FD-410;

.2 Jay R. Smith #8915FC;

.3 Zurn #Z-799-1;

.4 Mifab #F1570.

2.11 BACKWATER VALVES

.1 Heat bonded powder epoxy coated cast iron in-line type, each complete with a bolted and gasketed cover, bronze flapper, stainless steel extension, and stainless steel hardware.

.2 Manufacturers:

.1 Watts Industries (Canada) Inc. BV-230-R Series;

.2 Jay R. Smith #7022-CAN.

.3 Zurn #Z-1095-15-MJ;

2.12 EXTENDABLE BACKWATER VALVES

.1 Equal to “Mainline Adapt-a-valve” ABS/PVC backwater valve cassette with ABS/PVC flush cap cleanout for use with ABS or PVC pipe. Provide extension piece cut to length to extend valve access to finished floor level. Provide flush cap cleanout cover to match backwater valve size and material.

2.13 EXTERIOR CATCH BASINS

.1 Pre-cast reinforced concrete catch basins manufactured to ASTM C478 and Municipal standards, each sized and arranged to suit drainage pipe size and arrangement, and complete with:

.1 cast iron frame and cover to Municipal standards;

.2 required masonry work to raise top of catch basins flush with finished grade or pavement surfaces.

.2 Masonry work is to consist of cement mortar and clay or shale bricks to ASTM C32 Grade M5, or Oaks Precast Industries "MODULOC" pre-cast interlocking concrete members and accessories.

2.14 EXTERIOR MANHOLES

.1 Pre-cast reinforced concrete manholes manufactured to ASTM C478 and Municipal standards, each sized and arranged to suit drainage pipe size and arrangement, and complete with:

.1 poured-in-place or pre-cast concrete base;

.2 cast-in-place "Safety" type aluminum steps on 300 mm (12") centres, each step coated with 2 coats of static asphalt paint;

.3 unperforated cast iron cover with lifting holes and a matching frame;

.4 as required by manhole depth and safety regulations, cast-in-place hinged aluminum safety grating with SG 1 1 R-T6 aluminum alloy bearing bars, aluminum grate to CAN/CSA S157, and self-locking type stainless steel hinges and fasteners with galvanized steel safety chain and snap hook;

.5 required masonry work to raise top of manholes flush with finished grade.

.2 Masonry work is to consist of cement mortar and clay or shale bricks to ASTM C32 grade M5, or Oaks Precast Industries "MODULOC" pre-cast interlocking concrete members and accessories.

2.15 GREASE INTERCEPTORS

.1 Grease intercepting and recovery unit of #11 gauge type 304 stainless steel construction with sensor controlled grease draw-off solenoid valve, automatic shut-down with audible/visual alarm if maximum grease capacity is exceeded, integral heating element with thermostat, gasketed stainless steel cover, stainless steel solids interceptor, and remote surface wall mounting indicator panel with status indicating lights, audible alarm, 115/24 volt control transformer and NEMA 2 enclosure.

.2 Manufacturers:

.1 Watts Industries (Canada) Inc. WD-E Series;

.2 Jay R. Smith #8000-ELECT series or #8400-ELECT series.

.3 Zurn #Z1172-UN series;

2.16 OIL INTERCEPTORS

.1 Epoxy coated steel construction automatic oil interceptor with removable baffles, deep seal trap with cleanout, sediment bucket, aluminum frame and cover, and remote wall mounting indicating panel with status indicating lights, audible alarm, 115/24 volt control transformer, and NEMA 2 surface wall mounting enclosure.

.2 Manufacturers:

.1 Watts Industries (Canada) Inc. OI-SS / HI 7873 Series;

.2 Jay R. Smith 8500-SC-ELECT-CAN Series.

.3 Zurn #Z1198 series;

PART 3 - EXECUTION

3.1 DEMOLITION

.1 Refer to demolition requirements specified in Section 20 05 05 – Selective Demolition for Mechanical.

3.2 UNDERGROUND MUNICIPAL SERVICE CONNECTION

.1 Make required arrangements with Municipality for installation of drain service piping mains from Municipal main to property line.

.2 Pay charges levied by Municipality for service connection work.

.3 Municipal charges for underground street service connection work will be paid out of a prime cost allowance. Submit original copies of invoices issued by Municipality for street service connection work.

3.3 DRAIN AND VENT PIPING INSTALLATION REQUIREMENTS

.1 Provide required drainage and vent piping. Pipe, unless otherwise specified, as follows:

.1 for underground pipe inside building and to points 1.5 m (5') outside building lines – rigid PVC sewer pipe, minimum 75 mm (3") dia.;

.2 for pipe inside building and aboveground in sizes less than or equal to 65 mm (2-½") dia. – type DWV copper;

.3 for pipe inside building and aboveground in sizes greater than or equal to 75 mm (3") dia. – Class 4000 cast iron;

.4 for pipe inside building and aboveground in lieu of type DWV copper and cast iron, at your option and where permitted by governing Codes and Regulations – rigid PVC DWV;

.5 for drainage pump discharge pipe connections from pump to and including shut-off and check valve connections – Type "DWV" copper with Victaulic "Copper Connection" fittings and couplings, or Schedule 40 galvanized steel with Victaulic fittings and couplings.

.2 Unless otherwise specified, slope horizontal drainage piping aboveground in sizes to and including 75 mm (3") dia. 25 mm (1") in 1.2 m (4'), and pipe 100 mm (4") dia. and larger 25 mm (1") in 2.4 m (8').

.3 Install and slope underground drainage piping to inverts or slopes indicated on drawings to facilitate straight and true gradients between points shown. Verify available slopes before installing pipes.

.4 Unless otherwise specified, slope horizontal branches of vent piping down to fixture or pipe to which they connect with a minimum pitch of 25 mm (1") in 1.2 m (4').

.5 Extend vent stacks up through roof generally where shown but with exact locations to suit site conditions and in any case a minimum of 3 m (10') from fresh air intakes. Terminate vent stacks a minimum of 330 mm (13") above roof (including roof parapets) in vent stack covers. Where not shown on drawings, route vent piping from source to building exterior as required in order to satisfy local governing codes and authority. Coordinate vent routing with other building services and ensure there is no architectural impact.

.6 Provide cast brass dielectric unions at connections between copper pipe and ferrous pipe or equipment.

3.4 INSTALLATION OF SHUT-OFF AND CHECK VALVES

.1 Provide a shut-off valve and a check valve in discharge piping of each drainage pump.

.2 Locate valves so they are easily accessible without the use of ladders or other such devices.

3.5 SUPPLY OF VENT STACK COVERS

.1 Supply a properly sized vent stack cover for each vent stack penetrating roof.

.2 Hand vent stack covers to roofing trade at site for installation and flashing into roof construction as part of roofing work. Coordinate installation to ensure proper locations. Provide waterproofing caps over vent stacks.

3.6 INSTALLATION OF CLEANOUTS

.1 Provide cleanouts in drainage piping in locations as follows:

.1 in building drain or drains as close as possible to inner face of outside wall, and, if a building trap is installed, locate cleanout on downstream side of building trap;

.2 at or as close as practicable to the foot of each drainage stack;

.3 at maximum 15 m (50') intervals in horizontal pipe 100 mm (4") dia. and smaller;

.4 at maximum 30 m (100') intervals in horizontal pipe larger than 100 mm (4") dia.;

.5 in the wall at each new urinal or bank of urinals in a washroom;

.6 wherever else shown on drawings.

.2 Cleanouts are to be same diameter as pipe in piping to 100 mm (4") dia., and not less than 100 mm (4") dia. in piping larger than 100 mm (4") dia.

.3 Where cleanouts in vertical piping are concealed behind walls or partitions, install cleanouts near floor and so cover is within 25 mm (1") of the finished face of the wall or partition.

3.7 INSTALLATION OF FLOOR CLEANOUT TERMINATIONS

.1 Where cleanouts occur in horizontal inaccessible underground piping, extend cleanout TY fitting up to floor, and provide a cleanout termination set flush with finished floor.

.2 In waterproof floors, ensure each cleanout termination is equipped with a flashing clamp device. Cleanout terminations are to suit floor finish.

.3 Where cleanout terminations occur in finished areas, confirm locations prior to rough-in and arrange piping to suit.

.4 Ensure cleanout termination covers in tiled floor are square in lieu of round.

3.8 INSTALLATION OF FLOOR DRAINS, FUNNEL FLOOR DRAINS AND HUB DRAINS

.1 Provide floor drains, funnel floor drains and hub drains.

.2 Coordinate location of floor drains, funnel floor drains and hub drains with equipment provided by Mechanical Division and Owner's supplied equipment. Install in accordance with manufacturer's instructions.

.3 Equip each drain with a trap.

.4 In equipment rooms and similar areas, exactly locate floor drains to suit location of mechanical equipment and equipment indirect drainage piping. In washrooms, exactly locate floor drains to avoid interference with toilet partitions.

.5 Confirm exact location of drains prior to roughing in. Where floor drains occur in washrooms coordinate locations with toilet partition installations.

.6 Temporarily plug and cover floor drains during construction procedures. Remove plugs and covers during final clean-up work and when requested, demonstrate free and clear operation of each drain. Replace any damaged grates, and refinish any areas of the drain where cast iron finish has been damaged or removed, including rusted areas.

3.9 INSTALLATION OF ROOF DRAINS

.1 Supply roof drains and place roof drain bodies in position for flashing into roof construction as part of roofing work. Connect with piping and provide accessories.

.2 Protect roof drains from damage and entrance of debris until roofing work is complete, and refinish any areas where cast iron factory finish has been damaged or removed, including rusted areas.

3.10 INSTALLATION OF DRAINAGE TRENCH FRAMES AND GRATING

.1 Supply frame and grating sections for drainage trench. Provide piping connections, traps, etc., as required.

.2 Hand frames to concrete trade forming and pouring trenches. Ensure frames are properly and accurately installed.

.3 Be present during concrete pour to ensure frames are not dislodged or damaged and remain straight and true. Immediately report any problems.

.4 Install grates and secure in place. Temporarily cover grates during construction procedures. Clean trenches when work is complete.

3.11 INSTALLATION OF TRENCH DRAINS

.1 Provide pre-sloped sections of drainage channel and install so top frames are level and plumb in relation to floor finishes. Provide accessories, traps, etc., as required.

.2 Be present during concrete pour to ensure trench drainage is not dislodged or damaged and remains straight and true. Immediately report any problems.

.3 Install grating and secure in place.

.4 Temporarily cover trench drainage openings during construction procedures. Clean trenches when work is complete.

3.12 INSTALLATION OF INTERIOR CATCH BASIN FRAMES AND COVERS

.1 Supply frames and hinged grates for interior catch basins and provide sump inlet and outlet piping and accessories.

.2 Hand frames to concrete trade pouring concrete sump, and coordinate installation of sump piping with the formwork installation.

.3 Install grates and secure in place. Clean sumps when work is complete.

3.13 INSTALLATION OF BACKWATER VALVES

.1 Provide backwater valves in drainage piping and connect with piping.

.2 Set backwater valve assembly such that cover is flush with finished floor. Provide an extension piece if required due to depth of piping.

3.14 INSTALLATION OF EXTERIOR MANHOLES

.1 Provide pre-cast concrete manholes. Properly bed each unit and set to required invert.

.2 Provide a reinforced pre-cast concrete base slab and bottom section for each manhole, or provide a poured-in-place concrete base. Ensure each manhole is sized to suit pipe size and arrangement. Conform to Municipal installation standards.

.3 Provide masonry work required to raise top of each assembly flush with finished grade level.

.4 When work is substantially complete, clean out each manhole.

3.15 INSTALLATION OF EXTERIOR CATCH BASINS

.1 Provide pre-cast concrete catch basins. Properly bed each unit and set to required invert.

.2 Ensure each catch basin is sized to suit pipe size and arrangement. Conform to Municipal installation standards.

.3 Provide masonry work required to raise top of each assembly flush with finished grade level.

.4 When work is substantially complete, clean out each catch basin.

3.16 INSTALLATION OF DRAINAGE INTERCEPTOR

.1 Provide an interceptor in drainage piping.

.2 Ensure unit is easily accessible for maintenance. Confirm exact location prior to roughing-in.

.3 Wall mount control panel and provide required 24 volt control wiring in conduit from control panel to interceptor.

.4 For equipment/system start-up requirements, refer to Section 20 05 00 – Common Work Results for Mechanical.

.5 For equipment/system manufacturer certification requirements, refer to Section 20 05 00 – Common Work Results for Mechanical. Submit a copy of the letter prior to Substantial Performance of the Work.

.6 Include for 2 hours of on-site training for 2 groups of 6 people. Training is to be a full review of all components including but not limited to a full operation and maintenance demonstration, with abnormal events.

END OF SECTION

Updated through ADD#10

PART 1 - GENERAL

1.1 SUBMITTALS

.1 Submit shop drawings/product data sheets for all products specified in this section, except piping and valves.

1.2 CLOSEOUT SUBMITTALS

.1 Submit a letter from compressor manufacturer/supplier to certify proper compressor set installation as specified in Part 3 of this section.

.2 Training attendance records.

1.3 QUALITY ASSURANCE

.1 Compressed air piping system work is to be in accordance with the following:

.1 CSA B51, Boiler, Pressure Vessel, and Pressure Piping Code;

.2 ASME B31, Standards of Pressure Piping;

.1 ASME-B31.1 – Power Piping.

.3 ASME/ANSI B16 - Standards for Pipes and Fittings.

.4 and governing Provincial and/or Municipal Codes and Regulations.

.1 O.Reg. 220/01 - Boiler and Pressure Piping Regulation.

PART 2 - PRODUCTS

2.1 PIPE, FITTINGS AND JOINTS

.1 Galvanized Steel

.1 Schedule 40 mild steel, galvanized, ASTM A53, screwed, complete with Class 125 galvanized cast iron screwed fittings and screwed joints.

.2 Copper

.1 Type "L" hard drawn seamless copper to ASTM B88, complete with forged solder type fittings to suit pipe, and soldered joints using 95% tin / 5% Antimony solder.

2.2 PIPING UNIONS

.1 Screwed Steel Piping

.1 Malleable iron, galvanized, ground joint, brass to iron or bronze to bronze seat unions and union elbows with a minimum pressure rating of 1725 kPa (250 psi) steam at 260°C (500°F).

.2 Soldered Copper Piping

.1 Solder-on forged copper or bronze screwed unions suitable in all respects for the application.

2.3 LOW PRESSURE SHUT-OFF VALVES

.1 Class 600, 4140 kPa (600 psi) WOG rated full port ball valves, each complete with a forged brass or bronze body with solder joint or screwed joint ends as required, forged brass cap and blowout-proof stem, forged brass chrome plated ball, "Teflon" or "PTEF" seat, and a removable lever handle.

.2 Manufacturers:

.1 Toyo Valve Co. Fig. 5049A solder or Fig. 5044A screwed;

.2 Watts Industries (Canada) Ltd. #FBV-3 or #FBVS-3;

.3 Kitz Corporation Code 59 solder or Code 58 screwed;

.4 Apollo Valves #70-100 screwed or #70-200 solder.

2.4 HIGH PRESSURE SHUT-OFF VALVES

.1 Equal to Apollo Valves #70-100-27, 4140 kPa (600 psi) rated Class 600, screwed bronze ball valve with a PTFE seat, automatic relief vent, and removable lever handle.

2.5 DRAIN VALVES

.1 Minimum 2070 kPa (300 psi) water rated, 20 mm (¾") dia. straight pattern full port bronze ball valves, each complete with a threaded outlet suitable for coupling connection of 20 mm (¾") dia. garden hose, and a cap and chain.

.2 Manufacturers:

.1 Toyo Valve Co. Fig. 5046;

.2 Kitz Corporation Code 58CC;

.3 Apollo Valves #78-100 or #78-200;

.4 Watts Industries (Canada) Ltd. #B6000-CC.

2.6 AIR COMPRESSOR SET

.1 “Campbell Hausfeld”, CE5002 compressor features a cast iron, oil lubricated 2 stage pumps. 175 PSI max pressure, 7.6 SCFM @ 90 PSI. 60-gallon ASME vertical tank design. Induction engine. ASME, UL, CSA certified.

.2 Compressor set model number, performance and electrical characteristics as follows:

.1 model number: WBB2764020

.2 motor characteristics: 3.7 HP, 230 volts, 1 phase;

.3 tank capacity: 60 GAL

.3 Each compressor complete with:

.1 cast iron cylinders, heads, crankcase, and cast iron connecting roads with replaceable automotive type insert bearings;

.2 cast iron crankshaft supported on both ends by oversized tapered roller bearings;

.3 pressure type oil lubrication with oil sight gauge;

.4 steel inlet and discharge valves, and a high efficiency intercooler with steel fins on copper tubes;

.5 heavy-duty dry type inlet filter-silencer;

.6 high volume, statically balanced flywheel/cooing fan;

.7 motor conforming to requirements specified in Section 20 05 00 – Common Work Results for Mechanical, on an adjustable support base, and V-belt drive with OHSA type steel belt guard, also as specified in Basic Mechanical Materials and Methods.

.4 Welded steel receiver including an ASME rated tank in accordance with CSA B51 and TSSA requirements, complete with welded steel support feet, and following:

.1 ASME rated safety relief valve;

.2 positive seating ball type outlet valve, a screwed union, and a length of braided metallic flexible connection;

.3 pressure gauge with gauge cock;

.4 adjustable pressure switch for automatic start-stop operation of the compressors;

.5 valved manual tank drain, and an automatic tank drain;

.6 properly sized neoprene-steel-neoprene vibration isolating mounting pads;

.7 braided stainless steel flexible pipe connectors supplied loose.

.5 Surface wall mounting power and control panel in a NEMA 1 (NEMA 2 if room is sprinklered) enamelled steel enclosure with a hinged (piano hinge) lockable front door, door interlock disconnect switch, and following:

.1 overload protected across-the-line, non-reversing magnetic starter, and a door mounted H-O-A switch for each motor, in accordance with Section 20 05 00 – Common Work Results for Mechanical;

.2 fused control transformer;

.3 electronic alternator to automatically alternate lead compressor after each start cycle, and to automatically start lag compressor should the lead compressor fail to start;

.4 door mounted "power on" LED for panel and door mounted "run" LED for each compressor;

.5 terminal block and strips for power and control wiring connections, including control wiring from receiver mounted pressure switch.

.6 Manufacturers:

.1 CompAir Kellog;

.2 Atlas Copco Compressors Canada;

.3 DeVair Systems.

.4 Campbell Hausfeld.

PART 3 - EXECUTION

3.1 INSTALLATION OF AIR COMPRESSOR SET

.1 Provide an air compressor set.

.2 Secure set in place on vibration isolation on a concrete housekeeping pad.

.3 Ensure housekeeping pad is keyed to structure, and compressor assembly is secured to structure by slack cable restraints. Refer to Section 20 05 48.16 - Seismic Controls for Mechanical Systems.

.4 Install accessories shipped loose with set, except power and control panel.

.5 Extend type DWV soldered hard copper drainage piping from tank drain assemblies to nearest floor drain.

.6 Hand power and control panel to electrical trade at site for mounting and power wiring connections as part of electrical work.

.7 Connect receiver pressure switch to starter and control panel with wiring in conduit to the standards of the electrical work and in accordance with panel supplier's instructions.

.8 Touch-up paint any damage to the factory finish.

3.2 INSTALLATION OF PIPING AND PIPING SYSTEM COMPONENTS

.1 Provide required compressed air piping. Unless otherwise specified, install horizontal piping to outlets 1.5 m (5 feet) above finished floor level.

.2 Pipe is to be Schedule 40 mild galvanized steel, screwed, or type "L" hard copper, soldered.

.3 Support and secure piping generally as specified in Section 20 05 00 – Common Work Results for Mechanical, but with extra support and securing hardware as required to prevent drumming. Provide rigid supports at each side of outlets.

.4 Arrange piping so condensate will drain from mains and branches into drip legs. Provide drip legs at bottom of risers, every 30 m (100') of pipe run, and at the end of each branch piping run, whether indicated on drawings or not.

.5 Drip legs are to extend down from bottom of pipe and consist of a piping tee and 250 mm (10") long pipe nipple same size as main or branch pipe, then a reducing fitting (if required) and 12 mm (½") dia. piping extended down to floor level and terminated with a ball valve. Ensure drain points are easily accessible and identified.

.6 Extend branch piping to outlets and/or equipment off the top of the main(s).

.7 Provide shut-off valves in piping at all equipment connections, to isolate piping components for removal or maintenance, and wherever else specified or shown. Provide vented type valves between air compressor set and pressure reducing stations.

.8 Provide unions in piping at connections to equipment.

.9 When piping is complete and has been pressure tested, but before connection of outlets, blowout piping to remove oil and foreign matter.

.10 Provide adjustable pressure regulators, filters, compressed air outlets, etc. Unless otherwise indicated locate outlets 1.5 m (5 feet) above floor and properly secured in place. Provide a hose hanger at each outlet location. Confirm exact location of piping components prior to roughing-in.

3.3 SYSTEM STARTUP

.1 For equipment/system start-up requirements, refer to Section 20 05 00 – Common Work Results for Mechanical.

.2 For equipment/system manufacturer certification requirements, refer to Section 20 05 00 – Common Work Results for Mechanical. Submit a copy of the letter prior to Substantial Performance of the Work.

3.4 CLOSEOUT ACTIVITIES

.1 Include for 4 hours of on-site training for 2 groups of 6 people. Training is to be a full review of all components including but not limited to a full operation and maintenance demonstration, with abnormal events.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Electric water heaters and water heater accessories.

1.2 REFERENCES

.1 ANSI Z21.22, Relief Valves for Hot Water Supply Systems.

.2 ASHRAE/IESNA 90.1, Energy Standard For Buildings Except Low-Rise Residential Buildings.

.3 CSA C22.2 No. 88, Construction and Test of Industrial Heating Equipment.

1.3 SUBMITTALS

.1 Product Data: For each product:

.1 Manufacturer's data sheets indicating unit performance and compliance with requirements.

.2 Include details of electrical and mechanical operating parts.

.3 Show mounting and securing requirements and utility connection requirements.

1.4 CLOSEOUT SUBMITTALS

.1 Submit manufacturer/supplier installation certification letters as specified in Part 3 of this Section.

.2 Submit with delivery of heater(s) a copy of the factory inspection and test report for each heater and include a copy of each report with O&M manual project closeout data.

.3 Submit, prior to Substantial Performance of the Work, start-up or test data specified in Part 3 of this Section.

1.5 WARRANTY

.1 Standard Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of electric, domestic-water heaters that fail in materials or workmanship within specified warranty period.

.1 Standard Warranty Period: From Date of Substantial Completion:

.1 Electrical Components: two years

.2 Heating Elements: four years

.3 Heat Exchanger free from leaks: eight years.

PART 2 - PRODUCTS

2.1 INSTANTANEOUS ELECTRIC HOT WATER HEATER (FOR REMOTE SINGLE FIXTURES)

.1 Chronomite Laboratories Inc., 1-phase, CSA certified, 98% energy efficient instantaneous point-of-use electric hot water heater with model number and performance as specified on drawings, factory pre-set to deliver 29°C (85°F) water, and complete with:

.1 a back plate for surface mounting;

.2 enclosure;

.3 Celcon waterways;

.4 stainless steel heating coil;

.5 fail-safe microprocessor based temperature controls that adjust heater's power to suit variations in flow rate;

.6 external digital temperature selection;

.7 differential pressure flow activated switch;

.8 on/off power switch;

.9 electrical access door;

.10 compression connection pipe fittings.

.2 Manufacturers

.1 Chronomite Laboratories Inc. (basis of design);

.2 Stiebel Eltron;

.3 EEMAX;

.4 Bosch.

2.2 POINT-OF-USE ELECTRIC DOMESTIC HOT WATER STORAGE TANK AND HEATER

.1 ULC listed and CSA certified electric domestic hot water storage tank and heater with model number and performance as specified on drawings, and complete with:

.1 1035 kPa (150 psi) rated (working pressure) steel tank, glass lined, polyurethane foam insulated, covered with an enamelled steel jacket with access panel, and equipped with a bottom hose end drain cock;

.2 immersion heating element imbedded in magnesium oxide and sealed in a seamless copper tube;

.3 sacrificial anode rod;

.4 surface mounted adjustable thermostat and a high temperature safety cut-out;

.5 ASME rated temperature and pressure relief valve;

.6 round galvanized steel auxiliary catch pan with drain hole and connection spigot.

.2 Acceptable manufacturers are:

.1 A.O. Smith Water Products Co.;

.2 John Wood (GSW Water Heating Co.);

.3 Rheem Canada Ltd.;

.4 Bradford White Canada Inc.

PART 3 - EXECUTION

3.1 DRAINAGE COORDINATION

.1 Coordinate drain requirements of plumbing equipment provided by Mechanical Division and or Owner with location of drains specified in Section 22 13 00.

3.2 INSTALLATION OF INSTANTANEOUS ELECTRIC HOT WATER HEATER

.1 Provide a tankless, electric, instantaneous, point-of-use domestic hot water heater.

.2 Rigidly secure in place in accordance with manufacturer's instructions and ensure unit is easily accessible.

.3 Coordinate installation with electrical trade who will connect heater with power wiring.

.4 Set thermostat to ensure heater produces maximum 49°C (120°F) hot water.

.5 For equipment/system start-up requirements, refer to Section 20 05 00 – Common Work Results for Mechanical.

.6 For equipment/system manufacturer certification requirements, refer to Section 20 05 00 – Common Work Results for Mechanical. Submit a copy of the letter prior to Substantial Performance of the Work.

3.3 INSTALLATION OF POINT-OF-USE ELECTRIC DOMESTIC HOT WATER STORAGE TANK AND HEATER

.1 Provide a point-of-use domestic hot water storage tank and heater.

.2 Provide a wall bracket (supplied by the heater manufacturer) for heater mounting and rigidly secure in place.

.3 Mount heater in a catch pan and:

.1 pipe temperature/pressure relief valve outlet to drain;

.2 pipe auxiliary catch pan to drain;

.3 coordinate installation with electrical trade who will connect heater with power wiring;

.4 check and test heater operation and, unless otherwise specified or instructed, set thermostat to produce 48.8°C (120°F) hot water.

3.4 TRAINING

.1 Include for 2 hours of on-site training for 2 groups of 6 people. Training is to be a full review of all components including but not limited to a full operation and maintenance demonstration, with abnormal events.

END OF SECTION

PART 1 - GENERAL

1.1 SUBMITTALS

.1 Submit shop drawings/product data sheets for all equipment and associated hardware specified in this Section.

1.2 CLOSEOUT SUBMITTALS

.1 Submit with delivery of heater(s) a copy of the factory inspection and test report for each heater, and include a copy of each report with O&M Manual project closeout data.

.2 Submit manufacturer/supplier installation certification letters as specified in Part 3 of this Section.

.3 Submit, prior to Substantial Performance of the Work, start-up or test data specified in Part 3 of this Section.

PART 2 - PRODUCTS

2.1 ELECTRIC DOMESTIC HOT WATER TANK AND HEATER

.1 CSA certified electric domestic hot water tank and heater with model number and performance as specified on drawings, and complete with:

.1 1035 kPa (150 psi) rated (working pressure) steel tank, glass lined, insulated (except for control panel area) with injected minimum R-16 foam insulation, covered with an enamelled steel jacket, and equipped with 40 mm (1-½") dia. NPS brass nipple water inlet and outlet connections, a drain valve, and sacrificial anode rods;

.2 removable multiple immersion heating elements, each consisting of a wire filament in a sealed stainless steel sheath;

.3 ASME rated temperature and pressure relief valve;

.4 factory pre-wired power and control panel.

.2 Equip enamelled steel ventilated control panel with removable glass fibre insulation to cover bare area of tank, a hinged door, multiple knockouts, a ground screw, and following:

.1 terminal block for power wiring connections;

.2 magnetic contactors for heating elements;

.3 adjustable immersion thermostat;

.4 manual reset immersed high temperature limit control for each element;

.5 fuse block with fuses;

.6 element diagnostic panel with LED’s for each element to monitor on-off operation of each element;

.7 contacts, relays and any other hardware, compatible with building automation system protocol and required to connect heater(s) to BAS in accordance with BAS control points list.

.3 Equip heaters with factory fabricated type "L" hard copper inlet and outlet manifolds.

.4 Manufacturers

.1 A.O. Smith Water Products Co.;

.2 John Wood (GWS Water Heating Co.);

.3 Rheem Canada Ltd.;

.4 Bradford White Canada Inc.

2.2 ELECTRIC DOMESTIC HOT WATER BOOSTER HEATER

.1 CSA certified electric domestic hot water booster heater with model number and performance as specified on drawings, and complete with:

.1 1035 kPa (150 psi) rated (working pressure) steel tank with a double coating of high temperature glass, rigidly supported anode rods, blanket type glass fibre insulation, an enamelled steel enclosure with control centre hinged door and element and cleanout access panel, 32 mm (1-¼") dia. NPS brass nipple water inlet and outlet connections, a drain valve, and 150 mm (6") high stainless steel support legs;

.2 immersion type screw-in heating elements embedded in magnesium oxide sealed in a tinned copper tube;

.3 ASME rated relief valve;

.4 stainless steel rewired power and control panel with magnetic contactors, element diagnostic panel with LED's, element fuses, an adjustable thermostat, and immersion type high temperature limit control.

.2 Manufacturers:

.1 A.O. Smith Water Products Co.; John Wood (GSW Water Heating Co.);

.2 Rheem Canada Ltd.; Bradford White Canada Inc.

PART 3 - EXECUTION

3.1 ELECTRIC DOMESTIC HOT WATER TANK AND HEATER

.1 Drainage Coordination

.1 Coordinate drain requirements of plumbing equipment provided by Mechanical Division and or Owner with location of drains specified in Section 22 13 00.

.2 Installation

.1 Provide an electric domestic hot waters tank and heaters.

.2 Secure heaters in place, level and plumb, on a concrete housekeeping pads, and:

.1 pipe temperature/pressure relief valve outlet to drain;

.2 pipe drain valve outlet to drain;

.3 coordinate installation with electrical trade who will connect heater with power wiring.

.3 Ensure housekeeping pad is keyed to structure and tank assembly is secured to structure by slack cable restraints. Refer to Section 20 05 48.16 - Seismic Controls for Mechanical Systems.

.4 Install inlet and outlet manifolds supplied with heaters.

.5 Set thermostat to produce 48.8°C (120°F) hot water.

.3 System Startup

.1 For equipment/system start-up requirements, refer to Section 20 05 00 – Common Work Results for Mechanical.

.2 For equipment/system manufacturer certification requirements, refer to Section 20 05 00 – Common Work Results for Mechanical. Submit a copy of the letter prior to Substantial Performance of the Work.

.4 Training

.1 Include for 2 hours of on-site training for 2 groups of 6 people. Training is to be a full review of all components including but not limited to a full operation and maintenance demonstration, with abnormal events.

3.2 ELECTRIC DOMESTIC HOT WATER BOOSTER HEATER

.1 Drainage Coordination

.1 Coordinate drain requirements of plumbing equipment provided by Mechanical Division and or Owner with location of drains specified in Section 22 13 00.

.2 Installation

.1 Provide an electric domestic hot water booster heater.

.2 Secure heater in place, level and plumb, and:

.1 pipe temperature/pressure relief valve outlet to drain;

.2 pipe drain valve outlet to drain;

.3 coordinate installation with electrical trade who will connect heater with power wiring;

.4 set thermostat to produce 82°C (180°F) hot water.

.3 System Startup

.1 For equipment/system start-up requirements, refer to Section 20 05 00 – Common Work Results for Mechanical.

.2 For equipment/system manufacturer certification requirements, refer to Section 20 05 00 – Common Work Results for Mechanical. Submit a copy of the letter prior to Substantial Performance of the Work.

.4 Training

.1 Include for 2 hours of on-site training for 2 groups of 6 people. Training is to be a full review of all components including but not limited to a full operation and maintenance demonstration, with abnormal events.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Plumbing fixtures and related components.

1.2 SUBMITTALS

.1 Submit product data sheets (fixture cuts) for all plumbing fixtures and fittings, including accessories.

.2 Product Data: Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports and indicate materials and finishes, dimensions, construction details, and flow-control rates for each type of fixture indicated.

.3 Wiring Diagrams: Power, signal, and control wiring.

.4 Submit fixture manufacturer's standard colour charts for all fixtures where colours are available, but a particular colour is not specified.

1.3 CLOSEOUT SUBMITTALS

.1 Operation and maintenance data.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Subject to compliance with requirements, manufacturers that may be incorporated into the Work include, but are not limited to, following:

.1 Flush Valves:

.1 Sloan;

.2 Delta Commercial;

.3 Zurn Industries;

.4 Moen Commercial.

.2 Plumbing Brass:

.1 Sloan;

.2 Acorn Engineering;

.3 American Standard;

.4 Delta Commercial;

.5 Chicago Faucet;

.6 Moen Commercial.

.3 Stainless Steel Sinks:

.1 Franke Commercial;

.2 Novanni Commercial;

.3 Aristaline;

.4 Arch Metal Ind.

.4 Mop Sinks:

.1 Stern Williams;

.2 Acorn Engineering;

.3 Zurn Industries.

.5 Emergency Eye Wash and Emergency Showers:

.1 Haws;

.2 Speakman;

.3 Bradley.

.6 Drain Fittings, Angle Supplies, and Traps:

.1 McGuire;

.2 American Standard;

.3 Delta Commercial;

.4 Zurn Industries.

.7 Fixture Carriers:

.1 Watts Industries;

.2 Jay R. Smith;

.3 Zurn Industries.

.8 Hose Bibbs:

.1 Jay R. Smith;

.2 Zurn Industries.

.9 Water Closets, Lavatories, and Urinal:

.1 American Standard;

.2 Zurn Industries;

.3 Kohler.

.10 Thermostatic Mixing Valves:

.1 Lawler;

.2 Delta Commercial;

.3 Leonard.

.11 Shower and Associated Trim:

.1 American Standard;

.2 Delta Commercial;

.3 Zurn Industries;

.4 Moen Commercial.

.12 Toilet Seats:

.1 Olsonite;

.2 Centoco;

.3 Bemis Commercial.

.13 Electronic “No Touch” Flush Valves:

.1 Sloan;

.2 Delta Commercial;

.3 Zurn Industries;

.4 Moen Commercial.

.14 Electronic “No Touch” Faucets:

.1 Sloan;

.2 Delta Commercial;

.3 Zurn Industries;

.4 Moen Commercial.

2.2 GENERAL RE: PLUMBING FIXTURES AND FITTINGS

.1 Fixtures and fittings, where applicable, are to be in accordance with requirements of CAN/CSA B45 Series, General Requirements for Plumbing Fixtures, including supplements, ASME A112.1.18.1/CSA B125.1, Plumbing Supply Fittings, and CSA B125.3, Plumbing Fittings.

.2 Barrier-free fixtures and fittings are to be in accordance with governing Code requirements.

.3 Unless otherwise specified, vitreous china, porcelain enamelled, and acrylic finished fixtures are to be white.

.4 Unless otherwise specified, fittings and piping exposed to view are to be chrome plated and polished.

.5 Fittings located in areas other than private washrooms are to be vandal-proof.

.6 Fixture carriers are to be suitable in all respects for the fixture they support and construction in which they are located.

.7 Floor flanges for floor mounted water closets are to be cast iron or brass, secured to floor to prevent movement and complete with a wax seal and brass or stainless steel bolts, nuts, and washers. Plastic floor flanges will not be acceptable.

.8 Proper seal to mate with fixture carrier flange and produce a water-tight installation.

.9 Exposed traps for fixtures not equipped with integral traps, such as lavatories, are to be adjustable chrome plated cast brass "P" traps with cleanouts, minimum 17 gauge chrome plated tubular extensions, and chrome plated escutcheons, all to suit fixture type and drain connection.

.10 Concealed traps for fixtures not equipped with integral traps, such as counter sinks, are to be adjustable cast brass with cleanout plugs, all to suit fixture type and drain connection.

.11 Exposed supplies for fixtures which do not have supply trim/fittings with integral stops, i.e. lavatories, are to be solid chrome plated brass angle vales with screwdriver stops for public areas, wheel handle stops for private areas, flexible stainless steel risers, and stainless steel or chrome plated steel escutcheons, all arranged and sized to suit fixture.

.12 Water piping as specified, complete with ball type shut-off valves as specified with water piping, or Dahl Bros. Canada Ltd. ¼ turn Mini Ball Valves.

2.3 PLUMBING FIXTURES AND FITTINGS

.1 Plumbing fixtures and fittings are to be in accordance with the following:

.1 [ ].

2.4 CAULKING

.1 General Electric Series SCS-1200 Silicone Construction Sealant or Dow Corning 780 silicone rubber sealant with primers as recommended by sealant manufacturer. Caulking colour(s) for coloured fixtures other than white, if any, will be selected by the Consultant from sealant manufacturer's standard colour range.

PART 3 - EXECUTION

3.1 DEMOLITION

.1 Refer to demolition requirements specified in Section 20 05 05 – Selective Demolition for Mechanical.

3.2 INSTALLATION OF PLUMBING FIXTURES AND FITTINGS

.1 Provide required plumbing fixtures and fittings.

.2 Where new fixtures and fittings are to be connected to existing piping, include for required piping revisions.

.3 Connect plumbing fixtures and fittings with piping sized in accordance with drawing schedule. Refer to manufacturer's published connection (rough-in) requirements. Where manufacturer requires piping connection larger than shown below, provide piping accordingly:

Fixture and/or Fitting	Drain Size mm (in)	Vent Size mm (in)	DHW Size mm (in)	DCW Size mm (in)	Temp Water Size mm (in)
Water Closets Flush Valve Type	100 (4)	38 (1-½)	-	25 (1)	-
Urinals	75 (3)	38 (1-½)	-	25 (1)	-
Lavatories	32 (1-¼)	32 (1-¼)	12 (½)	12 (½)	-
Lavatories (Electronic Faucet)	32 (1-¼)	32 (1-¼)	12 (½)	12 (½)	12 (½)
Counter Sinks	38 (1-½)	32 (1-¼)	12 (½)	12 (½)	-
Shower Valves and Heads	-	-	12 (½)	12 (½)	12 (½)
Shower Stalls	50 (2)	38 (1-½)	12 (½)	12 (½)	12 (½)

Fixture and/or Fitting	Drain Size mm (in)	Vent Size mm (in)	DHW Size mm (in)	DCW Size mm (in)	Temp Water Size mm (in)
Prefab. Mop Sinks with Drain	75 (3)	38 (1-½)	20 (¾)	20 (¾)	-
Emergency Eye Wash	-	-	-	-	12 (½)
Emergency Shower	-	-	-	-	25 (1)

.4 Confirm exact location of plumbing fixtures and trim prior to roughing-in. Refer to architectural plan and elevation drawings.

.5 When installation is complete, check, and test operation of each fixture and fitting. Adjust or repair as required.

.6 For barrier-free fixtures, comply with mounting height and other requirements of governing Code(s).

.7 For barrier-free water closets utilizing manual flush controls, controls to be installed so that it is operable from the transfer side of the fixture.

.8 Supply templates for counter mounted fixtures and trim and hand to trades who will cut the counter. Ensure openings in counter are properly located.

.9 Locate control panels for electronic faucets under lavatories and recessed into wall. Coordinate panel installations with electrical trade who will provide 115 V power wiring to panels. Install flexible conduit (supplied with box) and extend cord from faucet through the flexible conduit to control box. Connect hot and cold water piping to mixing valve in each box, and tempered water piping from each mixing valve to faucet. Set mixing valve maximum temperature limit stops to 43°C (110°F) after domestic water systems (hot and cold) are complete. Ensure each programmable controller is properly programmed and water off after deactivation is set for 3 seconds.

.10 For electronic flush valves, locate transformer in ceiling space above electronic units to be served. Coordinate locations with electrical trade who will provide 120 V line supply to transformers. Provide low voltage wiring from transformers to each electronic flush valve terminal point. Electrical line supply and low voltage wiring is to be concealed and access to transformer must be provided for servicing.

.11 Protect shower bases from damage during construction and finishing work.

.12 Confirm exact mixing valve and shower head locations prior to roughing-in.

.13 Install refrigerated drinking fountains in accordance with manufacturer’s instructions. Plug into a wall receptacle provided as part of electrical work. Coordinate receptacle installation with electrical trade on site.

.14 For emergency showers, install so bottom of shower head is approximately 2 m (82 in) above floor, and approximately 400 mm (16 in) out from the wall. Wall mount mixing valve approximately 1.5 m (5 ft) above floor and adjacent shower head. Set valve temperature limit stop to 35°C (95°F). Ensure valve is open and exposed piping is chrome plated or stainless steel.

.15 Install eye wash fixtures in accordance with manufacturer’s instructions. Ensure exposed piping is painted.

.16 Wall mount mixing valves for emergency fixtures approximately 1.5 m (5 ft) above floor and secure in place. Check and confirm valve operation and temperature of tempered water supply. Provide cabinets. Identify each cabinet and hand 3 identified cabinet keys to Consultant prior to Substantial Performance of the Work.

.17 Set mop service basins on floor over drain piping and connect to roughed-in service. Install wall supply trim and any accessories specified.

3.3 CAULKING AT PLUMBING FIXTURES AND FITTINGS

.1 Caulk around plumbing fixtures and fittings where they contact walls, floors, and any other building surface.

.2 Clean areas/surfaces to be caulked and prime in accordance with sealant manufacturer's instructions. Where damage to a building surface may occur, mask surface to prevent damage and ensure a clean exact edge to the caulking bead.

.3 Apply caulking using a gun with proper size and shape of nozzle and force sealant into joints to ensure good surface contact and a smooth and even finished bead of sealant.

.4 If joints have been masked sealant may be tooled in a continuous stroke to obtain complete void filling. Remove masking tape immediately after tooling and before sealant begins to skin.

3.4 DISHWASHER CONNECTIONS

.1 Provide roughed-in water and drain connections for Owner supplied dishwasher consisting of:

.1 15 mm (½") dia. domestic hot water connection with a Dahl "Mini-Ball" valve with hose end and water hammer arrestor;

.2 40 mm (1-½") dia. DWV copper drain connection with "P" trap and cleanout plug.

3.5 CLOTHES WASHER CONNECTIONS

.1 Provide roughed-in water and drain connections for Owner supplied clothes washer consisting of:

.1 15 mm (½") dia. piping connection for both hot and cold water, each terminated in a Dahl "Mini-Ball" Valve with hose end and water hammer arrestor;

.2 50 mm (2") dia. standing waste with a height to suit the washer drain and complete with a "P" trap.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 Ontario Building Code (OBC).

1.2 SUBMITTALS

.1 Provide in accordance with Section 20 05 00.

.2 Shop drawings including cut-sheets of equipment, and riser diagram of system showing all interconnections between control panel, sensors, and fans.

1.3 CLOSEOUT SUBMITTALS

.1 Provide in accordance with Section 20 05 00.

.2 Start-up report.

.3 System recertification recommendations.

.4 Attendance record from training session.

1.4 WARRANTY

.1 Unless otherwise specified in Division 00 and Division 01, warrant mechanical work to be in accordance with Contract Documents and free from defects for a period of 1 year from date of issue of a Certificate of Substantial Performance of the Work.

.2 Warranty to include parts, labour, travel costs and living expenses incurred by manufacturer's authorized technician to provide factory authorized on-site service.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Honeywell Analytics Inc.

.2 Armstrong Monitoring Co.

.3 Opera Inc.

.4 Quatrosense Environmental Ltd. (QEL).

2.2 GAS DETECTORS

.1 Basis of design: Honeywell Analytics E3SM-E3SCO & E3SM-E3SNO2

.2 Providing continuous monitoring in ambient air of two factory-set alarm levels and outputs.

.3 The transmitter will be capable of operating on a fully addressable Modbus RS-485 digital network in a daisy-chain configuration. Communication 915 m (3000 ft) max per channel and power 24 VAC 1000 ft max per channel.

.4 Transmitter will have an onboard DPDT relay (rated at 5 A, 30 Vdc or 250 Vac (resistive load)) and can be triggered through the programming on the control panel to activate remotely located fan starters without the need for a separate relay pack.

.5 Sensor cell shall have a continuous self-test to ensure operation and to provide EOL notification.

.6 The transmitter shall have a plug-in capability for a field replaceable gas cartridge. The replaceable gas cartridge shall be factory calibrated and certified to the target gas ready for operation without the requirement for site calibration.

.7 Transmitter will be capable of operating within relative humidity ranges of 5-95% non-condensing and temperature ranges of 4°F to 104°F (-20°C to 40°C).

.8 All sensors in maintenance bays to be outfitted for water ingress protection.

.9 Audible alarm rated at minimum 65 dBA at 1 m (3 ft) that will fully activate at programmable levels.

2.3 CONTROL PANEL

.1 Basis of design: Honeywell Analytics 301C-DLC

.2 The control panel must come c/w a BACnet/IP module, allowing for an output to the Building Automation System.

.3 The control panel must be capable of communicating digitally with the networked gas detection monitors on three separate RS-485 Modbus communication channels.

.4 The controller will house four internal DPDT relays at fully programmable alarm levels (and within programmable time delays). The relay rating will be no lower than 5 A, 30 VDC or 250 VAC (resistive load).

.5 Digital to Analog Output Convertor: Model 4201 24 VAC, 500 mA convertor to communicate digitally with up to 8 sensor/transmitter units and control panel within a daisy-chain network to convert digital signal from transmitters to analog outputs to permit each transmitter to produce up to 8 dedicated 4-20 mA signals to a building automation system or variable frequency drive from one central location which can be a maximum of 600 m (2000 ft) from control panel.

.6 The controller must include a self-test function that allows for the activation/deactivation of all the programmed outputs by simulating a continuous 5% increase/decrease value until the maximum/minimum value is reached.

.7 The controller must include a real-time clock that enables operation of the outputs for a specific timeframe.

.8 The controller must also include an energy saving feature that allows for output operation on alarms set at the max., min., or average value of a specific group of transmitters. This feature must also allow for the activation of outputs upon a certain number of a specific group (¾, ½, ⅓ and ¼) of transmitters reaching their alarm levels.

.9 The controller will indicate the exact concentration of gas, the gas detected, and the location of the sensor by sweeping through the network and displaying the detected levels at each point on a graphic LCD display.

.10 Integrate strobe/horn, 120 V, 85 dB at 3 m (10 ft) minimum with blue lens.

.11 Capacity for long term data logging.

.12 Ratings and Certifications:

.1 Conforms to International Mechanical and Electrical Codes.

.2 EMI/RFI Complies with EMC Directive 89/336/EEC.

.3 CSA Certification.

2.4 CONDUITS

.1 Provide conduits from control panel to sensors/transmitters and starter relays in accordance with Section 26 05 33.13.

2.5 SEQUENCE OF OPERATION

.1 When first alarm level is achieved, relay is energized to activate the exhaust fan and open corresponding damper. Program a relay delay-off of 2 minutes to allow gas time to clear.

Gas	First Alarm / Output (TWA)	Second Alarm / Output (STEL)	Sensor Mounting Height
Carbon Monoxide (CO)	50 ppm	100 ppm	1500 mm AFF
Nitrogen Dioxide (NO_2)	0.7 ppm	3 ppm	In accordance with manufacturer's instructions

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install hazardous gas monitoring equipment including sensors and control panel as shown on the drawings.

.2 Confirm exact locations of equipment prior to installation.

.3 Perform required 24 V wiring in conduit to control panel(s) and from each panel to associated sensor/transmitter units as required and in accordance with wiring requirement specified in the electrical work specification and system manufacturer's certified wiring schematics. Provide 24 V interlock wiring to exhaust fan starters in accordance with drawing control requirements.

.4 Install conduit and wiring from sensors to control panel and to the fan starters. Communication wiring 24 gauge shielded twisted pair Belden 9841 or equivalent; 610 m (2000 ft) max per channel from controller. Power is 24 VAC, 14 gauge; 305 m (1000 ft) max from the controller.

3.2 SITE TEST AND INSPECTIONS

.1 Test to demonstrate operation of functions described above under sequence of operation to be performed by manufacturer's certified technician.

.2 Provide start-up report to the Consultant prior to request for occupancy.

3.3 TRAINING

.1 Demonstrate operation of system to Owner's representatives.

.2 Instruct Owner on timeline for inspection and recertification of sensors.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Materials and installation for piping, valves, and fittings for gas fired equipment.

1.2 REFERENCES

.1 CSA B149.1:20, Natural Gas and Propane Installation Code.

.2 TSSA FS-255-21, Gaseous Fuels Code Adoption Document Amendment: Ontario requirements effective May 1, 2021.

.3 CSA C282:19, Emergency electrical power supply for buildings.

1.3 DEFINITIONS

.1 PRV – Pressure Reducing Valve.

1.4 SUBMITTALS

.1 Submit shop drawings/product data for all products specified in Part 2 of this section except for pipe, fittings, and unions. Indicate performance criteria, conformance to appropriate reference standards, and limitations.

.2 For each gas pressure regulating station, submit:

.1 a selection sheet for each PRV, indicating connected equipment, heating loads, design allowance, meter model, body size, spring range and orifice size;

.2 a selection sheet for each relief valve(s) serving a PRV.

1.5 CLOSEOUT SUBMITTALS

.1 Submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00.

.2 Indicate operating set-points, relief settings and vent arrangements for each regulating station on as-built record drawings.

1.6 QUALITY ASSURANCE

.1 All gas system work is to be in accordance with requirements of CSA B149.1, Natural Gas and Propane Installation Code, as amended by local Gas Codes.

.2 All gas system work is to be performed only by licensed gas pipe fitters (holding Gas Technician 1 Certificate) authorized under the TSSA Act.

.3 Apply for, on TSSA forms, approval of the gas system design by the TSSA prior to work beginning at the site and prior to ordering any equipment. Submit the completed TSSA form and copies of shop drawings/product data sheets as required to the TSSA and obtain an approval certificate. Pay all costs for the TSSA review and approval process. If the TSSA requires revisions to the system and the revisions result in an extra cost, a Notice of Change will be issued by the Consultant for the revision.

PART 2 - PRODUCTS

2.1 PIPE, FITTINGS, AND JOINTS

.1 Uncoated Black Steel - Screwed Joints: Schedule 40 mild black carbon steel, ASTM A53, Grade B, complete with malleable cast iron screwed fittings to ANSI B2.1, and screwed joints.

.2 Uncoated Black Steel - Welded Joints: Schedule 40 mild black carbon steel, ASTM A53, Grade B, mill or site bevelled, complete with factory made forged steel butt welding fittings and welded joints.

.3 Copper-Uncoated: Type "G" seamless copper tubing to ASTM B837, hard temper with wrought copper capillary brazed joint type fittings to ASTM B.61, and brazed joints made with "Sil-Fos" or "Sil-Fos 5" brazing alloy, or, soft temper with flared brass fittings of a single 45º flare type, forged or with a machined long nut and copper to copper threaded connectors, and, where required, flared brass copper to NPS adapters.

.4 Flexible Stainless Steel: Flexible, CSA certified, 860 kPa (125 psi) rated, gas-tight, convoluted stainless steel tubing factory jacketed with a bright yellow PVC coating which is continuously identified. The tubing is to be supplied in coils and is to be complete with factory attached stainless steel end fittings, and adapter unions, protective plates, and steel clamps.

.1 Manufacturers:

.1 Tru-Flex Metal Hose LLC. "Pro-Flex";

.2 Titeflex Corp. "Gastite";

.3 Omega Flex Canada "TracPipe".

2.2 PIPING UNIONS

.1 Screwed Piping: Malleable iron, ground joint, bronze or brass to iron or bronze to bronze seat screwed unions and union elbows with a minimum pressure rating of 1725 kPa (250 psi) steam at 260°C (500°F).

.2 Flanged Piping: Forged carbon steel slip-on type raised faced welding flange unions to ASTM A105, 150 lb. Class for steel pipe, and slip-on type 150 lb. Class bronze flanges for copper pipe.

.3 Copper to Steel: Equal to Kamco Products "Copper Stopper".

2.3 EARTHQUAKE ACTIVATED AUTOMATIC SHUT-OFF VALVES

.1 Equal to KAS International or Nihon Koso Model 315 HPF earthquake activated, flanged, high pressure automatic shut-off valve suitable for both natural gas and propane, ULC listed and in accordance with ANSI Z21.70, Earthquake Actuated Automatic Gas Shutoff Valves.

2.4 SHUT-OFF VALVES

.1 Ball Type:

.1 CSA certified, minimum 3100 kPa (450 psi) WOG rated, 1/4 turn, full port non-lubricated brass ball valves, each complete with a Teflon PTFE seat, chrome plated solid ball, removable lever handle, and screwed ends.

.2 Manufacturers:

.1 Neo Valves Inc. #425;

.2 Kitz Corp. Code 58;

.3 Toyo Valve Co. Fig. 5044A.

.2 Plug or Ball Type: CSA certified, plain face flanged, Class 125, 1380 kPa (200 psi) rated, 1/4 turn, cast iron lubricated plug valves, each wrench operated and complete with cylindrical plug with lubricant grooves, lubricant screw, and lubricant receptacle, or full port carbon steel ball valves with flanged ends.

.1 Manufacturers:

.1 Neo Valves Inc. #1AS40114 plug valve;

.2 Newman Hattersley #171M plug valve;

.3 Kitz Corp. Code No. 150 SCTAM-FS-CGA ball valve.

2.5 POSITION INDICATING SWITCHES FOR SHUT-OFF VALVES

.1 CSA approved limit switch, rated EX db IICT6/EX tb IIIC T85°C explosion proof, class 1, zone 1, IP67 enclosure.

.2 Secure water resistant case with multi-angle top and side visual indicator. Red to indicate fully closed position and yellow to indicate fully open position.

.3 Two single pole double throw mechanical switches.

.4 Includes position indicating contacts for connection of supervisory cabling and remote monitoring of valve status.

.5 NAMUR shaft.

.6 Ensure the shut off valve and the position indicating switch are compatible with one another.

.7 Manufacturers:

.1 CVS Controls Ltd., CVS 870 series limit switch.

.2 Rotork.

.3 Topworx.

2.6 NATURAL GAS CONVENIENCE OUTLET

.1 Neo Valves Model 3/375 quick-connect type CSA certified outlet with interlocking safety cam to prevent release of the appliance connector until the valve is off, integral thermal protection to prevent gas flow if the outlet is exposed to temperatures exceeding 90°C (195°F), and a wall enclosure box.

.2 Manufacturers:

.1 Neo Valves Inc.;

.2 Fairview Fittings & Mfg. Ltd.

2.7 PRESSURE REGULATORS

.1 CSA certified pressure regulators as follows:

.1 non-vented type: lever action, dead end lockup type, each complete with a vent limiter, self-aligning valve, die-cast aluminium housing, and synthetic rubber compound diaphragm.

.2 vented type: spring-loaded self-operated design, tight closing, selected for the facility gas pressure and piping pressure loss, and connected equipment load at full firing rate plus 20% spare, and complete with:

.1 1035 kPa (150 psi) rated cast iron body finished with corrosive resistant epoxy enamel.

.2 Aluminum diaphragm and spring case with Nitrile diaphragm, disc, and body o-ring.

.3 Throttling type, high flow rate, tight shut-off relief valve selected to protect equipment downstream of the regulator in coordination with regulator capacity.

.2 Manufacturers:

.1 Maxitrol Co.

.2 Fisher Controls.

.3 Leslie Controls Inc.

.4 Lakeside Process Controls.

PART 3 - EXECUTION

3.1 NATURAL GAS SERVICE

.1 Make all required arrangement with the natural gas supply utility on behalf of the Owner for installation of natural gas service piping with gas pressure regulator and meter assembly.

.2 Provide an earthquake activated automatic shut-off valve in gas service piping outside the building in accordance with the valve manufacturer's installation instructions. Provide an angle iron framed wire mesh enclosure around the valve and bolted to the wall.

.3 Provide 2 m (7') high minimum 200 mm (8") diameter Schedule 80 galvanized steel concrete filled bollards at the meter-regulator location in a pattern to protect the meter-regulator. Install the pipe straight and plumb a 1.2 m (4') below grade in a continuous 600 mm (2') diameter reinforced concrete footing. Smoothly crown the top of the concrete above the top of the pipe.

.4 Maintain minimum 300 mm (12 in) horizontal separation between buried natural gas piping and other services.

3.2 NATURAL GAS PIPING INSTALLATION REQUIREMENTS

.1 Provide all required natural gas distribution piping and connect gas fired or operated equipment, and provide all required vent piping to atmosphere, including vent piping from pressure regulators. Do all piping work in accordance with requirements of CAN/CSA-B149.1, Natural Gas and Propane Installation Code, as amended by local Gas Codes.

.2 Piping is to be as follows:

.1 for underground piping, coated Schedule 40 black steel, coated soft copper, or polyethylene;

.2 for above ground piping, uncoated Schedule 40 black steel, hard temper or soft copper, or, if permitted, flexible stainless steel.

.3 Install flexible stainless steel pipe in strict accordance with the pipe manufacturer's printed instructions.

.4 Slope gas piping in the direction of flow to low points.

.5 Where natural gas piping is run vertically through internal building risers, provide vent through roof for reach riser.

.6 Where natural piping serving an emergency generator is run internally to the building, provide a fire rated enclosure around that piping, isolated from all other natural gas piping or other building services.

.7 Ensure that supports for roof mounted piping are sized (height) to accommodate the roof slope and the required piping slope, and to permit the installation of low point dirt pockets.

.8 Provide full pipe diameter 150 mm (6") long drip pockets at the bottom of all vertical risers, at all piping low points, and wherever else shown and/or required.

.9 Identify all natural gas piping above ground with two coats of safety yellow enamel applied over primer and coil type vinyl identification makers with arrows. SMS Ltd. or equal can be used for identification markers.

.10 For all underground gas piping, provide continuous 75 mm (3") wide yellow PVC warning tape with "CAUTION - GAS LINE BURIED BELOW" wording at 750 mm (30") intervals located above the pipe approximately 250 mm (10") below grade.

.11 Rough-in all required natural gas piping for kitchen and laundry equipment in accordance with drawing plans and schedules. Obtain accurately dimensioned rough-in drawings for the equipment and confirm exact locations prior to roughing-in. When the equipment has been installed, connect the equipment from the roughed-in Work. Provide shut-off valves in all piping connections to the equipment.

.12 Include for mounting only of a solenoid valve in the gas piping to kitchen cooking equipment.

3.3 INSTALLATION OF SHUT-OFF VALVES

.1 Provide CSA approved ball type or lubricated plug type shut-off valves to isolate equipment, and wherever else shown.

.2 Ensure that valves are located for easy accessibility and maintenance.

.3 CSA C282:19 clause 7.3.7.(b): “any and all valves installed in the emergency gas supply line between the standardized pressure regulator station and the generator set fuel line connection shall have a position-indicating contact that will initiate a trouble alarm condition at the generator control panel”

.4

.5 For all valves installed in an emergency gas supply line including, but not limited to, the regulator station. Provide position indicating contacts to initiate a trouble alarm condition at the generator control panel and/or fire alarm control panel when any valve is closed. Provide in accordance with CSA C282:19 Emergency Electrical Power. Coordinate with electrical trade and generator supplier.

3.4 INSTALLATION OF NATURAL GAS CONVENIENCE OUTLETS

.1 Provide natural gas convenience outlets and wall mount.

.2 Provide a shut-off valve in connecting piping, confirm exact location prior to roughing-in, and ensure that the outlet is rigidly secured in place.

3.5 INSTALLATION OF PRESSURE REGULATORS

.1 Provide pressure regulators in gas distribution piping where indicated and/or required.

.2 For indoor appliances, use lever acting design vent limiter type, sized as shown and mounted in a horizontal upright position in strict accordance with the manufacturer’s instructions. Note that these pressure regulators do not require vent piping.

.3 Use vented type pressure regulators for all other applications.

.4 Install regulating stations in accordance with requirements of CAN/CSA-B149.1.

.5 CSA B149.1, 5.2.1.7. “a pressure regulator shall have a manual shut off valve installed upstream up the pressure regulator; and an overpressure protection device in accordance with Clause 5.3.”

.6

.7 Provide a manual shut-off valve upstream of the pressure regulator and provide overpressure protection devices.

.8 Provide 6 mm (1/4") diameter test ports upstream and downstream of each regulator assembly.

.9 Locate outdoor regulating stations vent termination a minimum of 300 mm (12") away from walkways, and 3 m (10') away from equipment air intakes and building openings. Provide all required vent piping and terminate vents in a turn-down elbow fitting with bronze bug screen secured in place.

.10 Locate indoor regulating stations in locations accessible without the use of ladders or lifts. Combine vents where permitted and increase vent pipe size accordingly. Extend vent piping up through the roof 3 m (10') away from equipment air intakes and building openings and terminated in a turn-down elbow fitting with bronze bug screen secured in place.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

.1 System to collect data on Natural Gas supplied as part of the Electricity Metering Package specified per Section 26 27 13.

1.2 RELATED REQUIREMENTS

.1 Section 26 27 13 – Electricity Metering:

.1 Refer to this Section for all requirements.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION – NOT USED

END OF SECTION

PART 1 - GENERAL

1.1 SUBMITTALS

.1 Submit shop drawings/product data sheets for all products specified in this section except piping and unions.

.2 Submit motor product data sheets and certified performance curves with all pump shop drawings.

1.2 CLOSEOUT SUBMITTALS

.1 Submit with delivery of each unit a copy of factory inspection and test report, and include a copy of each report with O&M Manual project closeout data.

.2 Submit a site inspection and start-up report from manufacturer's representative as specified in Part 3 of this section.

.3 Prior to Substantial Performance of the Work, submit a spare seal flush line filter for each pump equipped with a seal flush line.

.4 Shop drawings for piping anchors must be prepared and stamped by a professional Structural Engineer registered in the jurisdiction of the work. Refer to requirements for Contractor retained engineers specified in Section 20 05 10 – Mechanical Work General Instructions.

.5 Submit a letter from pipe anchor design engineer to stating engineer has visited site to examine installation of pipe anchors and pipe anchor installation is in accordance with reviewed anchor shop drawing.

1.3 QUALITY ASSURANCE

.1 Pump motors are to comply with requirements of Section 20 05 00 – Common Work Results for Mechanical.

PART 2 - PRODUCTS

2.1 PIPE, FITTINGS, AND JOINTS

.1 Black Steel - Screwed Joint

.1 Mild black carbon steel, Grade B, ASTM A53, complete with Class 125 cast iron threaded fittings to ANSI/ASME B16.4, and screwed joints.

.2 Black Steel - Welded Joint

.1 Mild black carbon steel, Grade B, ASTM A53, mill or site bevelled, complete with factory made seamless carbon steel butt welding fittings to ASTM A234, Grade WPB, with long sweep pattern elbows unless otherwise specified, and welded joints.

.3 Black Steel - Grooved End Mechanical Joint

.1 Mild black carbon steel, Grade B, ASTM A53, factory or site roll grooved, complete with cast ductile iron grooved end fittings, including full flow elbows, and conforming to ASTM A536.

.2 Manufacturers:

.1 Equal to Victaulic Style 107 "QuickVic" rigid couplings for sizes 2" to 12", Style 07 "Zero-Flex" rigid couplings, Style W07 AGS rigid couplings for sizes 350 mm (14") to 1525 mm (60");

.2 Flexible grooved couplings can be used where system flexibility is desired. Noise and vibration reduction at mechanical equipment connections is achieved by installing three flexible couplings near the vibrations source in lieu of braided flex connectors. Victaulic Style 177 QuickVic or Style 77 flexible couplings for sizes 50 mm (2”) to 300 mm (12”). Style W77 AGS flexible couplings for sizes 350 mm (14”) to 1525 mm (60”).

.3 Grooved end fittings shall be cast of ductile iron conforming to ASTM A-536, Grade 65-45-12, forged steel conforming to ASTM A-234, Grade WPB 0.375" wall (9.53 mm wall), or fabricated from Std. Wt. Carbon Steel pipe conforming to ASTM A-53, Type F, E or S, Grade B. Fittings provided with an alkyd enamel finish or hot dip galvanized to ASTM A-153. Branch reductions on 2" (DN50) through 8" (DN200) header piping. Bolted branch outlets shall be manufactured from ductile iron conforming to ASTM A-536, Grade 65-45-12, with synthetic rubber gasket, and heat treated carbon steel zinc plated bolts and nuts conforming to physical properties of ASTM A-183. Victaulic Style 920 / 920N.

.4 Black Steel – Plain End Mechanical Joint

.1 Mild black carbon steel, Grade B, ASTM A53, mill or site bevelled, complete with cast ductile iron end fittings conforming to ASTM A536.

.2 Manufacturers:

.1 Equal to Victaulic QuickVic SD rigid couplings for sizes 1/2" to 2", rated for a working pressure of 300 psi.

.5 Black Steel – Pressure Coupled Joints

.1 Mild black carbon steel conforming to ASTM F3226, IAPMO PS117, ICC LC1002, ASME B31.1, B31.3, or B31.9. MegaPress fittings ½-inch thru 4-inch for use with schedule 40 ASTM A53 carbon steel pipe.

.2 Pressure connect fittings shall carry CRN numbers.

.3 Pressure connect fitting shall have Viega Smart Connect technology to detect unpressed fittings shall be integrated into the body of the fitting.

.4 1/2 inch thru 2 inch fittings shall have stainless-steel grip ring with bidirectional teeth, 304 stainless separator ring, EPDM or FKM sealing element at each press connection. 2-1/2 inch thru 4 inch shall have stainless-steel grip ring with bidirectional teeth, PBT separator ring, and FKM sealing element at each press connection.

.5 There shall be no mixing of manufacturers.

.6 The manufacturer’s installation instructions shall be strictly adhered to.

.7 Special attention shall be given to the required two step pressure test.

.8 Initial test for unpressed fitting detection per manufacturer’s installation manual.

.9 Full pressure test in accordance with code requirements.

.10 Installers shall be field trained by Viega factory representative.

.6 Soft Copper Pipe

.1 Type "L" seamless soft copper to ASTM B77.

.7 Hard Copper - Solder Joint

.1 Type "L" hard drawn seamless copper to ASTM B88, complete with wrought copper fittings to ANSI B16.22, and 95% tin / 5% Antimony solder joints.

.8 Hard Copper - Pressure Coupled Joint

.1 Type "L" hard drawn seamless copper to ASTM B88, complete with Viega "ProPress with Smart Connect feature" system copper fittings with EDPM seals, and pressure type crimped joints made by use of manufacturer recommended tool.

2.2 PIPING UNIONS

.1 Screwed Piping

.1 Malleable iron, ground joint, bronze or brass to iron or bronze to bronze seat screwed unions and union elbows with a minimum pressure rating of 1725 kPa (250 psi) steam at 260°C (500°F).

.2 Flanged Piping

.1 Forged carbon steel slip-on type raised faced welding flange unions to ASTM A105, 150 lb. Class for steel pipe, and slip-on type 150 lb. Class bronze flanges for copper pipe.

2.3 SHUT-OFF VALVES

.1 Ball Type

.1 Class 600, 4140 kPa (600 psi) WOG rated full port ball valves, each complete with a forged brass or bronze body and cap, blowout-proof stem, solid forged brass chrome plated ball, "Teflon" or "PTFE" seat, threaded ends, and removable lever handle.

.2 Manufacturers:

.1 Toyo Valve Co. Fig. 5044A;

.2 Watts Industries (Canada) Inc. #FBV-3;

.3 Kitz Corp. Code 58;

.4 Victaulic Co. of Canada Ltd. Series 722;

.5 Apollo Valve #77-100.

.2 Butterfly Type

.1 Cast ductile iron, lug body style, 1200 kPa (175 psi) rated butterfly valve, each complete with a neck to permit 50 mm (2") of insulation above the flange, a field replaceable EPDM seat, ductile iron disc, stainless steel shaft with EPDM seal, a lever handle for valves to and including 150 mm (6") diameter, a handwheel and gear type operator for valves larger than 150 mm (6") diameter, and each suitable for bubble-tight dead end service with valve closed and either side of connecting piping removed.

.2 Manufacturers:

.1 DeZurik of Canada Ltd., Figure No. 632;

.2 Victaulic Co. of Canada Ltd. Vic-300 MasterSeal or AGS Vic-300;

.3 Apollo Valve 143 Series;

.4 Watts Industries (Canada) Inc. #BF-03;

.5 Kitz Corp. 6112 Series;

.6 Toyo Valve Co. 918DESL/G2.

2.4 SWING CHECK VALVES

.1 Bronze - Screwed

.1 Class 125, 1380 kPa (200 psi) WOG rated horizontal swing check valves, each complete with a "Y" pattern bronze body, hinged brass disc, easy access screw-in cap, and screwed ends.

.2 Manufacturers:

.1 Toyo Valve Co. Fig. 236;

.2 Nibco #T-433;

.3 Kitz Corp. Code No. 22.

.2 Steel - Grooved Ends

.1 Victaulic Co. of Canada Ltd. Series 716, 779 or W715 grooved end carbon steel check valves suitable for mounting horizontally or vertically.

.3 Cast Iron - Screwed and Flanged

.1 Cast iron, bronze trim, 1380 kPa (200 psi) rated swing check valves, each complete with a bronze disc and seat, malleable iron hinge, bolted cover, and screwed or flanged ends as required.

.2 Manufacturers:

.1 Toyo Valve Co. Fig. 435A;

.2 Watts Industries (Canada) Inc. #F-511;

.3 Kitz Corp. Code No. 78.

2.5 VERTICAL LIFT CHECK VALVES

.1 Class 150, 1380 kPa (200 psi) WOG rated bronze vertical lift check valves, each complete with screwed ends and a bronze disc.

.2 Manufacturers:

.1 Toyo Valve Co. Fig. 231;

.2 Watts Industries (Canada) Inc. #600;

.3 Kitz Corp. Code No. 36.

2.6 WAFER CHECK VALVES

.1 Threaded lug body type, full bore, ANSI Series 150, 1965 kPa (285 psi) rated at 38°C (100°F), non-slam wafer check valves, each complete with a carbon steel body, stainless steel discs, a shaft, springs, disc stop and thrust bearings constructed of type 316 stainless steel, and seat materials to suit the application. The inside diameter of the valve must equal the inside diameter of the connecting pipe.

.2 Manufacturers:

.1 Gulf Valve Co. "WAFER CHECK";

.2 Watts Industries (Canada) Inc. Series ICV-125;

.3 The Metraflex Co. Style CVXX.

2.7 DRAIN VALVES

.1 Minimum 2070 kPa (300 psi) WOG rated, 20 mm (¾") diameter straight pattern bronze ball valves, each complete with a threaded outlet suitable for coupling connection of 20 mm (¾") diameter hose, and a cap and chain.

.2 Manufacturers:

.1 Toyo Valve Co. Ltd. Fig. 5046;

.2 Watts Industries (Canada) Inc. #B-6000-CC;

.3 Kitz Corp. Code No. 68AC;

.4 Apollo Valves #78-104-01.

2.8 CIRCUIT BALANCING VALVES

.1 Screwed or flanged as required, globe style, non-ferrous circuit balancing valves designed to facilitate precise flow measurement, precision flow balancing, and positive shut-off, complete with capped and valved drain connection, and valved ports for connection to a differential pressure meter.

.2 Manufacturers:

.1 Equal to Victaulic Co. of Canada Ltd. (Tour & Anderson) Series 787 screwed, Series 788 flanged, and 789 grooved end, and Series 78K "Koil Kit" valves.

2.9 RADIATOR SHUT-OFF AND BALANCING VALVES

.1 Heavy pattern, straight, 1750 kPa (250 psi) rated at 120°C (250°F) bronze radiator valves, each complete with composition disc, spring loaded packing, and union. Equip inlet valves with a handle for shut-off. Equip outlet valves with a lockshield for shut-off and balancing.

.2 Manufacturers:

.1 Dahl Brothers Canada Ltd. #11042 and #13013;

.2 Spirax Sarco Ltd. Type R.

2.10 PRESSURE RELIEF VALVES

.1 ASME tested, rated, and certified, bronze or cast iron bronze fitted, 1725 kPa (250 psi) rated pressure relief valves, each capable of relieving full output of equipment it is associated with, and each factory set at 415 kPa (60 psi) unless otherwise specified.

.2 Manufacturers:

.1 ITT Bell & Gossett 3301/4100, or 790/1170;

.2 Dresser Industries "CONSOLIDATED";

.3 Spirax Sarco Ltd. SVI Series;

.4 McDonnell & Miller Models 250 and 260;

.5 Conbraco 10-600 Series;

.6 Watts Industries (Canada) Inc. 174A or 740.

2.11 AIR VENTS

.1 Manual Air Vents

.1 Equal to Conbraco 27 Series, 3.2 mm (⅛") diameter with a key handle.

.2 Automatic Air Vents

.1 Float actuated air vents, each complete with a semi-steel body and cap, a stainless steel float assembly and seat, and a neoprene head.

.2 Manufacturers:

.1 Spirax Sarco Ltd., Type 13 W for system working pressures to 1035 kPa (150 psi), 13 WH for system working pressures greater than 1035 kPa (150 psi);

.2 Armstrong International Inc. No. 1-AV.

2.12 STRAINERS

.1 Cast iron wye shaped strainers, minimum 890 kPa (125 psi) rated and complete with a removable type 304 stainless steel screen with perforations sized to suit the application, and, for strainers 50 mm (2") diameter and larger, a blowdown pipe connection tapping.

.2 Manufacturers:

.1 Spirax Sarco Ltd. Type IF-125 screwed or Type AF-250 flanged;

.2 Toyo Valve Co. Ltd. Fig. 380A screwed or Fig. 381 flanged;

.3 Victaulic Co. of Canada Style 732 or W732 "Vic-Strainer";

.4 Armstrong International Inc. A1 Series;

.5 Watts Industries (Canada) Inc. #77SCI;

.6 Mueller Steam Specialty Products Model 11M screwed or Model 758 flanged.

2.13 PIPING EXPANSION JOINTS

.1 Steel Piping Mains:

.1 Controlled flexing, flanged expansion joints, 2070 kPa (300 psi) rated, with corrugated stainless steel bellows with closely matched neck rings and reinforcing or control rings, and selected for operating pressure plus 25% safety factor.

.2 Manufacturers:

.1 Senior Flexonics Ltd. Series CSF "High-Corr";

.2 Victaulic Co. of Canada Ltd. Style 155 with Style 07 or 107 "Zero-Flex" couplings on each side of assembly and a full length steel "V" shaped support trough with hangers;

.3 The Metraflex Co. Model MC.

.2 Steel or Copper Branch/Runout Piping:

.1 Externally pressurized, 1380 kPa (200 psi) rated expansion joints with a stainless steel bellows and shroud, welding or threaded steel nipple ends for steel piping, and copper sweat nipple ends for copper piping.

.2 Manufacturers:

.1 Senior Flexonics Ltd. Series "H";

.2 The Metraflex Co. Model "HP".

2.14 PIPING ALIGNMENT GUIDES

.1 Prime coat painted black carbon steel pipe alignment guides sized and fabricated to suit pipe size and pipe insulation thickness.

.2 Manufacturers:

.1 Senior Flexonics Ltd. Series PGT;

.2 E. Myatt & Co. Ltd. Fig. 1267;

.3 Empire Tool & Mfg. Inc. Fig 256;

.4 The Metraflex Co. Style IV.

2.15 PIPE ANCHORS

.1 Welded structural black steel anchors of a design, size, and type to securely anchor pipe at point shown. Each anchor is to withstand 150% of axial thrust, and, as specified in Part 1 of this section, is to be designed and detailed by a Professional Structural Engineer.

2.16 FLEXIBLE PUMP CONNECTIONS

.1 Flexible metal hose assemblies, each complete with annular corrugated unbraided type 321 stainless steel inner core, braided type 321 stainless steel hose, and a collar and flange at each end, all suitable for twice the working pressure of the system.

.2 Manufacturers:

.1 Senior Flexonics Inc. A1 and A6 Series;

.2 The Metraflex Co. Model SST and "METRA-MINI".

.3 Option: Victaulic Series 380, 381 or 382 pump drop assemblies. Includes flow control, vibration-controlling flexible couplings, access ports for gauges and thermowells and an integral flanged pump connection. Rated to the working pressure of Class 150 flange connection. Sizes 2” to 12”.

2.17 AIR SEPARATORS

.1 Vortex type vertical air separator with side tangential inlet and outlet connections, a top air outlet connection, and bottom drain connection. Separator is to be constructed of cast iron or fabricated steel for a pressure of 1105 kPa (160 psi) at 180°C (350°F) in accordance with Section VIII, Division 1 of the ASME Boiler and Pressure Vessel Code.

.2 Manufacturers:

.1 S.A. Armstrong Ltd. Model "VA".

.2 ITT Bell & Gossett "Rolairtrol".

.3 Taco Canada Ltd. "Vortech".

.4 Flo-Fab Inc. “SEP-T” Series.

2.18 EXPANSION TANKS

.1 Replaceable bladder type, factory pressurized expansion tank with permanent separation of air and water, in accordance with drawing schedule and complete with:

.1 steel pressure tank suitable for a working pressure of 870 kPa (125 psi) at 115°C (240°F), constructed and stamped in accordance with the ASME Code for Unfired Pressure Vessels and

complete with a system connection, drain connection, air charging valve, and a red oxide primer finish;

.2 heavy-duty butyl rubber (EDPM) bladder;

.3 tapping for installation of a pressure gauge;

.4 For horizontal tanks only, mounting saddles supplied loose;

.5 factory secured seismic restraint connection hardware.

.2 Manufacturers:

.1 Hamlet & Garneau Inc. AL Series "Expanflex";

.2 S.A. Armstrong Ltd. Series "AX-V" Series "L";

.3 ITT Bell & Gossett Series "B" (ASME);

.4 Amtrol "Extrol" Series.

.5 Taco (Canada) Ltd. "CBX" Series.

.6 Flo-Fab Inc. “WX-C” Series, “ABT” Series

2.19 GLYCOL SOLUTION MIXING AND STORAGE TANKS

.1 Package type glycol solution mixing, storage and automatic feed assembly designed to maintain minimum system pressure levels and complete with:

.1 round, polyethylene or polypropylene tank sized to suit system capacity, complete with a solution level scale in litres and Imperial gallons, removable cover, and a welded steel angle stand assembly with legs, pump shelf, and control panel bracket, all factory finished with enamel;

.2 factory pre-piped minimum 1/3 hp, 115 V, 1-phase rotary bronze gear pump with capacity and pressure differential to suit system requirements, factory wired to control panel, mounted on a shelf integral with steel stand assembly, and complete with shut-off valve and strainer;

.3 tank pressure relief valve with discharge piped back into tank;

.4 tank low level switch;

.5 pressure gauge;

.6 Honeywell #L404A "Pressurtrol" or equal pipe mounting differential pressure switch with a 100 kPa to 1000 kPa (15 psi to 150 psi) range;

.7 115 V, 1-phase, factory mounted and pre-wired control panel with an NEMA 2 enamelled steel enclosure, designed to control and operate glycol gear pump either manually or automatically to pump glycol solution into system, and to stop pump and initiate an audible/visual alarm if a low glycol solution level occurs in tank, and complete with:

.1 terminal blocks for power and control wiring connections;

.2 H-O-A switch with green "Power On" indicator light;

.3 120 volt/12 volt control transformer;

.4 low glycol solution level alarm buzzer with silencing switch, an alarm light which remains illuminated until low-level switch is reset, and an alarm push-to-test button;

.5 dry contacts for building automation system alarm annunciation.

.8 factory secured seismic restraint connection hardware.

.2 Manufacturers:

.1 ITT Bell & Gossett Series GMU;

.2 S. A. Armstrong Ltd. GLA Standard Series;

.3 HG Spec. Inc.

2.20 GLYCOL

.1 Propylene glycol blended with Nitrite based corrosion inhibitors.

2.21 GENERAL RE: CIRCULATING PUMPS

.1 Pumps are to be bronze fitted centrifugal pumps in accordance with drawing schedule, each non-overloading under all operating conditions and factory tested at specified operating conditions.

2.22 BASE MOUNTED PUMPS

.1 End suction, horizontal, top discharge, factory mounted and aligned on a steel baseplate, connected to a motor by means of a flexible coupling with guard, and complete with:

.1 heavy-duty, radially split, gasketed cast iron volute designed for servicing and removal of rotating assembly without disturbing pipe connections, and complete with plugged tappings for gauge and drain;

.2 balanced bronze impeller secured to a carbon steel shaft equipped with a stainless steel shaft sleeve;

.3 ball type, heavy-duty, lifetime lubricated sealed bearings with back pull-out design bearing frame;

.4 TEFC motor;

.5 watertight John Crane Inc. JC2, OPID1 carbon rotating face type mechanical seal with tungsten carbide stationary seat, Viton secondary seal and alloy 20 springs, and bronze gland plate with stainless steel gland bolts to secure the stationary seat.

.2 Manufacturers:

.1 S.A. Armstrong Ltd.;

.2 ITT Bell & Gossett;

.3 Grundfos CBS Inc. PACO;

.4 Wilo

.5 Taco Canada Ltd.

.6 Patterson Pump Company.

2.23 SPLIT COUPLED VERTICAL IN-LINE PUMP

.1 Split coupled, single stage, vertical in-line pump complete with:

.1 radially split, gasketed cast iron volute with equally sized suction and discharge flanged connections, tappings for gauge, drain and flush line connections, and a cast iron motor mount bracket;

.2 dynamically balanced cast bronze impeller secured to a type 416 stainless steel shaft which is connected to motor by means of a high tensile strength aluminium bar split type spacer coupling with guard designed to permit servicing of mechanical seal without disturbing pump, motor, or electrical wiring;

.3 TEFC vertical mount motor;

.4 watertight John Crane Inc. #JC8B2, XP1D1 or Durametallic #RA EU5-FV carbon rotating face type outside mechanical seal with tungsten carbide stationary seat, Viton secondary seal and alloy 20 springs, and bronze gland plate with stainless steel gland bolts to secure stationary seat;

.5 factory installed seal flush line tubing with 50 micron Cuno cartridge type filter with 2 extra cartridges, a sight flow indicator, air vent, and valved tubing;

.6 For pump(s) [_____], in lieu of a flush line filter, factory installed valved seal flush line tubing with cyclone type separator and sight flow indicator.

.2 Manufacturers:

.1 S.A. Armstrong Ltd.;

.2 ITT Bell & Gossett;

.3 Grundfos CBS Inc. PACO;

.4 Wilo

.5 Taco Canada Ltd.

.6 Patterson Pump Company.

2.24 CLOSE COUPLED VERTICAL IN-LINE PUMP

.1 Close coupled, single stage vertical in-line pump complete with:

.1 radially split, gasketed cast iron volute with equally sized suction and discharge flanged connections, and tappings for gauge, drain and flush line connections;

.2 dynamically balanced bronze impeller with bronze shaft sleeve, secured to motor shaft;

.3 face mounted TEFC vertical motor;

.4 watertight John Crane Inc. #JC 8B2, XP1D1 or Durmetallic #RA EU5-FV carbon rotating face type inside mechanical seal with tungsten carbide stationary seat, Viton secondary seal and alloy 20 springs, and bronze gland plate with stainless steel gland bolts to secure stationary seat.

.2 Manufacturers:

.1 S.A. Armstrong Ltd.;

.2 ITT Bell & Gossett;

.3 Wilo

.4 Taco Canada Ltd.

.5 Grunfos CBS Inc. PACO;

.6 Patterson Pump Company.

2.25 SPLIT COUPLED, DUAL VERTICAL IN-LINE PUMP

.1 Split coupled, single stage, vertical in-line pump assemblies incorporating 2 radially split pumps, complete with:

.1 cast iron volute with equally sized suction and discharge flanged connections, tappings for gauge, drain and flush line connections, and cast iron motor mount brackets;

.2 For each pump, dynamically balanced cast bronze impeller secured to a type 416 stainless steel shaft which is connected to motor by means of a high tensile strength aluminium bar split type spacer coupling with guard designed to permit servicing of mechanical seal without disturbing pump, motor, or electrical wiring;

.3 For each pump, a TEFC vertical mount motor;

.4 For each pump, a watertight John Crane Inc. #JC8B2, XP1D1 or Durametallic #RA EU5-FV carbon rotating face type outside mechanical seal with tungsten carbide stationary seat, Viton secondary seal and alloy 20 springs, and bronze gland plate with stainless steel gland bolts to secure the stationary seat;

.5 factory installed seal flush line tubing with 50 micron Cuno cartridge type filter with 2 extra cartridges, a sight flow indicator, air vent, and valved tubing;

.6 For pump(s) ___ , in lieu of a flush line filter, factory installed valved seal flush line tubing with cyclone type separator and sight flow indicator.

.2 Manufacturers:

.1 S. A. Armstrong Ltd.;

.2 ITT Bell & Gossett;

.3 Wilo

.4 Taco Canada Ltd.

.5 Grunfos CBS Inc. PACO.

2.26 SPLIT COUPLED, DUAL, VFD DRIVE VERTICAL IN-LINE PUMP

.1 Split coupled, single stage, vertical in-line pump assemblies incorporating 2 radially split pumps, complete with:

.1 cast iron volute with equally sized suction and discharge flanged connections, tappings for gauge, drain and flush line connections, and cast iron motor mount brackets;

.2 For each pump, a dynamically balanced cast bronze impeller secured to a type 416 stainless steel shaft which is connected to motor by means of a high tensile strength aluminium bar split type spacer coupling with guard designed to permit servicing of mechanical seal without disturbing pump, motor, or electrical wiring;

.3 For each pump, a TEFC vertical mount motor;

.4 For each pump, a watertight John Crane Inc. #JC8B2, XP1D1 or Durametallic #RA EU5-FV carbon rotating face type outside mechanical seal with tungsten carbide stationary seat, Viton secondary seal and alloy 20 springs, and bronze gland plate with stainless steel gland bolts to secure stationary seat;

.5 factory installed seal flush line tubing with 50 micron Cuno cartridge type filter with 2 extra cartridges, a sight flow indicator, air vent, and valved tubing;

.6 For each pump, a factory mounted VFD pre-wired to pump motor, capable of operating in any of following control modes:

.1 duty/standby pumps with sensorless control;

.2 duty/standby pumps with remote sensor or building automation system control;

.3 parallel pumps with single or multiple sensor(s) system control with IPS controller.

.7 For pump(s) [___], in lieu of a flush line filter, factory installed valved seal flush line tubing with cyclone type separator and sight flow indicator.

.2 Manufacturers:

.1 S. A. Armstrong Ltd.;

.2 ITT Bell & Gossett;

.3 Wilo

.4 Taco Canada Ltd.

.5 Grundfos CBS Inc. PACO.

2.27 CLOSE COUPLED, DUAL VERTICAL IN-LINE PUMP

.1 Close coupled, single stage, vertical in-line pump assemblies incorporating 2 radially split pumps, complete with:

.1 cast iron volute with equally sized suction and discharge flanged connections, tappings for gauge, drain and flush line connections, and cast iron motor mount brackets;

.2 For each pump, a dynamically balanced cast bronze impeller secured to a type 416 stainless steel shaft which is connected to motor by means of a high tensile strength aluminium bar split type spacer coupling with guard designed to permit servicing of mechanical seal without disturbing pump, motor, or electrical wiring;

.3 For each pump, a TEFC vertical mount motor;

.4 For each pump, a watertight John Crane Inc. #JC8B2, XP1D1 or Durametallic #RA EU5-FV carbon rotating face type outside mechanical seal with tungsten carbide stationary seat, Viton secondary seal and alloy 20 springs, and bronze gland plate with stainless steel gland bolts to secure stationary seat;

.5 factory installed seal flush line tubing with 50 micron Cuno cartridge type filter with 2 extra cartridges, a sight flow indicator, air vent, and valved tubing;

.6 For pump(s) [___], in lieu of a flush line filter, factory installed valved seal flush line tubing with cyclone type separator and sight flow indicator.

2.28 VERTICAL IN-LINE PUMP VARIABLE FREQUENCY DRIVES

.1 Variable frequency drives for vertical in-line pumps as scheduled are to be in accordance with Section 20 05 13.13 – Variable Frequency Drives for Mechanical Equipment.

2.29 CIRCULATING PUMP SUCTION AND DISCHARGE CONNECTION ACCESSORIES

.1 Circulating pump manufacturer supplied suction guides with a cast iron body, stainless steel strainer screen, removable fine mesh start-up strainer screen and steel guide vanes, and cast iron body, angle, or straight type control valve assemblies, each acting as a check valve, balancing valve, and shut-off valve. Unless otherwise shown or specified, suction and discharge connection accessories are to be piping line size.

.2 Manufacturers:

.1 S.A. Armstrong Ltd. Type "SG" suction guides and "Flo-Trex" triple duty valve assemblies;

.2 ITT Bell & Gossett Bulletin B-820D suction guides and Bulletin B-821F triple duty valve assemblies.

2.30 HORIZONTAL IN-LINE PUMP

.1 Horizontal, in-line pump complete with:

.1 cast iron casing with flanged in-line pipe connections;

.2 alloy steel shaft with integral thrust collar, copper shaft sleeve, and oil lubricated bronze bearings;

.3 balanced, corrosion resistant steel, cast bronze, or stamped brass impeller;

.4 motor connected to pump by means of a 4-spring coupling with guard;

.5 mechanical seal.

.2 Manufacturers:

.1 S.A. Armstrong Ltd.;

.2 ITT Bell & Gossett;

.3 Grundfos Canada Inc.

.4 Wilo

.5 Taco Canada Ltd.

2.31 WET ROTOR 3-SPEED HORIZONTAL IN-LINE PUMP

.1 Grundfos Canada Inc. "VersFlo" Series UPS wet rotor design, 3-speed horizontal in-line pump with a head-capacity curve that has a steady rise in head from maximum to minimum flow within preferred operating range, factory tested as an assembly and with a maximum noise level when operating of 41 dBA, capable of continuous operation at 120°C (248°F), and equipped with:

.1 cast iron housing with flanged inlet and outlet with gauge taps, laser welded stainless steel impeller, bearing plate and shaft, stainless steel neck ring, dynamically balanced rotor with stainless steel cladding, and tungsten carbide sleeve type motor bearings;

.2 3-speed asynchronous, squirrel cage, self-venting motor cooled by pumped fluid and complete with stator housing drain holes to permit condensed water to drain;

.3 bolt-on terminal box with 3-speed switch assembly with each speed having a distinct pump performance curve, and fibre optic indicator lights for visual inspection of on/off, rotation, and troubleshooting;

.4 terminal box add-on protective module to permit direct electrical connection to feeder switch;

.5 terminal box add-on relay module to permit direct connection to electrical feeder switch, signals output for external operating or fault indications, and to permit operation of 2 pumps in parallel with 24 hour alternation;

.2 Manufacturers:

.1 Grundfos Canada Inc.;

.2 S. A. Armstrong Ltd.

2.32 WET ROTOR VARIABLE SPEED HORIZONTAL IN-LINE PUMP

.1 Grundfos Canada Inc. "Magna" Series wet rotor design, horizontal, variable frequency drive in-line pump with a head-capacity curve that has a steady rise in head from maximum to minimum flow within preferred operating range, factory tested as an assembly and with a maximum noise level when operating of 41 dBA, capable of continuous operation at 120°C (248°F), and equipped with:

.1 cast iron housing with flanged inlet and outlet with gauge taps, laser welded stainless steel impeller, bearing plate and shaft, stainless steel neck ring, dynamically balanced rotor with stainless steel cladding, and tungsten carbide sleeve type motor bearings;

.2 squirrel cage, self-venting motor suitable for a VFD, cooled by pumped fluid and complete with stator housing drain holes to permit condensed water to drain;

.3 bolt-on, integrated, CSA or ETL certified variable frequency drive assembly with "AUTOADAPT" function which automatically adjusts proportional pressure and sets an efficient performance curve whenever possible, an operating panel with control modules and clear indications for pump flow rate and head, and a bus communication module for site connection into building automation system.

.2 Manufacturers:

.1 Grundfos Canada Inc. “Magna” Series;

.2 Taco Canada Ltd. “Delta T”.

PART 3 - EXECUTION

3.1 DEMOLITION

.1 Perform required hydronic piping system demolition/revision work. Refer to demolition requirements specified in Section 20 05 05 – Selective Demolition for Mechanical.

3.2 PIPING INSTALLATION REQUIREMENTS

.1 Provide required hydronic piping. Pipe, unless otherwise specified, is to be:

.1 For pipe sizes up to and including 50 mm (2") diameter, Schedule 40 black steel, screwed, or type "L" hard copper with solder joints or pressure coupled joints;

.2 For pipe 65 mm (2-½") to 300 mm (12") dia. and larger, Standard weight grooved end black steel pipe, 10 mm (0.375") thickness, with grooved end fittings and couplings, or, Standard weight black steel pipe, 10 mm (0.375") thickness, with welding fittings and welded joints;

.3 For short branch connections, 25 mm (1”) pipe diameter size and less, to heating equipment where structural obstructions occur and site bending of pipe is advantageous, a single length of type "L" soft copper.

.2 Slope horizontal piping mains to provide a minimum continuous up-grade of 25 mm (1") in 6 m (20') to high points. Slope branch supply and return piping connections to equipment a minimum of 25 mm (1") in 1.2 m (4'). Leave sufficient room at high points for installation and maintenance of air vents.

.3 Install automatic control valves, piping wells and similar piping and/or equipment mounted control components required for automatic temperature control systems supplied as part of the control work. Refer to drawing control diagrams and details.

.4 Connect equipment provided as part of the work of other sections with piping as indicated and/or required. Refer to pipe connection details on drawings.

.5 Provide screwed unions, removable mechanical joint couplings, or weld-on or solder-on flanges in piping at all connections to valves, strainers and similar piping system components which may need maintenance or repair, at equipment connections, in runs of piping exceeding 9 m (30') at 4.5 m (15') regular intervals to permit removal of sections of piping, and wherever else indicated on drawings.

.6 Provide shut-off valves in piping connections to equipment, to isolate piping risers, to isolate other sections of systems as shown, and wherever else indicated on drawings. Valves in piping to and including 50 mm (2") dia. are to be ball type. All other shut-off valves are to be ball or butterfly type unless otherwise specified. Locate valves so they are easily accessible. Wherever possible, install

valves at uniform height. Provide chain operators for valves which are inaccessible for operation from floor level.

.7 Provide a check valve in discharge piping of every pump, and elsewhere in piping where shown on drawings. Where check valves are required in vertical piping, ensure they are suitable in all respects for the application. Check valves for vertical in-line and/or base mounted circulating pumps are integral with the discharge accessory.

.8 Provide a drain valve at base of each piping riser, in drain connections to equipment, in low points of horizontal piping, and wherever else shown and/or specified.

.9 Provide circuit balancing valves in piping generally where shown on drawings but with exact locations in accordance with instructions of personnel doing system flow balancing work. Confirm locations prior to installation.

.10 Grooved pipe ends shall be clean and free from indentations, projections and roll marks in the area from pipe end to groove for proper gasket sealing. All couplings will meet Victaulic standards for visual inspection sizes 2” to 12”. The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service as specified. Install in accordance with manufacturer’s latest recommendations. A Victaulic factory trained representative shall periodically visit the job site and review the installation for best practices. The installing Contractor shall correct any identified deficiencies. Victaulic product that has been examined and has not met the visual inspection criteria for proper installation must be corrected and re-examined by Victaulic prior to the completion of the project.

3.3 INSTALLATION OF PRESSURE RELIEF VALVES

.1 Provide factory set pressure relief valves. Pipe discharge of each water piping relief valve to drain unless otherwise shown or specified.

.2 Pipe discharge of each glycol solution piping relief valve back to system expansion tank or return piping.

.3 Confirm relief valve settings.

3.4 INSTALLATION OF AIR VENTS

.1 Provide an air vent in piping mains at all high points, at equipment connections, and wherever else shown and/or specified. Equip each air vent with a ball type shut-off valve. Install vents in 100 mm (4") dia. and larger piping and all vents in mechanical rooms in accordance with drawing detail.

.2 Provide 9 mm (3/8") dia. copper drain piping from each automatic air vent to nearest suitable drain and terminate so discharge is visible. Identify drain piping.

3.5 INSTALLATION OF STRAINERS

.1 Provide strainers in piping. Locate strainers so baskets are easily accessible and removable. Clean strainer baskets during and after piping system flushing and cleaning is complete, and before water quantity balancing commences.

3.6 INSTALLATION OF EXPANSION COMPENSATORS

.1 Provide expansion compensation in piping.

.2 Generally, locate expansion compensation where shown, but with exact locations to suit piping as installed.

.3 Provide double pipe alignment guides in horizontal piping at each side of expansion compensation facilities to permit movement in axial direction only. Secure guides to building structure only.

.4 Provide a pipe guide at each side of expansion joints in vertical risers.

.5 When using grooved piping in a riser refer to a Victaulic riser design for anchor and guide locations.

3.7 INSTALLATION OF PIPING ANCHORS

.1 Provide anchors to secure piping to structure. Locate anchors generally where shown but with exact locations to suit piping as installed and requirements of reviewed anchor shop drawings.

.2 When installation of anchors is complete, arrange, and pay for anchor design engineer to visit site to review anchor installation. Submit a signed letter with engineer's stamp from design engineer confirming each anchor is properly installed.

3.8 INSTALLATION OF AIR SEPARATOR

.1 Provide an air separator in piping and connect with valved inlet and outlet piping.

.2 Extend valved blowdown piping from bottom pipe connection tapping to nearest floor drain location.

.3 Equip top pipe connection tapping with an automatic air vent, and piping as detailed.

3.9 INSTALLATION OF EXPANSION TANK

.1 Provide an expansion tank.

.2 Secure horizontal expansion tank in place from structure by means of properly sized galvanized steel hanger rods and support saddles supplied with tank.

.3 Secure tank stand to a concrete housekeeping pad by means of machine bolts.

.4 Brace and secure tank in accordance with requirements specified in Section 20 05 48.16 – Seismic Controls for Mechanical Systems.

.5 Connect tank with system piping. Extend a drain line from tank piping and terminate drain line with a drain valve. Provide an air vent.

.6 Provide a water make-up connection line complete with relief valve and pressure gauge and connect to system piping. Terminate make-up piping for connection to domestic cold water piping as part of the work of Section 22 11 00 – Facility Water Distribution. Check relief valve operation and adjust as required.

.7 Check tank air charge and adjust to suit system.

3.10 INSTALLATION OF GLYCOL SOLUTION MIXING AND STORAGE TANK

.1 Provide a mixing and storage tank and feed assembly for each glycol solution circulating system.

.2 Secure tank stand to a concrete housekeeping pad. Connect with system piping. Refer to drawing detail.

.3 Brace and secure each unit in accordance with requirements specified in Section 20 05 48.16 – Seismic Controls for Mechanical Systems.

.4 Fill tank with, unless otherwise specified, a solution of 50% water, 50% propylene glycol, and test solution to confirm proper concentrations.

.5 When installation is complete, test operation of assembly, including alarms, and adjust as required. Adjust pressure switch to suit glycol solution circulating system pressure.

3.11 INSTALLATION OF FLEXIBLE PIPING CONNECTIONS

.1 Provide flexible connections in piping connections to equipment.

.2 Install in accordance with manufacturer's instructions.

3.12 INSTALLATION OF CIRCULATING PUMPS

.1 Provide centrifugal circulating pumps.

.2 Secure base mounted pumps in place on seismic rated structural steel bases with vibration isolators as specified in Section 20 05 48.13 – Vibration Controls for Mechanical Systems, and restrain as specified in Section 20 05 48.16 – Seismic Controls for Mechanical Systems. Provide flexible connectors in pump suction and discharge piping 450 mm (18") from suction and discharge connection accessories.

.3 Secure base mounted pumps in place on a concrete housekeeping pad. Shim pump baseplate level using metal wedges prior to tightening bolts. When installation is complete and pump-motor alignment has been checked, fill void between pump base and housekeeping pad with KPM Industries Ltd. "In-Pakt" or equal non-shrink grout. Provide flexible connections in pump suction and discharge piping 450 mm (18") from suction and discharge connection accessories.

.4 Floor mount vertical inline pumps with seismically rated neoprene vibration isolators as specified in Section 20 05 48.13 – Vibration Controls for Mechanical Systems, and seismically rated steel pump mounting brackets custom welded to suction and discharge connections of pump. For further mounting requirements, refer to Section 20 05 48.16 – Seismic Controls for Mechanical Systems. Provide flexible connectors in vertical suction and discharge piping 450 mm (18") above suction and discharge connection accessories.

.5 Secure vertical inline pumps in place in accordance with requirements of drawing detail and provide flexible piping connections in vertical suction and discharge piping approximately 450 mm (18") above suction and discharge connection accessories.

.6 Provide a shut-off valve and suction guide in pump suction piping, and a combination check-balance-shut-off valve assembly in pump discharge piping, installed in accordance with manufacturer's instructions. Remove suction guide start-up strainer screens after piping flushing and cleaning is complete. Combination check-balance-shut-off valve assemblies are to be 150 mm (6") away from pump discharge for discharge piping to 150 mm (6") dia., and 300 mm (12") away from pump discharge for discharge pipe larger than 150 mm (6") dia.

.7 For pumps equipped with seal flush line filters, replace flush line filter cartridge when pipe flushing and cleaning is complete, and hand identified spare filter cartridges to Owner at site.

.8 Supply variable frequency drives (VFD) for pumps as scheduled. Hand VFD's to electrical trade at site for installation as part of the electrical work.

.9 Install horizontal inline pumps in place in vertical piping approximately 1.2 m (4') above floor in accordance with pump manufacturer's instructions.

.10 If circulating pumps are used for piping flushing and cleaning, and pump seal flush line filters are not installed, replace pump mechanical seals when flushing and cleaning is complete.

.11 For equipment/system manufacturer certification requirements, refer to Section 20 05 00 – Common Work Results for Mechanical.

.12 For equipment/system start-up requirements, refer to Section 20 05 00 – Common Work Results for Mechanical.

.13 Include for a 1/2 day on-site operation demonstration and training session. Training is to be a full review of all components including but not limited to a full operation and maintenance demonstration, with abnormal events.

3.13 FLUSHING AND CLEANING PIPING

.1 Flush and clean new piping in accordance with requirements specified in Section 23 25 00 – HVAC Water Treatment.

3.14 TESTING, ADJUSTING AND BALANCING

.1 When work is complete and equipment is operating as intended, test, adjust and balance water flows in accordance with requirements specified in Section 20 05 93 – Testing, Adjusting, and Balancing for Mechanical Systems, and Section 20 08 00 – Commissioning of Mechanical Systems.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Refrigerant piping, joining materials, valves, fittings, and accessories for refrigerant piping.

1.2 REFERENCES

.1 CSA B52-18, Mechanical refrigeration code.

1.3 SUBMITTALS

.1 Submit shop drawings/product data sheets for all products specified in Part 2 of this section except for pipe and fittings.

.2 Submit, in shop drawing form, a schematic piping diagram for each refrigerant piping system indicating pipe sizes, slopes, valves, traps, and piping specialties. Piping schematics must be reviewed, approved, and signed by refrigeration equipment manufacturers prior to being submitted to the Consultant for review.

1.4 CLOSEOUT SUBMITTALS

.1 Submit letters from equipment suppliers certifying proper installation and start-up of piping systems and equipment as specified in Part 3 of this section.

1.5 QUALITY ASSURANCE

.1 Refrigerant piping systems are to be in accordance with CSA B52, Mechanical Refrigeration Code, and any applicable local Codes and Regulations.

.2 Refrigerant piping installing contractor is to be certified by Technical Standards and Safety Authority (TSSA). Installing contractor is to install refrigerant piping in accordance with manufacturer's installation instructions and in accordance with local codes. Contractor is responsible for all regulatory approvals, if required. Upon completion of installation, documentation of refrigerant amount, test certificates and verification documentation, etc., is to be provided in a binder, in accordance with requirements of local authorities having jurisdiction.

.3 Refrigerant piping and direct expansion refrigeration equipment must be installed by or under direct on site supervision of a licensed journeyman refrigeration mechanic.

PART 2 - PRODUCTS

2.1 PIPE, FITTINGS, AND JOINTS

.1 Type ACR hard drawn seamless copper refrigerant tubing to ASTM B280, factory degreased, dehydrated and capped or nitrogen filled and capped, complete with factory washed and bagged wrought copper soldering fittings to ASME B16.22, and brazed joints made with high melting point silver brazing alloy conforming to AWS Classification BcuP-5.

2.2 PIPING LINE SETS

.1 Equal to Great Lakes Copper Inc. "EZ-Roll" soft annealed copper to ASTM B280, suitable for use with refrigerant involved, factory cleaned and capped, and with sizes and lengths as required.

2.3 GENERAL RE: VALVES AND PIPING SPECIALTIES

.1 Refrigerant valves and piping specialties specified below are to factory cleaned, degreased, and supplied to site with capped ends.

2.4 SHUT-OFF VALVES

.1 Ball Valves

.1 ¼ turn, CSA certified forged brass ball valves, each suitable for a maximum working pressure of 3445 kPa (500 psi) and complete with carbon filled Teflon ball seals, 2 O-ring stem seals, a gasketed seal cap, a flow direction arrow cast into body, a ball position indicator on stem, and extended copper tube connections to permit brazing the valve into line without disassembling valve.

.2 Manufacturers:

.1 Mueller Industries Inc.;

.2 Sporlan Valve Co.;

.3 Superior Refrigeration Products/Sherwood.

.2 Diaphragm Valves

.1 Forged brass, frost-proof, Type 1 Series, CSA certified packless diaphragm valves, each suitable for a 3445 kPa (500 psi) working pressure and complete with an O-ring to prevent moisture from entering diaphragm chamber, one phosphor bronze and 2 stainless steel diaphragms, and extended copper tube brazing connections.

.2 Manufacturers:

.1 Mueller Industries Inc.;

.2 Sporlan Valve Co.;

.3 Superior Refrigeration Products/Sherwood.

2.5 CHECK VALVES

.1 Straight through type for valves 6.4 mm to 16 mm (¼" to 5/8") diameter, globe type for valves 22 mm (7/8") diameter and larger, each complete with extended tubing for brazing connections, and as follows:

.1 straight through type check valves complete with a machined brass gasketed body, phosphor bronze spring, and neoprene seat;

.2 globe type check valves complete with a cast bronze body, forged brass cap, phosphor bronze spring, Teflon seat disc, and neoprene O-ring seal.

.2 Manufacturers:

.1 Mueller Industries Inc.;

.2 Sporlan Valve Co.;

.3 Superior Refrigeration Products/Sherwood.

2.6 PIPING TRAPS

.1 Mueller Industries Inc. Style No. WE-554P brazing end copper "P" traps.

.2 Manufacturers:

.1 Mueller Industries Inc.;

.2 Sporlan Valve Co.;

.3 Superior Refrigeration Products/Sherwood.

2.7 PRESSURE VESSEL RELIEF VALVES

.1 Factory set pressure relief valves, straight through or angle type as required, each constructed in accordance with requirements of ANSI B9.1 and the ASME Code for Unfired Pressure Vessels, and each complete with a brass body, neoprene seat disc, and lead seal and locking wire.

.2 Manufacturers:

.1 Mueller Industries Inc.;

.2 Sporlan Valve Co.;

.3 Superior Refrigeration Products/Sherwood.

2.8 REFRIGERANT LIQUID MOISTURE INDICATORS

.1 Forged brass, triple sealed, CSA certified liquid moisture indicators, each suitable for a maximum working pressure of 3445 kPa (500 psi) and complete with a liquid indicator which shows "FULL" when system is fully charged with refrigerant and remains blank when there is a restriction or shortage of refrigerant in liquid line, a moisture indicator which changes colour from blue to pink when moisture is present in system, a plastic dust cover, and extended copper tube brazing connections.

.2 Manufacturers:

.1 Mueller Industries Inc.;

.2 Sporlan Valve Co.;

.3 Superior Refrigeration Products/Sherwood.

2.9 LIQUID LINE FILTER-DRIER

.1 Mueller Industries Inc. "Drymaster" CSA certified filter-driers, each suitable for a maximum 3445 kPa (500 psi) working pressure and complete with a combination of desiccants in a fluted briquette for drying, and a fluted briquette type filter.

.2 Manufacturers:

.1 Mueller Industries Inc.;

.2 Sporlan Valve Co.;

.3 Superior Refrigeration Products/Sherwood.

2.10 FLEXIBLE PIPING CONNECTIONS

.1 Senior Flexonics Canada "VIBRA-SORBERS" phosphor bronze construction, factory cleaned, dried, and sealed flexible piping connections with copper tube brazing ends.

.2 Manufacturers:

.1 Senior Flexonics Canada;

.2 The Metraflex Co.

2.11 THERMOSTATIC EXPANSION VALVES

.1 Factory tested, balanced port design thermostatic expansion valves, with exact selection to suit the application and refrigerant used, each complete within a replaceable stainless steel diaphragm and welded element construction thermostatic element charged with hydraulic fluid, and removable inlet strainer.

.2 Manufacturers:

.1 Mueller Industries Inc.;

.2 Sporlan Valve Co.;

.3 Superior Refrigeration Products/Sherwood.

PART 3 - EXECUTION

3.1 DEMOLITION

.1 Perform required refrigerant piping system demolition work. Refer to demolition requirements specified in Section 20 05 05 – Selective Demolition for Mechanical.

3.2 INSTALLATION OF REFRIGERANT PIPING, VALVES AND SPECIALTIES

.1 Provide required refrigerant piping. Piping is to be type ACR copper with wrought copper fittings. Install piping in accordance with requirements of reviewed refrigerant piping schematics referred to in Part 1 of this section.

.2 Make refrigerant piping joints using a light coat of approved brazing flux applied to both pipe and fitting. Do not use acid flux. During brazing process, ensure pipe and fittings are kept full of nitrogen or carbon dioxide to prevent scale formation inside pipe and fitting.

.3 Where shown or specified, use soft copper refrigerant piping line sets.

.4 Provide shut-off valves to isolate each piece of equipment if shut-off valves are not supplied integral with equipment. Provide ball or diaphragm type shut-off valves inside building. Provide diaphragm shut-off valves outside building.

.5 Provide a refrigerant charging valve for each system if such a valve is not supplied integral with equipment.

.6 Provide refrigerant piping accessories shown and/or required and install in accordance with manufacturer’s recommendations.

.7 Provide required refrigerant.

.8 Provide flexible connections at piping connections to roof mounted condensing units. Install in accordance with manufacturer’s instructions.

.9 Provide expansion valves where shown and/or required, each matched to coil and installed in accordance with manufacturer’s instructions.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 HVAC water-treatment systems.

.2 Chemical treatment test equipment.

.3 HVAC water-treatment chemicals.

1.2 SUBMITTALS

.1 Submit shop drawings/product data sheets for all water treatment chemical feed equipment and associated hardware.

.2 Submit product literature sheets for all chemicals, as well as WHMIS Material Safety Data Sheets for all chemicals.

1.3 CLOSEOUT SUBMITTALS

.1 Submit water treatment manufacturer/supplier certification letters as specified in Part 3 of this section.

.2 Training attendance records.

1.4 MAINTENANCE MATERIAL SUBMITTALS

.1 Submit water treatment test sets and spare chemicals as specified below and in Part 3 of this section.

.2 Supply water softener salt sufficient for 2 months of normal softener operation and store salt on-site where directed by Owner.

PART 2 - PRODUCTS

2.1 CHARACTERISTICS OF CHEMICALS AND SPARE CHEMICALS

.1 Chemicals specified in this section are to be non-toxic when released to atmosphere, non-corrosive, and non-staining if a leak occurs, and compatible with all system components.

.2 Chemicals must be approved by governing authorities for release into Municipal sewer system.

.3 For each treatment system for which chemicals are supplied, supply and hand to Owner, at Substantial Performance of the Work, spare chemical in original containers/packaging sufficient for 2 months of treatment system operation.

2.2 MANUFACTURERS/SUPPLIERS OF CHEMICALS AND FEED EQUIPMENT

.1 Manufacturers:

.1 Ashland Hercules Water Technologies;

.2 Klenzoid Inc.;

.3 Magnus Canada;

.4 Chem-Aqua Canada.

2.3 PIPING SYSTEM FLUSHING AND CLEANING CHEMICAL

.1 Liquid form alkaline type cleaner consisting of a concentrated blend of highly active penetrating agents and detergents with a 12.5 pH and specifically formulated to remove oil, mill scale and oxides from piping and equipment.

2.4 CLOSED HEAT TRANSFER SYSTEM TREATMENT

.1 Chemicals, chemical feed equipment, and test equipment to control corrosion in closed heat transfer circulating systems as indicated on drawings and as specified below.

.2 Enamelled steel or cast iron by-pass feeders sized as shown, 2060 kPa (300 psi) rated and complete with 20 mm (¾") diameter NPT pipe connection tappings, and a screw-on cast iron cap with "Buna N" "O" ring seal.

.3 By-pass filter and flow indicator assembly equal to a Shelco Inc. FOS78, 1725 kPa (250 psi) rated replaceable cartridge filter assembly with a stainless steel housing and 20 mm (¾") diameter piping connections, sized for approximately 5% of rated circulating pump flow and complete with a minimum of 6, 20 micron filter cartridges, and a sight flow indicator equal to an Anderson Midwest Model 350SS with 20 mm (¾") diameter piping connections.

.4 Piping tee mounting coupon holders, each complete with 25 mm (1") diameter NPT plugs with a minimum of one coupon for copper and one coupon for steel.

.5 Chromate free, nitrite/borate type corrosion inhibitor suitable for use with both ferrous and non-ferrous metals.

.6 Test kit for measuring inhibitor level.

2.5 OPEN HEAT TRANSFER SYSTEM TREATMENT

.1 Chemicals, chemical feed equipment, and test equipment to control corrosion and scale formation and inhibit algae/bacteria growth in open heat transfer circulating systems as indicated on drawings and as specified below.

.2 Chemical feed equipment consisting of following:

.1 surface wall mounting PVC panel with shelf;

.2 water treatment controller equal to a Lakewood Instruments Model 1575e, 115 volt, 1-phase, 60 Hz, electronic, single circuit board design, field programmable, menu driven controller housed in NEMA 4X surface mounting enclosure and complete with:

.1 power cord with plug, and 4 female receptacles;

.2 3 relays for feed control of treatment chemicals, with feed based on water makeup, percent of bleed time, percent of "on" time, or schedule, feed lockout upon low system flow condition, and bleed lockout when feeding biocide;

.3 2 water meter inputs, 2 drum switch inputs, conductivity sensor input, flow switch input, and one 4-20 mA output;

.4 heavy-duty, stainless steel, domed, numeric 16 tactile pushbutton keyboard and illuminated LCD graphic display screen.

.3 3, electronic, 115 volt, 1-phase, 60 Hz, diaphragm type metering pumps equal to Idex Corp. "PULSEFEER" Series C Plus, each complete with manually adjustable stroke rate and length, guided ball check valve systems, bleed valve assembly, a pipe mounting injection/back

pressure valve assembly, foot valve strainer assembly, and required suction and discharge tubing;

.4 make-up water meter sized to water make-up pipe dia., complete with hermetically sealed register, factory preset pulse rate, and contact head with 10 ampere rated 115 volt switch;

.5 flow sensor assembly equal to Drew #9427-01-5 or #9426-01-7 to suit system flow rate;

.6 CSA certified, 1035 kPa (150 psi) rated, 12 mm (½") dia., 115 volt, 1-phase, 60 Hz, normally closed forged brass solenoid valve for system bleed;

.7 pipe mounting conductivity sensor with conduit elbow and a minimum of 6 m (20') of cable.

.3 Treatment chemicals equal to following Drew Canada chemicals:

.1 "Performax Millennium" Series #2395 corrosion inhibitor and deposit control in a drum type container;

.2 "Biocide T" slime control agent in a pail type container;

.3 "Biosphere 250" for control of bacteria, fungi, and algae, and supplied in pail or drum type containers as required.

.4 Chemical test equipment consisting of:

.1 organic or phosphate test kit;

.2 alkalinity and chloride dropper test kit.

2.6 BOILER BOIL-OUT CHEMICALS

.1 Boiler boil-out chemicals selected by chemical treatment manufacturer/ supplier in consultation with Consultant and boiler manufacturer, and chemicals selected must be approved by boiler manufacturer.

2.7 WATER SOFTENERS

.1 Package type, automatic, water conserving counterflow design water softener assembly to remove hardness to not more than 0.3 grains per gallon as determined by an ASTM standard soap test method, sized for a continuous flow rate of system make-up requirements at maximum output, and complete with:

.1 2 fibreglass reinforced plastic vessels, each sized for 100% of make-up requirements and complete with a moulded polypropylene structural base;

.2 controller for both automatic and manual regeneration, with electronic automatic regeneration based on adjustable totalized quantity of softened feed water, and designed to prevent simultaneous regenerations and permit time adjustment for backwash, brine and rinse steps;

.3 full charge of cation exchange resin which has a capacity of 68.8 kg/m3 (4.3 lb/ft³) of resin at a regeneration salt dosage level of 240 kg/m^3 (15 lb/ft³) of resin;

.4 high density brine tank, sized to contain amount of salt required for 10 regenerations and complete with required PVC valves and tubing;

.5 softener inlet water meter, calibrated in m^3;

.6 softener salt required for initial brine tank fill and system start-up, and bags of salt as required for 2 months of system operation;

.7 test kit for conducting a soap hardness test;

.8 factory secured seismic restraint connection hardware.

2.8 WATER TREATMENT TESTING COUNTERS

.1 Factory made, 1.8 m (6') long, 915 mm (36") high, 600 mm (24") deep commercial grade counter assembly with toe space, complete with:

.1 at one end, a 508 mm x 520 mm x 175 mm (20" x 20-½" x 7") type 316 stainless steel sink equal to a AMI #1017-C, complete with 3-hole punched ledgeback, crumb cup strainer, and a drain fitting with 40 mm (2-½") dia. tailpiece;

.2 supply fitting equal to a Zurn #Z-831B4-Ict-25 with vandal-proof aerator and 100 mm (4") long blade handles;

.3 acid-resistant counter surface with minimum 250 mm (10") high splashback;

.4 set of double doors under sink;

.5 set of 4 drawers at end opposite sink;

.6 cupboard with 3 adjustable shelves adjacent to drawers;

.7 all required hardware, including concealed hinges, drawer slides with stops, and door pulls;

.8 acid-resisting white enamel finish on all wooden surfaces.

PART 3 - EXECUTION

3.1 PIPING SYSTEM FLUSHING AND CLEANING

.1 After new heat transfer system piping has been installed and leakage testing has been satisfactorily completed, but before mechanical equipment start-up and performance tests, flush and chemically clean piping systems.

.2 Provide required temporary piping connections, including bypass piping to isolate dirt sensitive mechanical plant equipment. Remove instrumentation such as flow meters and switches, orifice plates, meter valves and similar devices and plug pipe openings. Reinstall when flushing and cleaning work has been certified complete by chemical manufacturer/installer. Ensure control valves are operational and fully open during flushing and cleaning.

.3 Prior to chemical cleaning, flush piping, including dead ends, with water to remove loose solids. Clean all strainers. Replace chemical feeder line filters as required. Flush and drain until water runs clear.

.4 When flushing with water is complete, fill systems with fresh clean water. Meter amount of water required to fill each system or otherwise calculate system capacity. Ensure all air is vented from systems. Add cleaning chemical as instructed by chemical manufacturer and circulate solution for a period of time and at a temperature as required to produce a clean piping system. Conduct daily pH, conductivity, and total iron tests in accordance with chemical supplier’s instructions.

.5 After chemical cleaning when test results indicate a clean system, drain solution from piping, refill with clean water and circulate water for a minimum of 24 hours to flush out remaining chemical solution, then drain water from piping using all drain points and again clean all system strainers and replace filters. Arrange for chemical supplier to check each system after flushing and cleaning is complete and to certify in writing that flushing and cleaning procedures have been properly performed. Submit a copy of the certification letter. Fill systems.

3.2 INSTALLATION OF CLOSED HEAT TRANSFER SYSTEM TREATMENT

.1 After flushing and cleaning procedures have been certified complete, provide a by-pass chemical feeder, a cartridge filter assembly, and corrosion test coupons for each closed heat transfer system. Install in accordance with requirements of drawing details.

.2 Supply and feed into each system sufficient chemical to charge system to proper concentrations of chemical, and maintain proper levels in system until Substantial Performance of the Work.

3.3 INSTALLATION OF OPEN HEAT TRANSFER SYSTEM TREATMENT

.1 After flushing and cleaning procedures have been certified complete, provide a PVC panel type backboard, a water treatment controller, 3 metering pumps, a make-up water meter, a flow sensor, a solenoid valve, and a conductivity sensor for each open heat transfer system. Install in accordance with requirements of drawing detail.

.2 Supply and feed into each system, sufficient chemical to charge system to proper concentrations of chemical, and maintain proper levels in system until Substantial Performance of the Work.

.3 Arrange for chemical supplier to check chemical levels in each system, to certify in writing that feed equipment is properly installed and water in each system is properly treated with chemical. Submit a copy of the certification letter.

.4 Hand test sets and spare chemicals to Owner at site. Store chemicals at site where directed by Owner.

.5 In addition to work described above, provide a pot feeder in valved by-pass piping around each pump.

3.4 BOILER BOIL-OUT AND CLEANING

.1 When boiler installation is complete, inspect each boiler and remove all visible debris, rust, scale, and oil, then thoroughly flush each boiler with clean water. Provide required temporary piping connections.

.2 When flushing is complete boil-out each boiler with a chemical solution approved by boiler manufacturer to remove remaining grease, oil, and dirt. Operate each boiler at 50% of normal operating pressure for a minimum of 48 hours or until all contaminants are removed, then again flush each boiler with fresh water until all traces of chemical solution are removed.

.3 When boilers are clean and have been flushed, immediately fill each boiler with water which is chemically treated as specified in this section.

3.5 INSTALLATION OF WATER SOFTENER

.1 Provide a package type water softener assembly and secure in place on a concrete housekeeping pad.

.2 Brace and secure assembly in accordance with requirements specified in Section 20 05 48.16 – Seismic Controls for Mechanical Systems.

.3 Install equipment and components supplied loose with softener in accordance with softener manufacturer’s instructions. Provide required valved piping, including drain piping terminated at a funnel floor drain combination.

.4 Install initial charge of softener salt. Hand spare salt and soap test kit to Owner at site and store where directed.

3.6 INSTALLATION OF WATER TREATMENT TESTING COUNTER

.1 Provide a counter assembly with sink and trim for use during water treatment testing of circulating system samples. Confirm exact location prior to rough-in of services.

.2 Store treatment test kits and a WHMIS Material Safety Data Sheet for each treatment chemical in the counter assembly.

3.7 MANUFACTURER'S CERTIFICATION, START-UP, AND TRAINING

.1 For all water treatment equipment include for on-site certification, start-up supervision, and system training by treatment chemical manufacturer's representative as follows:

.1 For equipment/system manufacturer certification requirements, refer to Section 20 05 00 – Common Work Results for Mechanical;

.2 For equipment/system start-up requirements, refer to Section 20 05 00 – Common Work Results for Mechanical;

.3 Include for 4 hours of on-site operation demonstration and training session. Training is to be a full review of all components including but not limited to a full operation and maintenance demonstration, with abnormal events.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 HVAC ducts and casings.

.2 Acoustic duct lining material.

.3 Special systems ductwork.

.4 Dampers.

.5 Louvres.

.6 Other duct work accessories.

1.2 SUBMITTALS

.1 Submit shop drawings/product data sheets for all products specified in this section except shop fabricated ductwork and fittings.

.2 Include capacity, throw and terminal velocity, noise criteria, and pressure drops with grille and diffuser shop drawing/product data sheet submission.

.3 With shop drawing/product data sheet submission, supply evidence that fire rated duct manufacturer is ULC listed to size requirements shows on drawings.

.4 Submit duct leakage test data prior to ductwork being covered from view.

.5 Submit manufacturer’s colour chart(s) for all items for which a finish colour is to be selected.

1.3 CLOSEOUT SUBMITTALS

.1 Submit proper installation certification from fire rated duct manufacturer as specified in Part 3 of this section.

1.4 MAINTENANCE MATERIAL SUBMITTALS

.1 Supply and hand to Owner at Substantial Performance of the Work, a minimum of 10 identified (with tags) grille/diffuser volume control damper adjustment keys.

1.5 COORDINATION

.1 Supply reviewed copies of ventilator/curb assembly shop drawings or product data sheets to trade who will cut roof openings for ventilators, and ensure openings are properly sized and located.

1.6 QUALITY ASSURANCE

.1 Grilles and diffusers are to be tested and performance certified to ANSI/ASHRAE 70, Method of Testing the Performance of Air Outlets and Air Inlets.

PART 2 - PRODUCTS

2.1 GALVANIZED STEEL DUCTWORK

.1 Galvanized steel sheet is to be hot dipped in accordance with requirements of ASTM A653. G60 galvanizing for bare uncovered duct to be finish painted. G90 for all other galvanizing.

.2 Rectangular

.1 Lock forming grade hot dip galvanized steel, ASTM A653, shop fabricated, minimum #26 gauge.

.3 Round

.1 Factory machine fabricated, spiral, mechanically locked flat seam, single wall duct, fittings and couplings.

.4 Flat Oval

.1 Factory machine fabricated, single wall, 4-ply spiral lock seam duct, fittings and couplings.

2.2 RECTANGULAR ALUMINUM DUCTWORK

.1 Alloy 3003 Temper H14 aluminum, ASTM B209, shop or factory fabricated, water-tight, with metal gauges and fabrication in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible to suit the duct working pressure classification, and type 316 stainless steel support hardware.

2.3 ROUND ALUMINUM DUCTWORK

.1 Alloy 3003 Temper H14 aluminum, ASTM B209, factory fabricated, water-tight, smooth interior, single wall duct, and fittings of spiral lockseam construction with site sealed beaded sleeve (slip type) joints, all in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible to suit duct working pressure classification, and type 316 stainless steel sheet metal screws and support hardware.

2.4 RECTANGULAR STAINLESS STEEL DUCTWORK

.1 300 Series stainless steel, type 304 or type 316 as specified in Part 3 of this Section, ASTM A167 and ASTM A480, with a #4 finish where bare (uncovered) and exposed in finished areas and a #2B finish elsewhere, with, unless otherwise specified, metal gauges in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible to suit duct location and working pressure classification, and stainless steel support hardware to match duct material.

2.5 ROUND STAINLESS STEEL DUCTWORK

.1 Factory made, spiral, mechanically locked flat seam, single wall duct fabricated from type 316 stainless steel to ASTM A240 with metal gauges in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible for 2.5 kPa (0.36 psi) pressure. Type 316 stainless steel fittings equipped with leak-proof stainless steel couplings secured to connecting duct by means of stainless steel sheet metal screws and duct sealer. Duct system performance is to meet SMACNA's Leakage Class 3 requirements at system design static pressure. Stainless steel finish is to be a #2B mill finish where concealed or exposed in unfinished areas and a #4 finish where exposed in finished areas.

2.6 ROUND STAINLESS STEEL LINED DUCTWORK

.1 Double wall self-sealing duct system constructed from type 316 stainless steel to ASTM A240 and consisting of 24 kg/m3 (1.5 lb/ft³) density, 25 mm (1") thick glass fibre insulation meeting NFPA 90A requirements and 25/50 flame spread/smoke developed ratings when tested in accordance with CAN/ULC S102 and wrapped in a thick non-woven polyester fabric, sandwiched between double wall duct and fittings. Spiral, mechanically locked, flat seam outer casing, and perforated inner liner with 3.2 mm (⅛") perforations on 6.4 mm (¼") staggered centres. Fittings and couplings constructed as for ducts and air-tight to SMACNA Leakage Class 3 requirements. Concealed duct and exposed

duct in unfinished areas is to have a #2B mill finish. Exposed duct in finished areas is to have a #4 finish.

2.7 FIBERGLASS REINFORCED PLASTIC DUCT – RECTANGULAR AND ROUND

.1 Factory fabricated duct and fittings in accordance with ASTM C582, ASTM D3982, ASTM D2996, SMACNA manual entitled "Thermoset FRP Duct Construction Manual", and with resin conforming to 25/50 flame spread/smoke developed rating when tested in accordance with CAN/ULC-S102, pigment coloured as selected from manufacturer's standard colours, with thixotropic resin paste sealed and fibreglass cloth and resin overwrapped bell and spigot joints for round ducts, air-tight gasketed flanged joints with type 316 stainless steel bolts, lock washers and nuts for rectangular ducts, and type 316 stainless steel support hardware.

2.8 FLEXIBLE METALLIC DUCTWORK

.1 Bare

.1 Spirally wound, semi-rigid, self-supporting corrugated aluminum duct with continuous triple lock seams, SMACNA Form "M-UN", CAN/ULC-S110 listed and labelled as a Class 1 Air Duct, constructed of dead soft aluminum strip, and supplied in 3 m (10') lengths.

.2 Insulated

.1 Spirally wound, semi-rigid, self-supporting corrugated aluminum duct with continuous triple lock seams, SMACNA Form "M-I", CAN/ULC-S110 listed and labelled as a Class 1 Air Duct, constructed of dead soft aluminum strip, supplied in 3 m (10') lengths and factory covered with 40 mm (1-½") thick, 12 kg/m3 (0.75 lb/ft³) density fibreglass insulation with a vinyl jacket meeting 25/50 flame spread and smoke developed requirements tested in accordance with CAN/ULC-S102.

2.9 FLEXIBLE FABRIC DUCTWORK

.1 Equal to DuctSox Corp. round fabric air duct, 25/50 flame spread/smoke developed rated when tested in accordance with CAN/ULC-S102, white or coloured (to manufacturer's standards), and complete with 3 x 1 tension cable suspension system.

2.10 FLEXIBLE FABRIC DUCTWORK

.1 Bare

.1 Equal to Flexmaster Canada Ltd. "Fabriflex" Type 4 ULC listed and labelled Class 1 flexible fabric duct consisting of vinyl coated fibreglass cloth mechanically bonded to a corrosion resistant galvanized steel helix.

.2 Insulated

.1 Equal to Flexmaster Canada Ltd. "Fabriflex" Type 4T ULC listed and labelled Class 1 flexible fabric duct consisting of vinyl coated fibreglass cloth mechanically bonded to a corrosion resistant galvanized steel helix and factory insulated with 25 mm (1") thick glass fibre insulation with a polyethylene vapour barrier jacket.

2.11 FLEXIBLE CONNECTION MATERIAL

.1 Waterproof, indoor-outdoor type flexible connection material meeting requirements of NFPA 90A, consisting of woven glass fibre fabric coated on both sides with synthetic rubber.

.2 Manufacturers:

.1 Duro Dyne Canada Inc. "DUROLON";

.2 Dyn Air Inc. "HYPALON".

2.12 METAL DUCT SYSTEM JOINT SEALANT

.1 ULC listed and labelled, premium grade, grey colour, water base, non-flammable duct sealer, brush, or gun applied, with a CAN/ULC S102 tested maximum flame spread rating of 5 and smoke developed rating of 0.

.2 Manufacturers:

.1 Johns Manville;

.2 Manson Insulation;

.3 Knauf Insulation.

2.13 ACOUSTIC LINING

.1 Minimum 25 mm (1") thick acoustic lining material meeting 25/50 flame spread and smoke developed ratings tested in accordance with CAN/ULC S102, meeting NFPA 90A, ASTM C1071, and ASTM G21 requirements, not supporting microbial growth, flexible for round ducts, board type for rectangular ducts, consisting of a bonded fiberglass mat coated on inside (airside) face with a black fire-resistant coating.

.2 Manufacturers:

.1 Johns Manville;

.2 Manson Insulation;

.3 Knauf Insulation.

2.14 FACTORY INSULATED FIRE RATED DUCTWORK

.1 Equal to DuraSystems Barriers Inc. "DuraDuct HP" or "DuraDuct GNX" duct, 2 hour fire rated, constructed, ULC listed and labelled for fire rated ventilation applications. Duct is constructed of a galvanized steel inner liner, a galvanized steel outer jacket, and all required fittings and accessories, including support hardware.

2.15 IN-SLAB EXHAUST DUCTWORK

.1 Equal to ECCO Manufacturing "ECCODUCT" spiral wound, galvanized steel, 300 mm x 45 mm (12" x 1-¾") rectangular duct supplied in 3 m (10') lengths complete with factory supplied galvanized steel connection couplers, fittings, exterior discharges with back draft dampers, and support brackets. Concrete encased duct and fittings are 3 hour fire rated in accordance with tests conducted by Intertek/Warnock Hersey in accordance with ULC S115 and ASTM E814, are to have an impact loading rating of 200 kg (440 lb) from 1.5 m (5') with no permanent deformations in accordance with CAN3-A23, and are to have a point loading rating with 1 mm (1/32") permanent deformation when tested to CSA S269.1.

2.16 CASING AND PLENUM MATERIAL AND ACCESSORIES

.1 Unless otherwise specified, casing and plenum material is to be same as connecting duct material.

.2 Accessories such as access doors and drain pans are to be constructed of same material as casing and plenum and are to be in accordance with Chapter 6 of SMACNA HVAC Duct Construction Standards Metal and Flexible.

2.17 ACOUSTIC PLENUM PANELS

.1 Vibro-Acoustics Ltd. type "AP", 100 mm (4") thick panels with acoustic media meeting NFPA 90A requirements sandwiched between minimum #24 gauge galvanized sheet steel, with airside face perforated, access doors where shown, and with acoustic performance as follows:

Octave Bands, (Hz)	125	250	500	1000	2000	4000
Transmission Loss	21	28	39	50	53	56
Absorption Coefficient	0.7	0.9	0.99	0.99	0.9	0.9

.2 Manufacturers:

.1 Vibro-Acoustics Ltd.;

.2 Kinetics Noise Control Inc.;

.3 Carrier Corp. – Racan;

.4 Haakon Industries;

.5 Price Industries Inc;

.6 Alumavent.

2.18 PLENUM ACCESS DOORS

.1 Factory fabricated, double wall insulated access doors, sized as indicated on drawings, and constructed of same material as connecting ductwork in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible to suit operating pressure of the system.

2.19 ROUND TO RECTANGULAR DUCT CONNECTIONS

.1 Equal to Flexmaster Canada Ltd. galvanized steel, flared, flanged or notched "Spin-On" round duct take-off collars with locking dampers in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible.

2.20 SPLITTER DAMPERS

.1 Minimum #20 gauge damper blade constructed of same material as duct, reinforced as required to suit blade size, system velocity, and to prevent "chatter", and complete with operating hardware equal to DynAir Inc. #Q-50 "DYN-A-QUAD S-S" quadrant regulator with RW-50 backup washers to prevent leakage, long square bearing pin, and slide pin.

2.21 AIR TURNING VANES

.1 For square elbows, multiple-radius turning vanes interconnected with bars, adequately reinforced to suit pressure and velocity of system, constructed of same material as duct they are associated with, and in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible.

.2 For short branch ducts at grille and diffuser connections, air extractor type each equipped with a matching bottom operated 90° opposed blade volume control damper, constructed of same material as duct it is associated with and in accordance with requirements and details in ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible.

2.22 MANUAL BALANCING (VOLUME) DAMPERS

.1 Flanged and drilled, single or parallel blade (depending on damper size) manual balancing dampers, each constructed of same material as connecting ductwork unless otherwise specified, each designed to maintain internal free area of connecting duct, and each complete with:

.1 hexagonal or square shaft extension through frame;

.2 non-stick, non-corrosive synthetic bearings for rectangular dampers, flange stainless steel bearings for round dampers;

.3 blade stops for single blade dampers, designed to prevent blade from moving more than 90°;

.4 linkage for multiple blade dampers;

.5 locking hand quadrant damper operator with, for insulated ducts 50 mm (2") standoff mounting.

.2 Rectangular Dampers: Nailor Industries Inc. 1800 Series, maximum size 1.2 m x 1.2 m (4' x 4') for a single damper.

.3 Round Dampers: Nailor Industries Inc. model 1890, maximum 600 mm (24") diameter, equipped with a minimum 200 mm (8") deep frame, and blade stiffeners where required.

.4 Multiple Rectangular Damper Section Assembly: Rectangular assembly supplied with the dampers or site constructed, of same material as damper and designed for tight and secure mounting of individual dampers.

.5 Manufacturers:

.1 Nailor Industries Inc.;

.2 T.A. Morrison & Co. Inc. "TAMCO";

.3 Greenheck Fan Corp.;

.4 Ruskin Co.

2.23 BACKDRAFT DAMPERS

.1 Nailor Industries Model 1370CB counterbalanced backdraft dampers, vertical or horizontal mounting, 50 mm (2") wide, sized as shown and complete with:

.1 extruded 6063-T5 aluminum frame, 2.3 mm (0.090") nominal wall thickness, with mitred corners;

.2 extruded 6063-T5 aluminum blades, 1.3 mm (0.050") nominal wall thickness on 92 mm (3-5/8") centres, and with extruded PVC blade seals;

.3 corrosion-resistant synthetic bearings;

.4 adjustable plated steel counterweights mounted internally in the airstream;

.5 concealed blade linkage located out of the airstream.

.2 Manufacturers:

.1 Nailor Industries Inc.;

.2 T.A. Morrison & Co. Inc. "TAMCO";

.3 Greenheck Fan Corp.;

.4 Ruskin Co.

2.24 FUSIBLE LINK DAMPERS

.1 Curtain blade type, dynamic, galvanized steel (unless otherwise specified) fusible link dampers, ULC classified to CAN/ULC S112 and in accordance with NFPA 90A requirements, factory tested

for closure under airflow, 1-1/2 hour or 3 hour rated as required, and complete with a constant force type 301 stainless steel closure spring, a blade lock assembly, a steel sleeve, retaining angles, and, unless otherwise specified, a 74°C (165°F) rated standard fusible link.

.2 Fusible link dampers are to be Type "B" or Type "C" (as required) with folded curtain blade out of air stream except where damper size or location requires use of type "A" dampers with curtain blade in air stream.

.3 Dampers in ductwork other than galvanized steel are to be as specified above but constructed of type 316 stainless steel.

.4 Manufacturers:

.1 Nailor Industries Inc.;

.2 Greenheck Fan Corp.;

.3 Ruskin Co.;

.4 Price Industries (E.H. Price).

2.25 COMBINATION FIRE/SMOKE DAMPERS

.1 Nailor Industries Series 1221, ULC listed to CAN/ULC S112 and CAN/ULC S112.1, meeting requirements of NFPA 80, 90A, 92, 101 and 105, consisting of type A, B, or C fusible link fire dampers as required and a fail-safe, opposed blade, normally closed, motor operated smoke damper complete with factory installed and tested 120 V electric actuator.

.2 ULC 1-1/2 hour fire rated and ULC Class I leakage rated for smoke, and equipped with a 74°C (165°F) ULC classified fusible link that will cause damper to close and lock independent of actuator when duct temperature reaches maximum temperature of damper assembly.

.3 Supply damper with factory installed sleeves of minimum 400 mm (16") length, field verified by contractor dependent on wall thickness. Caulk sleeves to ULC requirements and constructed of 20 gauge for sizes up to 2.1 m (84") wide and 18 gauge for sizes greater than 2.1 m (84") wide.

.4 Dampers in ductwork other than galvanized steel are to be as specified above but constructed of type 316 stainless steel.

.5 Manufacturers:

.1 Nailor Industries Inc.;

.2 Greenheck Fan Corp.;

.3 Ruskin Co.;

.4 Price Industries (E.H. Price).

2.26 SMOKE DAMPERS

.1 Multi-blade type, fail-safe, dynamic, galvanized steel (unless otherwise specified) smoke dampers, ULC classified to CAN/ULC S112.1, ULC Class I leakage rated for smoke, meeting requirements of NFPA 90A, 92, 101 and 105, normally closed, low pressure drop design, dynamically tested, each complete with jamb and blade seals, linkage concealed in the frame, a steel sleeve to suit the opening, and an electric actuator to automatically close damper upon receiving an external signal, and to automatically open damper when system is reset.

.2 Dampers in ductwork other than galvanized steel are to be as specified above but constructed of type 316 stainless steel.

.3 Manufacturers:

.1 Nailor Industries Inc.;

.2 Greenheck Fan Corp.;

.3 Ruskin Co.;

.4 Price Industries (E.H Price).

2.27 ROOF DUCT SUPPORTS

.1 Equal to PHP Systems Design Model PHP-D adjustable duct support assemblies sized to suit duct size, each assembly complete with injection moulded recycled plastic and carbon black bases and tubular hot dip galvanized steel framing.

2.28 PRESSURE RELIEF DOORS

.1 Greenheck model PRAD (positive) or VRAD (negative) pressure relief doors constructed of same material as duct or plenum they are associated with, each complete with a sealing gasket, special latches, cable assembly with spring to limit door opening to maximum 80° and factory set, field adjustable pressure relief magnet assembly.

.2 Size access doors to match requirements of system so pressure drop through open blow-out door at required flow rate will not exceed rated pressure of duct system.

.3 Manufacturers:

.1 Greenheck Fan Corp.;

.2 United Enertech.

2.29 DUCT ACCESS DOORS

.1 In accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible, with sizes suitable in all respects for purpose for which they are provided, and, unless otherwise specified, constructed of same material as duct they are associated with.

2.30 DUCTWORK DRAIN POINTS

.1 Equal to Ductmate Canada Ltd. "Moisture Drain", 20 mm (¾") diameter moisture drains with galvanized sheet metal funnel, and chrome plated brass threaded drain, nut, and cap.

2.31 INSTRUMENT TEST PORTS

.1 Equal to Duro-Dyne of Canada Ltd. #IP1 or #IP2 (to suit insulation thickness where applicable) gasketed, leakproof instrument test ports for round or rectangular ducts as required, each complete with a neoprene expansion plug and a plug securing chain.

2.32 WIRE MESH (BIRDSCREEN)

.1 Heavy-gauge galvanized steel or aluminum mesh, 12 mm x 12 mm (½" x ½") secured in a rigid galvanized steel or aluminum framework, sized as indicated on drawings, and constructed so as to be removable.

2.33 LOUVRES

.1 Price Industries Inc. DE439 or DE635, 100 mm (4") or 150 mm (6") deep (to suit wall thickness) factory assembled stationary, drainable, louvres sized as indicated on drawings, each AMCA water

penetration and air performance certified, constructed of welded, extruded, alloy 6063-T5 aluminum with drainable blades, mounting and securing hardware to suit the application, and 12 mm (½") mesh aluminum birdscreen in an aluminum frame.

.2 Acoustical Louvres: Price Industries Inc. Model QA1245 300 mm (12") deep, welded, extruded alloy 3003-H14 aluminum, storm-proof, stationary, drainable acoustical louvers, AMCA water penetration and air performance certified, with high density mineral wool acoustic media secured to blades and protected by perforated aluminum, sound ratings in accordance with ASTM E90 and ASTM E413, and mounting and securing facilities as required.

.3 Louvres are to be factory finished with a finish equal to PPG Industries "Duranar" fluoropolymer powder coating over primer with colour as selected from manufacturer's standard colour range.

.4 Manufacturers:

.1 Price Industries Inc.;

.2 The Airolite Co. LLC;

.3 Construction Specialities;

.4 Nailor Industries Inc.;

.5 Kinetics Noise Control Inc.

.6 Greenheck Fan Corp.

.7 Ventex.

2.34 LOUVRE BLANK-OFF PANELS

.1 Insulated, framed, sandwich construction panels consisting of 40 mm (1-½") thick rigid insulation (meeting NFPA 90A requirements) between minimum #20 gauge galvanized sheet steel with exterior face of panels finished to match finish of exterior wall louvres.

2.35 BRICK AND BLOCK VENTS

.1 Equal to Price Industries Inc. vents constructed of 6063-T5 alloy extruded aluminum, sized as shown, complete with stainless steel fasteners, aluminum rod vertical supports on minimum 300 mm (12") centres, #2 mesh fixed aluminum screen, and all required accessories to suit the application.

.2 Vent(s) to be factory finished with a finish equal to a baked "Kynar 500-XL" colour coat and a clear coat over cleaned and primed metal with colour as selected from manufacturer's standard colour range.

2.36 FIRE STOP FLAPS AND THERMAL BLANKET MATERIAL

.1 Rectangular or round, ULC listed and labelled, blade type galvanized steel fire stop flaps in accordance with CAN/ULC S112, Standard Methods of Fire Test of Fire-Damper Assemblies and CAN/ULC S112.2, Standard Method of Fire Test of Ceiling Firestop Flap Assemblies, each complete with #22 gauge G60 galvanized steel blade(s) and frame, a 74°C (165°F) fusible link, and, for dampers 300 mm (12") and larger, ceramic fibre insulation on both sides of the blades.

.2 Ceramic fibre material in accordance with 25/50 flame spread/smoke developed ratings when tested to CAN/ULC S102 and of a thickness to suit required fire rating.

2.37 GRILLES AND DIFFUSERS

.1 Grilles and diffusers of type, size, capacity, finish, and arrangement as shown on drawings and in accordance with drawing schedule, each equipped with all required mounting and connection accessories to suit mounting location and application.

.2 Manufacturers:

.1 Price Industries Inc.;

.2 Anemostat;

.3 Krueger Division of Air System Components Inc.;

.4 Titus;

.5 Nailor Industries Inc.;

.6 Tuttle & Bailey.

2.38 ROUND LOW SILHOUETTE ROOF MOUNTED VENTILATORS

.1 Spun aluminium, round, gravity roof mounting hoods in accordance with drawing schedule, each complete with:

.1 wind band with a rolled bead, and curb cap with one-piece, spun, deep venturi inlet, and pre-punched holes for mounting;

.2 galvanized steel bird screen;

.3 minimum 300 mm (12") high welded aluminium, insulated roof mounting curb with damper tray;

.4 aluminium backdraft damper supplied loose, for site installation in roof curb damper tray;

.5 non-corrosive motorized damper supplied loose for site installation in roof curb damper tray, equal to T. A. Morrison TAMCO Series 9000 insulated damper with linkage, end switch, and a Belimo or equal motor with voltage to suit control voltage requirements;

.6 factory secured seismic restraint connection hardware.

.2 Manufacturers:

.1 Greenheck Fan Corp.;

.2 PennBarry;

.3 Twin City Fan and Blower.

2.39 LOUVRED PENTHOUSE TYPE VENTILATORS

.1 Low silhouette, rectangular, roof mounting louvred penthouse type hoods in accordance with drawing schedule, each constructed of aluminium, supplied in knock-down form for site assembly, and each complete with:

.1 extruded aluminium, welded storm-proof louver blades with mitred corners and stainless steel securing screws;

.2 removable cover for internal access, lined with glass fibre insulation material and equipped with stainless steel fasteners;

.3 12 mm x 12 mm (½" x ½") aluminium mesh birdscreen;

.4 welded aluminium, minimum 300 mm (12") high insulated roof mounting curb with damper tray and curb seal;

.5 aluminium backdraft damper supplied loose, for site installation in roof curb damper tray;

.6 non-corrosive motorized damper supplied loose for site installation in roof curb damper tray, equal to T. A. Morrison TAMCO Series 9000 insulated damper with linkage, end switch, and a Belimo or equal motor with voltage to suit site control voltage requirements;

.7 factory secured seismic restraint connection hardware.

.2 Manufacturers:

.1 Greenheck Fan Corp.;

.2 Twin City Fan and Blower;

.3 PennBarry.

.4 Ventex.

2.40 HOODED TYPE VENTILATORS

.1 Low silhouette, rectangular, roof mounting hooded penthouse type ventilators in accordance with drawing schedule, each constructed of aluminium, supplied in knock-down form for site assembly, and each complete with:

.1 full 360° perimeter hood opening;

.2 12 mm x 12 mm (½" x ½") aluminium mesh bird screen;

.3 welded aluminium, minimum 300 mm (12") high insulated roof mounting curb with damper tray and curb seal;

.4 aluminium backdraft damper supplied loose for site installation in roof curb damper tray;

.5 non-corrosive motorized damper supplied loose for site installation in roof curb damper tray, equal to T. A. Morrison TAMCO Series 9000 insulated damper with linkage, end switch, and a Belimo or equal motor with voltage to suit site control voltage requirements;

.6 factory secured seismic restraint connection hardware.

.2 Manufacturers:

.1 Greenheck Fan Corp.;

.2 Twin City Fan and Blower;

.3 PennBarry.

2.41 INTAKE WALL BOX

.1 Equal to Reversomatic SWBL-INTAKE wall boxes leakproof seamless construction, extruded aluminum grille, sized as shown, complete with stainless steel fasteners, and all required accessories to suit the application. Contractor to coordinate colour and finish with colour as selected from manufacturer's standard colour range as noted in schedule.

2.42 EXHAUST WALL BOX

.1 Equal to Reversomatic SWBL wall boxes leakproof seamless construction, extruded aluminum grille, sized as shown, complete with stainless steel fasteners, neoprene backdraft damper, and all required accessories to suit the application. Contractor to coordinate colour and finish with colour as selected from manufacturer's standard colour range as noted in schedule.

PART 3 - EXECUTION

3.1 CLEANLINESS REQUIREMENTS FOR HANDLING AND INSTALLATION OF DUCTWORK

.1 Handle and install ductwork in accordance with SMACNA's Duct Cleanliness for New Construction Guidelines at the Advanced Level.

3.2 FABRICATION AND INSTALLATION OF GALVANIZED STEEL DUCTWORK

.1 Provide required ductwork, rectangular, round and/or flat oval. Where rectangular ductwork is shown, round or flat oval ductwork of equivalent cross-sectional area is acceptable.

.2 It is to be understood that all duct dimensions shown on drawings are clear internal dimensions.

.3 Unless otherwise specified, construct and install ductwork in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible to suit duct pressure class designation of minimum 500 Pa (2" w.c.) positive or negative as applicable, a minimum velocity of 10 m/s (2000 fpm), and so ductwork does not "drum". Flat surfaces of rectangular ductwork are to be cross-broken or beaded per SMACNA standards. Duct system sealing is to meet ANSI/SMACNA Seal Class A requirements.

.4 Variable air volume ductwork from supply fans to boxes is as above but rectangular duct take-offs are double side straight taper type with a take-off length equal to 0.5 times the branch duct width but minimum 150 mm (6") length, and double taper side is to have an included angle of minimum 60°.

.5 Confirm routing of all ductwork at site and site measure ductwork prior to fabrication. Duct dimensions may be revised to suit site routing and building element requirements, if dimension revisions are reviewed with and approved by the Consultant. Duct routing and/or dimension revisions to suit conditions at site are not grounds for a claim for an extra cost.

.6 Refer to structural drawings. Where ductwork is to be run within or through open web steel joists, ductwork shown on mechanical drawings is schematic only and is to be altered as required to suit steel joist configuration, spacing, panel points, and cross-bridging at no additional cost.

.7 Wherever ductwork is required at locations where sprayed fireproofing is applied to building construction, install ductwork only after fireproofing work is complete and do not compromise fire rating of sprayed fireproofing.

.8 Install (but do not connect) duct system mounted automatic control components supplied as part of the automatic control work.

.9 Where indicated, provide duct connections to fan powered heat transfer equipment with integral coils.

.10 Flange connect ductwork to hot water reheat coils in accordance with requirements of ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible. Coils will be suspended independent of connecting ductwork as part of the heat transfer work.

.11 Support horizontal rectangular ducts inside building in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible, but use trapeze hangers with, unless otherwise specified, galvanized steel channels, and galvanized steel hanger rods for exposed ducts and concealed ducts wider than 500 mm (20"). Support hardware constructed of same material as duct for metal duct, and, unless otherwise specified, type 316 stainless steel for non-metal duct. Supports for "heavy" duct such as cementitious core duct is to be suitable in all respects for the application and approved by the Consultant.

.12 Support round and flat oval ducts inside building in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible, but, unless otherwise specified, for both uninsulated

and insulated ducts exposed in finished areas, use bands and secure at top of duct to a hanger rod, all similar to Ductmate Canada Ltd. type "BA". If duct is insulated, size strap to suit diameter of insulated duct. Unless otherwise specified, duct support hardware for metal duct is constructed of same material as duct, and for non-metal duct, type 316 stainless steel.

.13 Where flanged duct joints are used, do not locate joints in wall or slab openings, or immediately at wall or slab openings. Do not use flanged joints for exposed uninsulated ducts in finished areas.

.14 Where watertight horizontal ductwork is required, construct ducts without bottom longitudinal seams. Solder or weld joints of bottom and side sheets. Seal all other joints with duct sealer. Slope horizontal duct to hoods, risers, or drain points. Provide drain points. Provide watertight ductwork for:

.1 ductwork outside building or otherwise exposed to the elements;

.2 dishwasher exhaust;

.3 shower exhaust ducts from grilles to duct main or riser;

.4 minimum of 3 m (10') upstream and downstream of duct mounted humidifiers or humidifier manifolds;

.5 fresh air intakes;

.6 wherever else shown.

.15 Leakage Testing:

.1 Ductwork leakage is not to exceed following:

.1 ductwork to 2" W.C. Class, 1% of total air quantity handled by respective fans;

.2 ductwork exceeding 2" W.C. Class, 2% of total air quantity handled by respective fans.

.2 Leakage testing is to be performed by the Testing, Adjusting and Balancing (TAB) agency in accordance with SMACNA HVAC Air Duct Leakage Test Manual and is to be witnessed by the Consultant.

.3 Leakage test following ductwork:

.1 [ ];

.2 [ ].

.4 Be responsible for following:

.1 preparing duct systems for leakage testing prior to installation of external insulation including capping duct runouts and provision of final tap-in for test equipment;

.2 schedule testing with TAB agency in advance, be present for all testing and ensure notice is given to the Consultant so they may witness testing;

.3 resealing and/or replacement of defective ductwork;

.4 bearing all costs associated with retesting ductwork which has failed to pass leakage testing.

.16 Seal all ductwork in accordance with SMACNA Seal Class "A", except for round duct with self-sealing gasketed fittings and couplings which does not require site applied sealant. Apply sealants by brush or gun to cleaned metal surfaces. Where bare ductwork is exposed apply neat uniform lines of sealant. Randomly brushed, sloppy looking sealant applications will be rejected and must be repaired or replaced with a neat application of sealant.

.17 Apply sealants by brush or gun to cleaned metal surfaces. Where bare ductwork is exposed apply neat uniform lines of sealant. Randomly brushed, sloppy looking sealant applications will be rejected and must be repaired or replaced with a neat application of sealant.

.18 Clean exterior exposed (uninsulated) ducts and coat with a heavy full coverage of Bakor #410-02 black metal paint.

.19 Where dissimilar metal ducts are to be connected, isolate ducts by means of flexible duct connection material.

.20 Equip ducts with a dimension of 600 mm (24") and larger and located in mechanical equipment rooms of any kind with hanger rods equipped with double deflection neoprene rod isolation hangers properly sized for associated load. Also refer to Section 20 05 48.16 – Seismic Controls for Mechanical Systems.

.21 In addition to SMACNA duct construction standards specified above, ductwork is to be constructed and installed to meet seismic requirements of British Columbia Building Code and ANSI/SMACNA The Seismic Restraint Manual: Guidelines for Mechanical Systems.

3.3 INSTALLATION OF ALUMINUM DUCTWORK

.1 Provide aluminum ductwork, rectangular or round.

.2 Provide aluminium ductwork for:

.1 [ ];

.2 [ ].

.3 Wherever bare aluminum ductwork comes in contact with ferrous metal or copper, paint ferrous metal or copper surface with a heavy, 100% covering coat of zinc chromate paint, asphalt paint or otherwise isolate direct contact with the bare aluminum.

.4 Refer to "Commentary on Aluminum Ducts" in ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible, however, do not use drive and S cleats for joining waterproof aluminum ductwork. Use following SMACNA joining methods:

.1 T-21 - welded flange;

.2 T-22 - companion angle and gasket;

.3 T-24A - flanged.

.5 Keep longitudinal joints at top surface of horizontal runs. Provide proper transverse supports to prevent deflection. Ensure duct is rigid.

.6 When mastic is used for sealing such as sealing longitudinal joints, apply mastic to both surfaces before they are mated. When dry, apply mastic again for a water-tight seal.

3.4 INSTALLATION OF STAINLESS STEEL DUCTWORK

.1 Provide stainless steel ductwork, round or rectangular.

.2 Provide stainless steel ductwork as follows:

.1 [ ];

.2 [ ].

.3 Exposed stainless steel kitchen exhaust duct is to be minimum #16 gauge and of welded construction with pickled and passivated welds which are ground to a finish to match duct finish.

3.5 INSTALLATION OF FIBREGLASS REINFORCED PLASTIC (FRP) DUCTWORK

.1 Provide rectangular fibreglass reinforced plastic ductwork.

.2 Provide FRP ductwork for:

.1 [ ];

.2 [ ].

.3 Generally, install duct in accordance with duct manufacturer's instructions and requirements of SMACNA publication entitled "Thermoset FRP Duct Construction Manual".

.4 Secure duct in place with type 316 stainless steel angles, straps, hanger rods, and accessories. Provide strips of felt or neoprene material between duct and hanging and support hardware.

3.6 INSTALLATION OF ROUND PVC COATED GALVANIZED STEEL DUCTWORK

.1 Provide round PVC coated galvanized steel ductwork.

.2 Provide round PVC coated galvanized steel ductwork for:

.1 [ ];

.2 [ ].

.3 Underground ductwork is to be constructed to SMACNA Positive Pressure Class 10" w.c. with minimum metal gauges as follows:

.1 150 mm (6") through 350 mm (14") dia. - #28 gauge;

.2 400 mm (15") through 660 mm (26") dia. - #26 gauge;

.3 685 mm (27") through 915 mm (36") dia. - # 24 gauge;

.4 940 mm (37") through 1.27 m (50") dia. - #20 gauge.

.4 Install underground ductwork in accordance with requirements and details for underslab duct in ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible.

3.7 INSTALLATION OF FABRIC DUCTWORK

.1 Provide fabric ductwork.

.2 Secure duct from structure by means of tension cable and suspension components supplied with ductwork.

.3 Install tension cable and suspension components in accordance with duct manufacturer's instructions.

.4 Provide metal duct connection collars as required.

.5 Start-up fabric duct system in accordance with manufacturer's instructions.

.6 Do not penetrate fire barriers with fabric duct.

3.8 INSTALLATION OF FLEXIBLE DUCTWORK

.1 For supply air ductwork, provide maximum 1.8 m fully stretched, long lengths of flexible ductwork for connections between galvanized steel duct mains and branches, and necks of ceiling grilles and diffusers. Do not install flexible ductwork through walls, even if shown on drawings.

.2 For return air ductwork, provide maximum 1.0 m fully stretched, long lengths of flexible ductwork for connections between galvanized steel duct mains and branches, and necks of ceiling grilles. Do not install flexible ductwork through walls, even if shown on drawings.

.3 At rectangular galvanized steel duct, accurately cut holes and provide flanged or "Spin-in" round flexible duct connection collars. Seal joints with duct sealer.

.4 Install flexible ducts as straight as possible and support in accordance with requirements of ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible, and secure at each end with nylon or stainless steel gear type clamps, and seal joints. Provide long radius duct bends where they are required.

.5 Do not penetrate fire barriers with flexible duct.

3.9 INSTALLATION OF ACOUSTIC LINING

.1 Provide acoustic lining in ductwork in locations as follows:

.1 wherever shown and/or specified on drawings;

.2 supply ductwork downstream of air terminal boxes for a distance of 2.4 m (8') measured along duct and outward from box in all directions;

.3 all transfer air ducts.

.2 Install lining in accordance with requirements of ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible, however, for all installations regardless of velocity, at leading and trailing edges of duct liner sections, provide galvanized steel nosing channel in accordance with detail entitled Flexible Duct Liner Installation found in the ANSI/SMACNA manual referred to above.

3.10 INSTALLATION OF FIRE RATED DUCTWORK

.1 Provide 2 hour fire rated ductwork.

.2 Install ductwork in strict accordance with duct manufacturer’s instructions using support hardware supplied with duct.

.3 When installation is complete, arrange, and pay for duct manufacturer to visit site and examine duct installation. Make any revisions requested by manufacturer, and when manufacturer is satisfied with installation, obtain and submit a letter certifying proper installation in accordance with ULC requirements.

3.11 INSTALLATION OF SHEET STEEL KITCHEN GREASE EXHAUST DUCTWORK

.1 Provide welded sheet steel kitchen grease exhaust ductwork from exhaust hood(s) to roof mounted exhaust fans, all in accordance with requirements of NFPA 96. Construct ductwork watertight with continuous externally welded seams and joints, cleanouts, duct expansion provisions, riser residue traps, etc.

.2 Clean and prime coat ground welds in black steel ducts.

.3 Support ductwork at not greater than 1.5 m (5') intervals and ensure fasteners at hangers do not penetrate duct. Install without forming dips, sags, or traps where grease reside might collect, and locate access door/cleanouts for ease of maintenance.

.4 Slope horizontal ductwork 25 mm per 300 mm (1" per foot) back to exhaust hood.

3.12 INSTALLATION OF IN-SLAB DUCTWORK

.1 Provide in-slab concrete encased ductwork, complete with required fittings and accessories.

.2 Install duct with support brackets supplied with duct and coordinated with location of reinforcing steel, post tensioning cables, and any other structural slab component. Install duct in strict

accordance with manufacturer's installation instructions and requirements of the Consultant. Ensure all joints are water-tight.

.3 Confirm finish of exterior discharge fittings with the Consultant prior to ordering.

3.13 INSTALLATION OF CASINGS AND PLENUMS

.1 Provide required shop or site fabricated casings and plenums. Unless otherwise specified or shown, construct casings and plenums of same material as connecting duct system.

.2 Construct and install casings and plenums in accordance with Chapter 6 of ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible to suit systems' pressure classification. Ensure plenums and casings secured to building structure are gasketed air-tight and equipped with angle reinforcing.

.3 Provide drain pans with accessible trapped drains for fresh air intake plenums, and wherever else shown.

.4 In addition to SMACNA duct construction standards specified above, casings and plenums are to be constructed and installed to meet seismic requirements of British Columbia Building Code and ANSI/SMACNA - The Seismic Restraint Manual: Guidelines for Mechanical Systems.

3.14 INSTALLATION OF ACOUSTIC PANELS

.1 Provide acoustic panels for plenums. Integrate acoustic plenums with standard casings and plenums. Install acoustic panels in strict accordance with manufacturer's instructions. Seal panels with acoustic caulking where pipes, ducts or conduit penetrate and make air and watertight.

.2 Provide floor to ceiling high acoustic plenums where shown, each complete with required framing, including framing for access doors and other openings, each structurally designed to resist excessive deflection or bowing, constructed to be air-tight when subjected to a pressure differential of 2.48 kPa (0.36 psi), and designed so any one panel can be removed without dismantling entire plenum.

.3 Provide acoustic type access doors where shown, and provide acoustic caulking at all locations where acoustic plenums abut building walls or slabs, and at all points where pipe, ducts or conduit penetrate acoustic panels.

.4 In addition to SMACNA duct construction standards specified above, acoustic plenums are to be constructed and installed to meet seismic requirements of [British Columbia Building Code] and ANSI/SMACNA, The Seismic Restraint Manual: Guidelines for Mechanical Systems.

3.15 INSTALLATION OF CASING AND PLENUM ACCESS DOORS

.1 Provide access doors into all site or shop fabricated casings and plenums requiring access, and wherever shown.

.2 Construct access doors to open in or out to suit positive and negative pressures of system.

.3 Provide pitot tube openings in access doors where required for system air quantity balancing purposes.

.4 Provide suitably sized, engraved, red-white laminated Lamacoid warning nameplates on access doors into casings and plenums where equipment is located, i.e. fans.

3.16 INSTALLATION OF ROUND TO RECTANGULAR DUCT CONNECTIONS

.1 Cut round holes in rectangular ducts and provide round to rectangular lock-in fittings with dampers for connection of flexible round ductwork.

3.17 INSTALLATION OF SPLITTER DAMPERS

.1 Provide splitter dampers in supply ductwork at branch duct connections off supply air mains, and wherever else shown and/or specified on drawings. Install splitter dampers so they cannot vibrate and rattle and so damper operation mechanisms are in an easily accessible and operable location. Ensure operators for dampers in insulated ducts are equipped with stand-off mounting brackets.

3.18 INSTALLATION OF TURNING VANES

.1 Provide turning vanes in ductwork elbows where shown on drawings and wherever else required where, due to site installation routing and duct elbow radius, turning vanes are recommended in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible.

.2 Provide volume extractor type turning vanes in short branch supply duct connections off mains to grilles and diffusers where shown and/or specified.

3.19 INSTALLATION OF MANUAL BALANCING (VOLUME) DAMPERS

.1 Provide manual balancing dampers as required to provide a fully balanced system, including but not limited to in all open end ductwork, in all duct mains, and wherever else shown and/or specified.

.2 Install dampers so operating mechanism is accessible and positioned for easy operation, and so dampers cannot move or rattle. Ensure operating mechanisms for dampers in insulated ducts are complete with stand-off mounting brackets.

.3 Where a duct for which a balancing damper is required has dimensions larger than dimensions of maximum size volume damper available, provide multiple dampers bolted together in a properly sized assembly, or bolted to a heavy-gauge black structural steel angle or channel framework which is properly sized. Seal to prevent air by-pass, and provide connecting linkage.

.4 Confirm exact damper locations with personnel doing air quantity balancing testing work and install dampers to suit. Include for providing 5 additional dampers at no additional cost.

3.20 INSTALLATION OF BACKDRAFT DAMPERS

.1 Provide backdraft dampers.

.2 Install and secure dampers so they cannot move or rattle.

3.21 INSTALLATION OF FUSIBLE LINK DAMPERS

.1 Provide fusible link dampers. Ensure damper rating (1-½ or 3 hr) is suitable for fire barrier it is associated with.

.2 Install dampers with retaining angles on all 4 sides of sleeve on both sides of damper and connect with ductwork in accordance with damper manufacturer’s instructions and details, and Code requirements.

.3 Provide expansion clearance between damper or damper sleeve and opening in which damper is required. Ensure openings are properly sized and located, and all voids between damper sleeve and opening are properly sealed to maintain rating of fire barrier.

.4 Where size of fire barrier opening requires use of a sectionalized fire damper assembly, provide multiple fusible link dampers (sized to CAN/ULC S112) bolted together in a properly sized assembly or bolted to a heavy-gauge black structural steel angle or channel framework.

3.22 INSTALLATION OF COMBINATION FIRE/SMOKE DAMPERS

.1 Provide combination fire/smoke dampers. Install dampers with retaining angles on all 4 sides of each side of damper, and, where required, connect with ductwork, all in accordance with damper manufacturer's instructions and details, and Code requirements.

.2 Coordinate damper installation with electrical work where electrical connections to damper actuators are specified.

3.23 INSTALLATION OF SMOKE DAMPERS

.1 Provide smoke dampers. Install dampers with retaining angles on all 4 sides of sleeve on both sides of damper and connect with ductwork in accordance with damper manufacturer's instructions and details, and Code requirements.

.2 Coordinate damper installation with electrical work where electrical connections to damper actuators are specified.

.3 Where size of fire barrier opening requires use of a sectionalized fire damper assembly, provide multiple smoke dampers (sized to CAN/ULC S112) bolted together in a properly sized assembly or bolted to a heavy-gauge black structural steel angle or channel framework.

3.24 INSTALLATION OF FLEXIBLE CONNECTION MATERIAL

.1 Provide a minimum of 100 mm (4") of flexible connection material where ducts, plenums, and/or easings connect to fans, and wherever else shown or specified.

.2 Rigidly secure a minimum of 75 mm (3") of duct material (minimum #24 gauge) to each edge of flexible fabric and to fan, duct, plenum, etc., in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible. Ensure connections to flexible fabric material are arranged and supported so as to not impose any external forces on the fabric.

.3 For system [_____] use high temperature flameproof flexible connection material.

3.25 INSTALLATION OF ROOF MOUNTED DUCT SUPPORTS

.1 Supply supports for roof mounted ductwork.

.2 Hand adjustable structural supports to roofing trade on roof for installation and flashing into roof construction as part of roofing work. Accurately mark exact locations and spacing of structural supports and supervise installation. Provide properly sized hot dip galvanized structural steel angles between structural supports and secure in place on support studs. Support ductwork on the angles and provide galvanized steel banding to secure ducts to the angles.

3.26 INSTALLATION OF PRESSURE RELIEF DOORS

.1 Provide pressure release access doors to prevent duct system explosion or implosion as a result of a duct obstruction, i.e. closed fire damper, which prevents normal air flow through the system. Size access doors in accordance with requirements of Part 2 of this section.

.2 Where pressure release doors are shown in suction ducts or plenums, mount access door assembly so door swings in and latch mechanism is on the inside of duct or plenum. If latch mechanism is not accessible, provide a standard access door at latch side of the pressure release access door for maintenance purposes.

.3 Adjust each latch mechanism by means of the adjusting pin to suit static pressure of the particular system in accordance with latch mechanism manufacturer's instructions.

3.27 INSTALLATION OF DUCT ACCESS DOORS

.1 Provide access doors in ductwork for access to all components which will or may need maintenance and/or repair, including reheat coils. Install in accordance with requirements of ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible.

.2 Identify access doors provided for fusible link damper maintenance with "FLD" stencil painted or marker type red lettering and ensure doors are properly located for damper maintenance.

.3 When requested, submit a sample of proposed duct access doors for review.

.4 Where sectionalized fusible link dampers and/or balancing dampers are provided in large ducts, provide a plenum type access door to suit, and adequately reinforce ductwork to suit access door installed.

3.28 INSTALLATION OF INSTRUMENTS TEST PORTS

.1 Provide instrument test ports in all main ducts at connections to fans, plenums, or casings, in all larger branch duct connections to mains, and wherever else required for proper air quantity balancing and testing.

.2 Locate test ports where recommended by personnel performing air quantity testing and balancing work.

3.29 INSTALLATION OF WIRE MESH (BIRDSCREEN)

.1 Provide framed, removable wire mesh panels over openings in ducts and/or walls where shown and/or specified on drawings. Rigidly secure in place but ensure panels are removable.

.2 Provide wire mesh panels for open-end return air ducts in ceiling spaces whether shown on drawings or not.

3.30 INSTALLATION OF LOUVRES

.1 Provide louvres for wall openings.

.2 Install louvre assemblies and secure in place in accordance with manufacturer’s instructions and details.

.3 Confirm exact louvre sizes and finish prior to ordering.

3.31 INSTALLATION OF LOUVRE BLANK-OFF PANELS

.1 Provide blank-off panels for inactive portions of exterior wall louvres.

.2 Secure panels in place with non-ferrous hardware so they cannot move or rattle, yet are easily removable.

.3 Confirm exact finish of panels prior to fabrication.

3.32 INSTALLATION OF BRICK AND BLOCK VENTS

.1 Supply brick or block vents for installation in exterior walls.

.2 Hand assemblies to masonry trade for installation.

.3 Accurately mark exact locations and coordinate installation.

3.33 INSTALLATION OF FIRE STOP FLAPS AND THERMAL BLANKETS

.1 Provide fire stop flaps in duct connection necks of grilles and diffusers installed in ULC fire rated suspended ceiling systems where shown on drawings.

.2 Provide thermal blanket material to completely cover grille and/or diffuser pans above suspended ULC fire rated ceilings. Cut, install, and secure in place in accordance with manufacturer's instructions and ULC requirements.

3.34 INSTALLATION OF GRILLES AND DIFFUSERS

.1 Provide grilles and diffusers. Wherever possible, grilles and diffusers are to be product of same manufacturer.

.2 Unless otherwise specified connect grilles and diffusers in accordance with requirements of SMACNA HVAC Duct Construction Standards Metal and Flexible.

.3 Exactly locate grilles and diffusers to conform to final architectural reflected ceiling plans and detailed wall elevations, and to conform to final lighting arrangement, ceiling layout, ornamental and other wall treatment.

.4 Equip supply diffusers having a basic 4-way or all round air pattern for operation in 1-, 2-, or 3-way pattern where indicated on drawings.

.5 Attach troffer type diffusers associated with typical ceiling mounted fluorescent lighting fixtures to the fixtures on floor prior to fixture installation in ceiling. When fixtures are installed, connect diffuser boots with flexible ductwork.

.6 Provide sheet metal plenums, constructed of same material as connecting duct, for linear grilles and/or diffusers where shown. Construct and install plenums in accordance with requirements of SMACNA HVAC Duct Construction Standards Metal and Flexible. Where individual sections of linear grilles or diffusers are not equipped with a volume control device, equip duct connection collar(s) with volume control device(s).

.7 Where linear type diffusers/grilles are installed in suspended T-bar ceilings, clip diffusers/grilles in place using clip supplied by diffuser/grille manufacturer.

.8 Confirm grille and diffuser finishes prior to ordering.

3.35 INSTALLATION OF FAN FILTER DIFFUSERS

.1 Provide fan filter diffusers.

.2 Exactly locate fan filter diffusers to conform to final architectural reflected ceiling plans, and to conform to final lighting arrangement and locations of ceiling equipment.

.3 Install in strict accordance with manufacturer’s instructions, including gasket tape on T-bar ceiling members at unit locations. Plug each unit into an adjacent ceiling receptacle.

.4 Brace and secure each unit in accordance with requirements specified in Section 20 05 48.16 – Seismic Controls for Mechanical Systems.

.5 For equipment/system manufacturer certification requirements, refer to Section 20 05 00 – Common Work Results for Mechanical.

.6 For equipment/system start-up requirements, refer to Section 20 05 00 – Common Work Results for Mechanical.

.7 Include for a 1/2 day on-site operation demonstration and training session. Training is to be a full review of all components including, but not limited to, a full operation and maintenance demonstration.

3.36 SUPPLY OF DOOR GRILLES

.1 Supply door grilles as shown and scheduled.

.2 Hand grilles to appropriate trade at site for installation.

3.37 INSTALLATION OF ROOF MOUNTED GRAVITY VENTILATORS

.1 Provide roof mounted gravity ventilators.

.2 Supply a roof mounting curb with each ventilator and hand curbs to roofing trade on roof for mounting and flashing into roof construction as part of the roofing work. Site assemble gravity ventilators as required, and secure in place on curbs.

.3 Brace and secure each unit in accordance with requirements specified in Section 20 05 48.16 – Seismic Controls for Mechanical Systems.

.4 Install dampers in curb damper tray and secure in place.

3.38 INSTALLATION OF INTAKE AND EXHAUST WALL BOXES

.1 Supply brick or block vents for installation in exterior walls.

.2 Hand assemblies to masonry trade for installation.

.3 Accurately mark exact locations and coordinate installation.

3.39 DUCT SYSTEM PROTECTION, CLEANING AND START-UP

.1 Temporarily cover all open ends of ducts during construction.

.2 Remove all dirt and foreign matter from entire duct systems and clean duct system terminals and interior of air handling units prior to operating fans.

.3 Prior to starting any supply air handling system provide 50 mm (2") thick glass fibre construction filters at fan equipment in place of permanent filters.

.4 Provide cheesecloth over duct system inlets and outlets and run system for 24 hours, after which remove cheesecloth and construction filters, and install new permanent filters.

.5 Include all labour for a complete site walk-through with testing and balancing personnel following route of all duct systems to be tested, adjusted, and balanced for the purpose of confirming proper position and attitude of dampers, location of pitot tube openings, and any other work affecting testing and balancing procedures. Perform corrective work required as a result of this walk-through.

END OF SECTION

PART 1 - GENERAL

1.1 SUBMITTALS

.1 Submit shop product data sheets for silencers. Include all construction, acoustic and aerodynamic performance data, and details with submission. Acoustical data is to demonstrate that duct systems with silencers will reduce mechanical fan system noise to required levels in occupied spaces.

.2 Submit manufacturer's test data to indicate results of factory tests on the silencers prior to shipment.

.3 Submit a copy of the silencer manufacturer's National Voluntary Laboratory Accreditation Program (NVLAP) accreditation certificate for ASTM E477 test standards.

1.2 CLOSEOUT SUBMITTALS

.1 Submit an installation certification letter from silencer manufacturer as specified in Part 3 of this section.

1.3 QUALITY ASSURANCE

.1 Silencer performance must be substantiated by laboratory testing in a duct-to-reverberant room test facility according to ASTM E477, Standard Test Method for Measuring Acoustical and Airflow Performance of Duct Liner Material and Prefabricated Silencers.

.2 Silencer acoustic media and any lining/wrapping material must have a maximum flame spread rating of 25 and a smoke developed rating of 50 when tested in accordance with CAN/ULC-S102, Surface Burning Characteristics of Building Materials, and Accessories.

.3 All silencer surfaces in contact with airstream are to be in accordance with ANSI/ASHRAE 62.1, Ventilation for Acceptable Indoor Air Quality.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Vibro-Acoustics Ltd.;

.2 Kinetics Noise Control Vibron Products Group;

.3 Price Industries Inc.

2.2 GENERAL RE: SILENCERS

.1 Silencers are to be factory fabricated by same manufacturer and are to be in accordance with drawing schedule, and tested in accordance with ASTM E477 through National Voluntary Laboratory Accreditation Program (NVLAP) with valid accreditation certificate.

.2 Silencer inlet and outlet dimensions are to be equal to duct sizes shown on drawings. Unless otherwise shown or specified, transitions will not be permitted.

.3 Silencers are to be constructed in accordance with SMACNA HVAC Duct Construction Standards Metal and Flexible, to suit duct system pressure and velocity classification. Unless otherwise specified, casing seams and joints are to be lock-formed and sealed or stitch welded and sealed, and silencers are to be constructed so as not to fail when subjected to an internal static pressure of 3.9 kPa (8" wg).

.4 Perforated steel is to be adequately stiffened to ensure flatness and form, and welds are to be shop painted with zinc rich paint.

.5 Silencers are to be shipped with factory installed end caps.

.6 Galvanized steel is to be in accordance with ASTM A653.

2.3 OUTER CASING MATERIALS

.1 Rectangular Straight and Transitional Straight Silencers: minimum #22 gauge lock forming quality galvanized steel.

.2 Elbow and Transitional Elbow Silencers: minimum #18 gauge for elbow lock forming quality galvanized steel.

.3 High Transmission Loss (HTL) Rectangular and Elbow Silencers: #16 or #10 gauge stitch-welded and caulked galvanized steel in accordance with drawing schedule.

.4 Circular Silencers: Lock forming quality galvanized steel with minimum gauges as follows:

.1 300 mm to 660 mm (12" to 26") dia. - #22 gauge;

.2 675 mm to 1.52 m (27" to 60") dia. - #18 gauge;

.3 1.55 m to 2.13 m (61" to 84") dia. - #16 gauge.

2.4 INTERIOR BAFFLE-LINER-BULLET MATERIAL

.1 Minimum #22 gauge lock forming quality galvanized steel.

2.5 INTERIOR BAFFLE TRANSITION

.1 Transitioning for interior transition silencers is to occur internal to silencer such that height of air passage is uniformly changing with the length of the air passage.

2.6 ACOUSTIC MEDIA MATERIAL

.1 Except for no media silencers, and unless otherwise specified, inert, inorganic glass fibre of a density to obtain specified acoustic performance, packed under not less than 5% compression to eliminate voids due to vibration and settling.

.2 For silencers as specified and/or scheduled, acoustic quality insulation which does not contain any formaldehydes, phenolic resins, or volatile organic compounds that can off-gas, but containing cotton fibres treated with an EPA registered non-toxic borate solution, "flash dried" to actively inhibit the growth of mould, mildew, bacteria, and fungi.

.3 No media silencers are not to contain absorptive media of any kind, achieve attenuation with controlled impedance membranes and broadly tuned resonators.

2.7 ACOUSTIC MEDIA PROTECTION MATERIAL

.1 Material for lining/wrapping acoustic media to help prevent shedding and erosion, in accordance with drawing schedule, is to be:

.1 Tedlar film material separated from perforated metal liner with a 12 mm (½") thick acoustically transparent spacer;

.2 glass fibre cloth.

2.8 ALTERNATIVE SILENCER MATERIALS

.1 Where indicated on drawing silencer schedule, types 304 or 316 stainless steel or aluminum silencer material is to be used.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Provide silencers. Ensure silencers are installed with airflow arrows in the direction of airflow.

.2 Support each silencer independent of connecting ductwork.

.3 Properly layout ductwork for silencer locations to provide a minimum of 5 diameters of straight duct upstream of silencer and 10 diameters of straight duct downstream of silencer.

.4 Unless otherwise specified, do not install silencers in walls or slabs.

.5 Where cross-talk silencers penetrate partition walls, seal joint between perimeter of silencer and the wall, on both sides of the wall, with proper acoustic caulking.

.6 Seal all silencer connections to ducts with proper fire/smoke rated duct sealer.

3.2 FIELD QUALITY CONTROL

.1 When silencer installations are complete, arrange, and pay for silencer manufacturer to examine silencer installations. Perform any corrective work required by manufacturer, then obtain from manufacturer and submit a signed letter certifying proper installation and operation of all silencers.

END OF SECTION

PART 1 - GENERAL

1.1 SUBMITTALS

.1 Submit shop drawings/product data sheets for fans and accessories. Include following:

.1 certified fan performance curves at specified operating point with flow, static pressure and HP clearly plotted;

.2 certified sound power data that conforms to specified levels;

.3 product data sheets for all accessories;

.4 product data sheets for fan motors.

1.2 CLOSEOUT SUBMITTALS

.1 Submit with delivery of each unit a copy of the factory inspection report, and include a copy of each report with O&M Manual project closeout data.

.2 Submit a site inspection and start-up report from manufacturer's representative as specified in Part 3 of this section.

.3 Supply reviewed copies of fan/curb assembly shop drawings or product data to trade who will cut roof openings for fans, and ensure openings are properly located.

.4 Supply reviewed copies of fan assembly shop drawings or product data to trade who will form/prepare wall openings for fans, and ensure openings are properly located.

.5 Submit a signed copy of destratification fan manufacturer's 5 year extended parts and labour warranty.

.6 Submit a signed copy of ceiling mounted fan manufacturer's extended 3 year warranty.

.7 Training attendance records.

1.3 QUALITY ASSURANCE

.1 Fan manufacturers, as applicable, are to be current members of the Air Movement and Control Association International Inc. (AMCA), and fans are to be rated (capacity and sound performance) and certified in accordance with requirements of following standards:

.1 ANSI/AMCA Standard 210, Laboratory Method of Testing Fans for Certified Aerodynamic Performance Rating;

.2 AMCA Standard 211, Product Rating Manual for Fan Air Performance;

.3 ANSI/AMCA Standard 300, Reverberant Room Method for Sound Testing of Fans;

.4 AMCA Standard 311, Product Rating Manual for Fan Sound Performance;

.5 AMCA Standard 99-2408, Operating Limits for Centrifugal Fans.

PART 2 - PRODUCTS

2.1 CENTRIFUGAL FANS

.1 Centrifugal fans in accordance with drawing schedule, each capable of operating over the complete pressure class limits as specified in AMCA Standard 99-16.

.2 Continuously welded heavy-gauge steel housing, braced and reinforced as required to prevent vibration or pulsation, equipped with a discharge flange, spun, aerodynamically designed inlet cones or venturies with wire grid guards, drain plug, and epoxy enamel coated both inside and outside to a 3 mm dry film thickness.

.3 Continuously welded, stable, non-overloading wheel with die-formed steel blades and, unless otherwise required, a cast iron hub, statically and dynamically balanced prior to assembly, then balanced as an assembly and braced and secured to base prior to shipment.

.4 AISI C1040 or C1050 hot rolled steel fan shaft, accurately turned, ground, polished, and ring gauged for accuracy, and sized for a first critical speed of at least 1.25 times the maximum rated speed for fan, and heavy-duty, grease lubricated, ball or roller, self-aligning pillow block type bearings selected for an AFBMA L-10 minimum average bearing life in excess of 200,000 hours, and equipped with extended copper lubrication lines terminated in lubrication fittings immediately inside fan section access door.

.5 NEMA Premium TEFC motor, adjustable V-belt drive selected for 40% service factor based on motor nameplate data, and OHSA guard, all in accordance with requirements of Section 20 05 00 – Common Work Results for Mechanical.

.6 Fan and motor support base is to be rigid, welded structural steel, vibration isolated base with steel cross members, factory cleaned, deburred, and finished with epoxy enamel, and complete with a slide type motor base and stable, colour coded spring mounts with sound pads selected to suit static deflection and maximum equipment load and to operate at not greater than 2/3 solid load, and shipping restraints.

.7 Maximum acceptable sound power levels at the fan outlet are as follows:

Fan	Octave Bands							
	1	2	3	4	5	6	7	8
[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]

.8 Unless otherwise specified, finish is to consist of rust inhibiting primer applied to cleaned and deburred metal surfaces prior to assembly, then a second coat of primer after assembly and an air dried epoxy enamel finished coat both inside and outside to a 3 mm dry film thickness.

.9 Factory secured seismic restraint connection hardware.

.10 Manufacturers:

.1 Twin City Fan and Blower;

.2 Loren Cook Co.;

.3 Greenheck Fan Corp.;

.4 CML Northern Blower;

.5 PennBarry.

2.2 EXPLOSION-PROOF CENTRIFUGAL FANS

.1 Explosion-proof centrifugal fans in accordance with drawing schedule, each capable of operating over complete pressure class limits as specified in AMCA Standard 99-2408 and rated Spark A in accordance with AMCA Standard 99-0401, Classification for Spark Resistant Construction.

.2 Housing constructed as per ASTM Standard 99-0401 to suit "Spark" classification, with a wheel direct connected to an explosion-proof TEFC motor conforming to requirements specified in Section 20 05 00 – Common Work Results for Mechanical, statically and dynamically balanced prior to assembly, then balanced as an assembly and secured to base prior to shipment.

.3 Rigid, welded structural steel, vibration isolated fan support base with steel cross members, factory cleaned, deburred, and finished with epoxy enamel, and complete with stable, colour coded spring mounts with sound pads selected to suit static deflection and maximum equipment load and to operate at not greater than 2/3 solid load, and shipping restraints.

.4 Factory secured seismic restraint connection hardware.

.5 Manufacturers:

.1 Twin City Fan and Blower;

.2 Loren Cook Co.;

.3 Greenheck Fan Corp.;

.4 CML Northern Blower;

.5 PennBarry.

2.3 UTILITY FANS

.1 Centrifugal, single width and inlet, factory run tested utility fans in accordance with drawing schedule, and capable of operating over complete pressure class limits as specified in AMCA Standard 2408.

.2 Rotatable, continuously welded heavy-gauge steel housing, braced and reinforced as required to prevent vibration or pulsation, equipped with a spun, aerodynamically designed inlet cone, and an attached welded steel bearing and motor support platform.

.3 Riveted aluminum or welded steel wheel, statically and dynamically balanced.

.4 For belt driven fans only, AISI C1040 or C1045 hot rolled steel shaft, accurately turned, ground, polished, and ring gauged for accuracy, and sized for a first critical speed of at least 1.43 times maximum rated speed for fan, equipped with heavy-duty, grease lubricated, ball, pillow block type bearings, selected for a minimum average AFBMA L-50 bearing life of 200,00 hours at the maximum fan RPM, and secured to bearing support platform, and an adjustable V-belt drive with OHSA guard (weather cover) in accordance with requirements of Section 20 05 00 – Common Work Results for Mechanical.

.5 NEMA Premium TEFC motor conforming to requirements of Section 20 05 00 – Common Work Results for Mechanical.

.6 Unless otherwise specified, the finish is to consist of rust inhibiting primer applied to cleaned and deburred metal surfaces prior to assembly, then a second coat of primer after assembly and an air dried epoxy enamel finished coat both inside and outside to a 3 mm dry film thickness.

.7 Factory secured seismic restraint connection hardware.

.8 Manufacturers:

.1 Twin City Fan and Blower;

.2 Loren Cook Co.;

.3 Greenheck Fan Corp.;

.4 CML Northern Blower;

.5 PennBarry.

2.4 CENTRIFUGAL INLINE FANS

.1 Centrifugal, ULC listed, factory run tested rectangular inline fans in accordance with drawing schedule.

.2 Heavy-gauge galvanized steel housing with removable side panels to permit removal of power assembly without disturbing duct connections, universal mounting brackets and hardware including spring vibration isolators to accommodate horizontal or vertical mounting as required, a flanged inlet panel with inlet venturi, a flanged outlet panel, both with duct connection collars, and galvanized steel wire grid fan inlet/outlet guard(s).

.3 Non-overloading aluminium wheel with backward inclined blades with matching inlet venturi, statically and dynamically balanced as an assembly.

.4 For belt-drive fans only, hot rolled steel shaft, accurately turned, ground, and polished, and sized for a first critical speed of at least 1.25 times maximum rated speed for fan, and heavy-duty, self-aligning pillow block type bearings selected for an AFBMA L-50 minimum average life in excess of 500,000 hours and equipped with lubrication line and fitting, and an adjustable V-belt drive with guard conforming to requirements of Section 20 05 00 – Common Work Results for Mechanical.

.5 TEFC motor conforming to requirements specified in Section 20 05 00 – Common Work Results for Mechanical, mounted out of the airstream, complete with a cover, and factory pre-wired to a NEMA 4 disconnect switch.

.6 For fans as scheduled, factory supplied accessories as follows:

.1 for fans as scheduled, housing insulation (lining), consisting of neoprene spray coated glass fibre semi-rigid insulation meeting NFPA 90A requirements and 25/50 flame spread/smoke developed ratings when tested in accordance with CAN/ULC S102, permanently secured in place with no exposed edges;

.2 for fans as scheduled, a galvanized steel filter box with frame suitable for 25 mm (2") thick disposable panel type filters;

.3 factory secured seismic restraint connection hardware.

.7 Manufacturers:

.1 Twin City Fan and Blower;

.2 Loren Cook Co.;

.3 Greenheck Fan Corp.;

.4 JencoFan;

.5 Carnes Company Inc.

.6 PennBarry.

2.5 PLENUM FANS

.1 Centrifugal airfoil design plenum fans in accordance with drawing schedule, designed without a scroll type housing, and capable of operating over complete pressure class limits as specified in AMCA Standard 99-2408.

.2 Heavy-gauge reinforced steel inlet plate with perimeter square formed lip, spun steel inlet cone bolted to inlet plate for smooth airflow into venturi shaped inlet cone of the fan wheel, and a welded structural steel framework forming a mounting base and bearing support platform welded to the inlet plate.

.3 Non-overloading wheel with 9 backward inclined, die-formed, airfoil design steel blades continuously welded to a spun inlet cone, back plate, and cast iron hub, statically and dynamically balanced as an assembly, and designed for critical speeds of at least 1.25 times maximum class speed.

.4 For belt driven fans, AISI C1040 or C1050 hot rolled steel shaft, accurately turned, ground, polished and ring gauged for accuracy, and sized for a first critical speed of at least 1.25 times maximum rated speed for fan, and heavy-duty, grease lubricated, ball or roller self-aligning pillow block type bearings selected for an AFBMA L-10 minimum average life in excess of 200,000 hours and equipped with extended copper tube lubrication lines terminated in accessible lubrication fittings, and an adjustable V-belt drive selected for 40% service factor based on motor nameplate data and conforming to requirements specified in Section 20 05 00 – Common Work Results for Mechanical.

.5 NEMA Premium TEFC motor conforming to requirements specified in Section 20 05 00 – Common Work Results for Mechanical.

.6 Rigid, welded structural steel, vibration isolated fan and motor support base with steel cross members, factory cleaned, deburred, and finished with epoxy enamel, and complete with slide type motor base, and stable, colour coded spring mounts with neoprene sound pads selected to suit static deflection and to operate at not greater than 2/3 solid load, and equipped with shipping restraints.

.7 Rigid, open mesh galvanized steel screen enclosure with fan wheel access facilities, and a removable galvanized steel mesh inlet screen.

.8 Minimum acceptable AMCA sound power levels at the fan outlet are as follows:

Fan	Octave Bands							
	1	2	1	4	1	6	1	8
[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]

.9 Unless otherwise specified, factory finish is to consist of rust inhibiting primer applied to cleaned and deburred surfaces prior to assembly, then a second coat of primer after assembly and an air dried epoxy enamel finish applied to all inside and outside surfaces to a 3 mm dry film thickness.

.10 Factory secured seismic restraint connection hardware.

.11 Manufacturers:

.1 Twin City Fan and Blower;

.2 Loren Cook Co.;

.3 Greenheck Fan Corp.;

.4 CML Northern Blower;

.5 PennBarry.

2.6 ROOF MOUNTED EXHAUST FANS

.1 Centrifugal, ULC listed, factory run tested roof mounted exhaust fans in accordance with drawing schedule.

.2 Spun aluminium housing with deep venturi inlet, aluminium curb cap with continuously welded corners, pre-punched mounting holes, galvanized steel or aluminium bird screen, and EMT conduit chase to the motor compartment.

.3 Centrifugal, non-overloading aluminum wheel with backward inclined blades matched to inlet venturi, statically and dynamically balanced as an assembly.

.4 For belt-drive fans only, hot rolled steel shaft, accurately turned, ground, and polished, and sized for a first critical speed of at least 1.25 times maximum rated speed for fan, and one-piece grease lubricated pillow block type bearings selected for an AFBMA L-50 minimum average life in excess of 500,000 hours at maximum catalogue operating speed and equipped with a lubrication fitting, and a heavy-gauge galvanized steel adjustable V-belt drive with guard conforming to requirements of Section 20 05 00 – Common Work Results for Mechanical.

.5 Motors are to conform to requirements specified in Section 20 05 00 – Common Work Results for Mechanical, mounted on vibration isolation in a compartment outside of the airstream, and factory pre-wired to a NEMA 4 disconnect switch.

.6 Prefabricated, minimum 300 mm (12") high heavy-duty aluminum roof mounting curb with factory installed wood nailer, 40 mm (1-½") thick insulation, continuously welded seams, and damper tray.

.7 For fans as scheduled, factory supplied accessories as follows:

.1 gravity backdraft damper with #20 gauge galvanized steel frame and #26 gauge aluminum blades with felt edge blade seals;

.2 non-corrosive motorized damper with linkage, end switch, and motor with voltage to match fan motor;

.3 continuous non-corrosive piano type curb hinge to permit access to fan, damper and connecting duct, complete with retaining chain and a security hasp to prevent removal of unit from curb cap and prevent building entry through connecting ductwork;

.4 2-speed switch and 2-speed double winding 1-phase motor in accordance with Section 20 05 00 – Common Work Results for Mechanical;

.5 factory secured seismic restraint connection hardware.

.8 Manufacturers:

.1 Twin City Fan and Blower;

.2 Loren Cook Co.;

.3 Greenheck Fan Corp.;

.4 JencoFan;

.5 Carnes Company Inc.

2.7 SIDEWALL PROPELLER FANS

.1 Axial flow type, ULC listed, factory run tested propeller fans in accordance with drawing schedule.

.2 Heavy-gauge galvanized steel drive component frame bolted or welded to formed galvanized steel fan panel equipped with formed flanged edges, pre-punched mounting holes, and a deep formed inlet venturi.

.3 Fabricated steel blades unless otherwise specified, welded to a heavy-gauge steel hub, and dynamically balanced.

.4 For belt-drive fans only, AISI 1045 cold rolled steel shaft, accurately turned, ground, and polished, and sized for a first critical speed of at least 1.25 times maximum rated speed for fan, and grease lubricated or permanently lubricated, sealed, ball type pillow block bearings selected for an AFBMA L-50 minimum average life in excess of 200,000 hours at maximum fan RPM, with a variable pitch adjustable V-belt drive with guard conforming to requirements of Section 20 05 00 – Common Work Results for Mechanical.

.5 Motor in accordance with requirements specified in Section 20 05 00 – Common Work Results for Mechanical.

.6 Unless otherwise specified, all bare steel surfaces are to be cleaned, primed, and factory finished with epoxy equipment enamel.

.7 Factory supplied accessories as follows:

.1 #16 gauge G90 galvanized steel wall box with removable screen guard, equipped with mounting flanges with pre-punched holes;

.2 back draft damper with galvanized steel frame, aluminum blades with felt edge seals, stainless steel shaft, and OHSA damper guard;

.3 galvanized steel weather hood with removable galvanized steel wire mesh bird screen, with mounting flanges equipped with pre-punched mounting holes;

.4 OHSA motor side guard with galvanized steel side panels and removable galvanized steel wire mesh screen;

.5 factory secured seismic restraint connection hardware.

.8 Manufacturers:

.1 Twin City Fan and Blower;

.2 Loren Cook Co.;

.3 Greenheck Fan Corp.;

.4 JencoFan;

.5 Carnes Company Inc.;

.6 PennBarry.

2.8 CORROSION RESISTANT CENTRIFUGAL FANS

.1 Centrifugal FRP fans in accordance with drawing schedule, with drive arrangement and configuration as indicated on drawings, and capable of operating over complete pressure class limits as specified in AMCA Standard 99-2408.

.2 Aerodynamically designed housing with high efficiency inlet, manufactured from resins, UV inhibited, reinforced with fibreglass, and with bolts holding housing to support plate encapsulated in FRP, and no uncoated metal in contact with corrosive air stream. Each assembly is to be complete with graphite impregnated interior casing, lifting lugs, type 304 stainless steel fasteners, a FRP ridge inside casing to divert condensation from dripping over hub and shaft, a flanged inlet and outlet, and an impeller inspection and service access door.

.3 Backward curved FRP wheel electronically statically and dynamically balanced after assembly, with an integral metal back plate encapsulated in resin and with hub extended to outside housing, a removable FRP cap to cover impeller end of shaft, and a vacuum hub seal to prevent contaminated air from escaping from fan housing.

.4 For belt driven fans, type 316 stainless steel shaft, accurately turned, ground, polished, and ring gauged for accuracy, and sized for a first critical speed of at least 1.25 times maximum rated speed for fan, and complete with guard, and heavy-duty, sealed, grease lubricated, ball or roller, self-aligning pillow block type bearings selected for an AFBMA L-10 minimum average bearing life in excess of 200,000 hours, and equipped with extended copper lubrication lines terminated

in lubrication fittings at exterior of fan assembly, and an adjustable V-belt drive selected for 50% service factor based on motor nameplate data, with FRP OHSA guard in accordance with requirements of Section 20 05 00 – Common Work Results for Mechanical.

.5 NEMA Premium TEFC motor conforming to requirements of Section 20 05 00 – Common Work Results for Mechanical.

.6 Rigid, welded structural steel unitary fan and motor support base, factory cleaned and finished with 4 to 6 mm thick baked powder epoxy enamel.

.7 Factory secured seismic restraint connection hardware.

.8 Manufacturers:

.1 M. K. Plastics Corp.;

.2 New York Blower Co.;

.3 Pasticair Inc.

2.9 VANEAXIAL FANS

.1 Vaneaxial, ULC listed, factory run tested fans in accordance with drawing schedule.

.2 Heavy-gauge welded ASTM A-569 hot rolled steel housing with inlet and outlet flanges, and, on the discharge side of fan wheel, aerodynamically designed stationary straightening guide vanes welded to both inner cylinder and fan housing interior.

.3 Propeller type wheel, solid, one-piece casting of A356-T6 aluminium with 7 airfoil shape blades and an integral centre hub, machined to proper diameter, secured to fan/motor shaft by means of a taper-lock bushing, and statically and dynamically balanced as an assembly.

.4 For belt-drive fans only, AISI 1040 or 1045 hot rolled steel shaft, accurately turned, ground, and polished, and sized for a first critical speed of at least 1.43 times maximum rated speed for fan, and heavy-duty, self-aligning, grease lubricated pillow block type bearings selected for an AFBMA L-50 minimum average life in excess of 200,000 hours at maximum fan RPM and equipped with extended lubrication lines terminated at housing exterior in lubrication fittings, and an adjustable V-belt drive with guard conforming to requirements of Section 20 05 00 – Common Work Results for Mechanical. Drive assembly is to extend through a 2-piece aerodynamically shaped belt fairing welded continuously to both inner cylinder housing fan shaft and bearings, and fan housing.

.5 TEFC foot mounted motor conforming to requirements specified in Section 20 05 00 – Common Work Results for Mechanical.

.6 Steel surfaces of entire fan assembly, excluding fan shaft, are to be thoroughly degreased, deburred, coated with rust-preventive primer, and finished with equipment enamel. Coat fan shaft with a petroleum-based rust protectant.

.7 For fans as scheduled, factory supplied accessories as follows:

.1 vibration isolators;

.2 torosoidal shaped inlet bell, flanged, drilled and bolted to fan’s flanged inlet;

.3 galvanized steel wire grid fan inlet/outlet guard(s);

.4 inlet/outlet cones, flanged at both ends and drilled to match fan flanges;

.5 steel support legs welded to fan flanges;

.6 formed steel angle support clips welded to fan housing;

.7 factory secured seismic restraint connection hardware.

.8 Manufacturers:

.1 Twin City Fan and Blower;

.2 Loren Cook Co.;

.3 Greenheck Fan Corp.;

.4 CML Northern Blower;

.5 PennBarry;

.6 JencoFan;

.7 Carnes Company Inc.

2.10 CEILING MOUNTED DESTRATIFICATION FANS

.1 Northwest Envirofan "Gold Line" white, down-blowing, extra heavy-duty industrial grade, CSA certified direct drive ceiling mount destratification fans in accordance with drawing schedule, each complete with:

.1 curved aluminum fan blades secured to a steel hub;

.2 permanent magnet, brushless, non-ventilated, heat sink design motor rated for continuous operation at maximum speed in a 55°C (130°F) ambient temperature and capable of modulating fan speed from 0 to 100% without the use of a gearbox or other mechanical means of control, and a factory programmed controller housed in an enclosure independent of motor to minimize starting and braking torques, with a simple diagnostic program and a LED to identify and relay faults in system;

.3 250 mm (10") long down rod, a 330 mm (13") long galvanized steel safety chain, and all other required mounting and securing hardware;

.4 400 mm (16") long power cord with 3-prong plug, factory pre-wired to motor;

.5 "Protecto-Guard" welded wire fan guard sized to suit fan blade size;

.6 120 volt variable speed (Off-High-Low) solid-state infinite speed fan controller with stainless steel faceplate designed to mount to a 100 mm (4") outlet box and to control fan groupings as indicated on drawings;

.7 factory secured seismic restraint connection hardware.

.2 Manufacturers:

.1 Northwest Envirofan;

.2 Big Ass Fan Co.;

.3 Marley Engineered Products "Leading Edge".

2.11 CEILING MOUNTED FANS

.1 ULC listed and labelled ceiling mounted centrifugal, AMCA rated and certified (capacity and sound to AMCA Standards 211 and 311), exhaust fans in accordance with drawing schedule, complete with:

.1 minimum #20 gauge galvanized steel housing equipped with duct connection collar(s), integral spring loaded aluminum backdraft damper, 12 mm (½") thick acoustic insulation meeting 25/50 flame spread/smoke developed ratings when tested in accordance with CAN/ULC S102, multi-position mounting brackets, and an integral CSA certified electrical receptacle in an outlet box for plug-in connection of fan motor;

.2 low RPM, resiliently mounted, direct connected fan wheel and motor assembly with a forward curved, statically and dynamically balanced galvanized steel or calcium carbonate filled polypropylene centrifugal wheel direct connected to a 1-phase motor conforming to requirements specified in Section 20 05 00 – Common Work Results for Mechanical, and equipped with a length of power cord and plug;

.3 for fans as indicated and/or scheduled, a white calcium carbonate exhaust grille;

.4 factory supplied accessories in accordance with drawing schedule, as follows:

.1 rectangular to round duct transitions;

.2 roof cap with backdraft damper and birdscreen;

.3 wall cap with backdraft damper and birdscreen.

.2 Manufacturers:

.1 Twin City Fan and Blower;

.2 Loren Cook Co.;

.3 Greenheck Fan Corp.;

.4 CML Northern Blower;

.5 PennBarry.

2.12 ROOF MOUNTED FILTERED SUPPLY FANS

.1 Low profile louvre penthouse type, weatherproof, packaged, centrifugal, factory run tested, roof mounted filtered supply fans as per the drawing schedule.

.2 Hood is to be all aluminium welded structural framing and aluminium alloy blade extrusions with mitred corners, removable top cap pitched for water run-off, side access panel, expanded aluminium mesh bird screen, formed filter channels, 25 mm (1") thick glass fibre insulation meeting 25/50 flame spread/smoke developed ratings when tested in accordance with CAN/ULC S102, and an aluminium curb cap.

.3 Galvanized steel fan housing of lock seam construction, braced to minimize pulsation and/or vibration and complete with spun, aerodynamically designed inlet cones or venturies, duct adaptor designed to fit over roof curb and permit duct connection before fan is set in place, and a fan inlet screen.

.4 Centrifugal, non-overloading aluminum wheel with backward inclined blades continuously welded to rim and back plate, and statically and dynamically balanced as an assembly.

.5 Disposable, 50 mm (2") thick glass fibre media filters, ULC Class 2, 20% – 35% efficient, minimum MERV 6 as per ASHRAE 52.2, enclosed in permanent galvanized steel frames with metal retainers on both sides.

.6 ANSI 1040 or 1045 cold rolled steel shaft, accurately turned, ground, and polished, and sized for a first critical speed of at least 1.25 times maximum rated speed for fan, and one-piece grease lubricated pillow block type bearings selected for an AFBMA minimum average life in excess of 200,000 hours at maximum catalogue operating speed and equipped with zinc rich paint coated steel bearing supports and a lubrication fitting.

.7 Motor mounted on a slide type base and factory pre-wired to a NEMA 4 disconnect switch on unit casing, and adjustable V-belt drive with guard conforming to requirements of Section 20 05 00 – Common Work Results for Mechanical.

.8 Prefabricated, minimum 300 mm (12") high heavy-duty aluminum roof mounting curb with factory installed wood nailer, 40 mm (1-½") thick insulation meeting 25/50 flame spread/smoke developed ratings when tested in accordance with CAN/ULC S102, and continuously welded seams.

.9 Non-corrosive motorized damper supplied loose for site installation in connecting ductwork, equal to T. A. Morrison TAMCO Series 9000 insulated damper with linkage, end switch, and a Belimo or equal motor with voltage to match fan motor.

.10 Factory secured seismic restraint connection hardware.

.11 Manufacturers:

.1 Twin City Fan and Blower;

.2 Loren Cook Co.;

.3 Greenheck Fan Corp.;

.4 CML Northern Blower;

.5 PennBarry;

.6 JencoFan;

.7 Carnes Company Inc.

PART 3 - EXECUTION

3.1 INSTALLATION OF CENTRIFUGAL FANS

.1 Provide centrifugal fans.

.2 Secure each base mounted fan in place, level and plumb, on vibration isolation on a concrete housekeeping pad.

.3 Secure suspended units in place from structure, level, and plumb, by means of vibration isolation spring hangers, properly sized galvanized steel hanger rods and galvanized structural steel angle or channel trapeze supports.

.4 Install explosion-proof units in accordance with classification requirements.

.5 Brace and secure each unit in accordance with requirements specified in Section 20 05 48.16 – Seismic Controls for Mechanical Systems.

.6 For equipment/system manufacturer certification requirements, refer to Section 20 05 00 – Common Work Results for Mechanical.

.7 For equipment/system start-up requirements, refer to Section 20 05 00 – Common Work Results for Mechanical.

.8 Include for a 1/2 day on-site operation demonstration and training session. Training is to be a full review of all components including but not limited to a full operation and maintenance demonstration, with abnormal events.

3.2 INSTALLATION OF UTILITY FANS

.1 Provide utility fans.

.2 Secure each fan in place, level, and plumb, on vibration isolation on a concrete housekeeping pad or base as indicated.

.3 Secure suspended units in place from structure, level, and plumb, by means of vibration isolation spring hangers, properly sized galvanized steel hanger rods, and galvanized structural steel angle or channel trapeze supports.

.4 Brace and secure each unit in accordance with requirements specified in Section 20 05 48.16 – Seismic Controls for Mechanical Systems.

.5 For equipment/system manufacturer certification requirements, refer to Section 20 05 00 – Common Work Results for Mechanical.

.6 For equipment/system start-up requirements, refer to Section 20 05 00 – Common Work Results for Mechanical.

.7 Include for a 4 hour on-site operation demonstration and training session. Training is to be a full review of all components including but not limited to a full operation and maintenance demonstration, with abnormal events.

3.3 INSTALLATION OF CENTRIFUGAL INLINE FANS

.1 Provide inline centrifugal fans.

.2 Secure each fan in place from structure with vibration isolation, independent of connecting ductwork and in accordance with fan manufacturer's instructions.

.3 Brace and secure each unit in accordance with requirements specified in Section 20 05 48.16 – Seismic Controls for Mechanical Systems.

.4 Ensure duct connections are made using flexible connection material.

.5 For equipment/system manufacturer certification requirements, refer to Section 20 05 00 – Common Work Results for Mechanical.

.6 For equipment/system start-up requirements, refer to Section 20 05 00 – Common Work Results for Mechanical.

.7 Include for a 4 hour on-site operation demonstration and training session. Training is to be a full review of all components including but not limited to a full operation and maintenance demonstration, with abnormal events.

3.4 INSTALLATION OF PLENUM FANS

.1 Provide plenum fans in air handling system plenums.

.2 Secure fans in place, level, and plumb, on vibration isolation.

.3 Brace and secure each unit in accordance with requirements specified in Section 20 05 48.16 – Seismic Controls for Mechanical Systems.

.4 For equipment/system manufacturer certification requirements, refer to Section 20 05 00 – Common Work Results for Mechanical.

.5 For equipment/system start-up requirements, refer to Section 20 05 00 – Common Work Results for Mechanical.

.6 Include for a 1/2 day on-site operation demonstration and training session. Training is to be a full review of all components including but not limited to a full operation and maintenance demonstration, with abnormal events.

3.5 INSTALLATION OF ROOF MOUNTED EXHAUST FANS

.1 Provide roof mounted exhaust fans.

.2 Supply a roof mounting curb with each fan and hand curbs to roofing trade on roof for mounting and flashing into roof construction as part of roofing work. Secure fans in place on curbs.

.3 Install dampers in curb damper tray and secure in place.

.4 Brace and secure each unit in accordance with requirements specified in Section 20 05 48.16 – Seismic Controls for Mechanical Systems.

.5 For equipment/system manufacturer certification requirements, refer to Section 20 05 00 – Common Work Results for Mechanical.

.6 For equipment/system start-up requirements, refer to Section 20 05 00 – Common Work Results for Mechanical.

.7 Include for a 4 hour on-site operation demonstration and training session. Training is to be a full review of all components including but not limited to a full operation and maintenance demonstration, with abnormal events.

3.6 INSTALLATION OF SIDEWALL PROPELLER FANS

.1 Provide sidewall propeller fans. Coordinate location(s) and size(s) of wall opening(s) with trade preparing the opening(s).

.2 Rigidly secure each fan and accessories in place to structure in accordance with fan manufacturer's instructions.

.3 Brace and secure each unit in accordance with requirements specified in Section 20 05 48.16 – Seismic Controls for Mechanical Systems.

.4 For equipment/system manufacturer certification requirements, refer to Section 20 05 00 – Common Work Results for Mechanical.

.5 For equipment/system start-up requirements, refer to Section 20 05 00 – Common Work Results for Mechanical.

3.7 INSTALLATION OF FRP CENTRIFUGAL FANS

.1 Provide FRP centrifugal fans.

.2 Secure each base mounted fan in place, level, and plumb, on corrosion resistant vibration isolation on a concrete housekeeping pad.

.3 Secure suspended units in place from structure, level and plumb, by means of corrosion resistant vibration isolation spring hangers, properly sized type 316 stainless steel hanger rods and a structural type 316 stainless steel angle, or channel support structure.

.4 Brace and secure each unit in accordance with requirements specified in Section 20 05 48.16 – Seismic Controls for Mechanical Systems.

.5 For equipment/system manufacturer certification requirements, refer to Section 20 05 00 – Common Work Results for Mechanical.

.6 For equipment/system start-up requirements, refer to Section 20 05 00 – Common Work Results for Mechanical.

3.8 INSTALLATION OF VANEAXIAL FANS

.1 Provide vaneaxial fans.

.2 Secure each fan in place to or from structure with vibration isolation as indicated, independent of connecting ductwork.

.3 Ensure duct connections are made using flexible connection material.

.4 Brace and secure each unit in accordance with requirements specified in Section 20 05 48.16 – Seismic Controls for Mechanical Systems.

.5 For equipment/system manufacturer certification requirements, refer to Section 20 05 00 – Common Work Results for Mechanical.

.6 For equipment/system start-up requirements, Refer to Section 20 05 00 – Common Work Results for Mechanical.

.7 Include for a 1/2 day on-site operation demonstration and training session. Training is to be a full review of all components including but not limited to a full operation and maintenance demonstration, with abnormal events.

3.9 INSTALLATION OF CEILING DESTRATIFICATION FANS

.1 Provide ceiling destratification fans.

.2 Secure each fan in place at the ceiling from structure in accordance with manufacturer's instructions and drawing details. Confirm exact locations prior to roughing-in. Install safety chains and fan blade guards.

.3 Plug each fan motor into an adjacent receptacle.

.4 Supply a fan speed controller for fans as indicated and hand to electrical trade at site for wall mounting and connection to fan motor controllers. Confirm exact speed controller locations prior to installation, and include for identification of each speed controller.

.5 Brace and secure each unit in accordance with requirements specified in Section 20 05 48.16 – Seismic Controls for Mechanical Systems.

.6 For equipment/system manufacturer certification requirements, refer to Section 20 05 00 – Common Work Results for Mechanical.

.7 For equipment/system start-up requirements, refer to Section 20 05 00 – Common Work Results for Mechanical.

.8 Include for a 1/2 day on-site operation demonstration and training session. Training is to be a full review of all components including but not limited to a full operation and maintenance demonstration, with abnormal events.

3.10 INSTALLATION OF CEILING FANS

.1 Provide ceiling exhaust fans.

.2 Secure each ceiling mounted fan housing in place in ceiling space, flush with suspended ceiling.

.3 Secure suspended units in place from structure, level, and plumb, by means of vibration isolation spring hangers and galvanized steel hanger rods.

.4 Plug fan motors into housing receptacles.

.5 Supply exterior wall/roof discharge caps as indicated.

.6 Hand roof caps to roof trade for installation and flashing into roof construction as part of roofing work.

.7 Install wall caps and secure in place. Caulk perimeter of each wall cap in accordance with caulking requirements specified in Division 07.

.8 Connect fan housings and discharges with ductwork.

.9 Brace and secure each unit in accordance with requirements specified in Section 20 05 48.16 – Seismic Controls for Mechanical Systems.

.10 For equipment/system start-up requirements, refer to Section 20 05 00 – Common Work Results for Mechanical.

3.11 INSTALLATION OF ROOF MOUNTED FILTERED SUPPLY FANS

.1 Provide roof mounted filtered supply fans.

.2 Supply a roof mounting curb with each fan and hand curbs to roofing trade on roof for mounting and flashing into roof construction as part of roofing work. Secure fans in place on curbs.

.3 Brace and secure each unit in accordance with requirements specified in Section 20 05 48.16 – Seismic Controls for Mechanical Systems.

.4 Secure duct adaptors in place on curbs on foam tape or other suitable gasket material, and install motorized dampers (supplied loose) in connecting ductwork. Coordinate connection of power from fan starter to damper motor with electrical trade who will make the connection.

.5 For equipment/system manufacturer certification requirements, refer to Section 20 05 00 – Common Work Results for Mechanical.

.6 For equipment/system start-up requirements, refer to Section 20 05 00 – Common Work Results for Mechanical.

3.12 CLOSEOUT ACTIVITIES

.1 Include for a 4 hour on-site operation demonstration and training session. Training is to be a full review of all components including but not limited to a full operation and maintenance demonstration.

END OF SECTION

PART 1 - GENERAL

1.1 SUBMITTALS

.1 Submit shop drawings/product data sheets for the stack and accessories. Include material specifications and metal gauges, design details, fabrication details, and erection requirements as well as anchor bolt assembly details. Shop drawings are to be prepared, signed, and stamped by a Structural Engineer registered in jurisdiction of the work.

.2 Submit stack engineering calculations, prepared, stamped and signed by engineer who produced shop drawings, with shop drawing submittal to show conformance to Code requirements for wind exposure A and 1/100 probability at stack location with a gust factor of 2, wind sensitive deflection at top with a deflection limit of h/360, base movement, shear at base, vortex shedding, anchor bolt design, bolt circle diameter, and reinforcement around cleanout and breeching openings.

.3 If requested, submit mill test report for CSA G40.20/G40.21-300W steel outer casing.

.4 Submit a colour chart for stack exterior paint.

1.2 CLOSEOUT SUBMITTALS

.1 Submit a letter signed and stamped by structural engineer who designed stack to certify stack installation has been reviewed in field and is in accordance with "Reviewed" or "Reviewed as Noted" shop drawings/product data sheets.

1.3 MAINTENANCE MATERIAL SUBMITTALS

.1 Submit a 1 L (2 pint) container of stack finish touch-up paint as directed in Part 3 of this section.

1.4 QUALITY ASSURANCE

.1 Stack welding is to be full penetration conforming to CSA W47.1, and performed by CWB certified welders.

.2 Stack is to be erected by manufacturer.

PART 2 - PRODUCTS

2.1 EXHAUST STACK

.1 One-piece, free-standing, self-supporting, double wall insulated steel stack, designed and constructed so outer casing and inner liner can expand and contract vertically independent of each other, and for bolting to a concrete base without need for guy wires or roof bracing. Stack dimensions are to be as indicated on drawings, and stack is to be complete with:

.1 outer casing, minimum 6.4 mm (¼") thick CSA G40.20/G40.21-300W mild black structural steel plate with bevelled edges, fabricated into stack shape by rolling and welding with vertical joints offset 180°;

.2 inner liner, minimum 3.5 mm (⅛") thick type 304 stainless steel welded, laterally braced with welded tees to outer casing at 120° intervals every 6 m (20');

.3 sloped type 304 stainless steel plate rain shelf continuously welded at the circumference to inner liner, and equipped with a 50 mm (2") dia. type 304 stainless steel drain pipe extended from bottom of rain shelf to exterior of outer casing where it is to be terminated with a screw-on stainless steel cap;

.4 minimum 40 kg/m³ (2-½ lb/ft³) density, semi-rigid glass fibre insulation, 75 mm (3") thick, supported vertically every 4.8 m (16'), arranged with staggered joints, and banded to inner liner on 300 mm (12") centres with 12 mm (½") wide stainless steel bands;

.5 minimum #12 gauge type 304 stainless steel top cap sized to fit over both inner liner and outer casing with approximately 12 mm (½") clearance between the side of cap and inner liner;

.6 150 mm (6") dia. type 304 stainless steel inspection port welded to inner liner, extended out through outer casing, with reinforcing around outer casing opening, and equipped with a flanged bolt-on cover plate;

.7 double wall insulated tee breeching connection constructed as for stack, with welded steel plate reinforcing at opening through outer casing, and a 6.4 mm (¼") flange for connection to breeching;

.8 wind spoilers, 50 mm x 6.4 mm (2" x ¼") thick steel plates welded to top 3.6 m (12') of outer casing at staggered 120° intervals;

.9 minimum 35 mm (1-⅜") thick black steel base plate with minimum 12 mm (½") thick black steel gusset ring welded to outer casing, aligned bolt holes in both the base plate and gusset ring, and 12 mm (½") thick by 300 mm (12") high gusset plates welded on 45° centres to outer casing and between base plate and gusset ring;

.10 factory assembled anchor bolt assembly ready for placement and securing to concrete base formwork, consisting of a minimum of 8, 25 mm (1") dia. anchor bolts with double nuts and washers secured together to 2 circular steel retaining rings;

.11 2, 20 mm (¾") dia. 450 mm (18") long type 304 stainless steel lightning rods welded to top of stack, and a minimum of 2 ground lugs welded to breeching connection tee and to base of stack;

.12 prepare outer casing and factory finish as follows:

.1 preparation – commercial sand blast clean in accordance with SSPC-SP6 requirements and degrease, ready for painting;

.2 primer – apply one coat of ICI Devoe Coatings 4160 Series primer to a dry film thickness of between 50 microns and 62 microns;

.3 finish – 2 separate coats of ICI Devoe Coatings 4338 Series, each coat to a dry film thickness of between 50 microns and 62 microns, with finish colour as selected from paint manufacturer's standard colour range;

.4 touch-up – 1 L (2 pints) of finish coating in a sealed and identified metal container, supplied loose.

.13 wall sleeve factory fabricated and supplied loose with the stack, consisting of a type 304 stainless steel sleeve sized to the wall thickness and the insulated breeching, and equipped with a stainless steel escutcheon plate on each side of the wall;

.14 universal type flexible connection in accordance with drawing detail;

.15 factory secured seismic restraint connection hardware.

.2 Manufacturers:

.1 Ellesmere Fabricators Ltd.;

.2 Stefco Ltd.;

.3 The Schebler Co.;

.4 Cheminée Lining E. Inc.

PART 3 - EXECUTION

3.1 INSTALLATION OF STACK

.1 Provide a one-piece free-standing stack on a concrete base.

.2 Supply a base anchor bolt assembly and hand to concrete trade at site for installation in base formwork. Supervise installation of assembly and be present during concrete pour to ensure anchor bolt assembly is not disturbed.

.3 Supply required hoisting equipment for stack erection, and journeyman millwrights as required.

.4 Bolt stack to concrete base. Ensure stack is plumb, and bolts are securely tightened. Prior to erecting stack, touch-up any damage to factory finish.

.5 Anchor and restrain stack in accordance with requirements of Section 20 05 48.16 - Seismic Controls for Mechanical Systems.

.6 Supply a wall sleeve for breeching penetration through wall and hand sleeve to trade preparing wall opening. Install escutcheon plates tight against wall surface over breeching at each side of the wall. Caulk exterior sleeve/plate joints to produce a watertight installation.

.7 Provide a flexible connection assembly, in accordance with drawing detail, in exhaust connections to stack.

.8 Coordinate installation of stack with electrical trade who will provide ground rods and ground conductor connections to stack.

.9 Extend stack drain pipe down to grade using stainless steel pipe. Coordinate installation with electrical trade who will provide electric heating cable for drain pipe.

.10 When stack installation is complete, arrange for Structural Engineer who designed stack to visit site and review installation, then submit a letter signed and stamped by Structural Engineer certifying stack installation has been reviewed in field and is in accordance with "Reviewed" or "Reviewed as Noted" shop drawings/product data sheets.

.11 Perform any required final touch-up painting, and hand container of touch-up paint to Owner prior to Substantial Performance of the Work.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Listed gas vents and vent connectors for natural gas fired appliances.

1.2 REFERENCES

.1 CSA B149.1:20, Natural gas and propane installation code.

.2 CAN/ULC-S604:2016, Standard for factory-built type A chimneys.

.3 CAN/ULC 605:2022, Standard for Gas Vents.

.4 CAN/ULC 609:2022, Standard for low temperature vents type L and PL.

.5 ULC-S636-08, Standard for type BH gas venting systems.

1.3 SUBMITTALS

.1 Submit product data sheets for flue gas vents/air intakes and accessories.

1.4 COORDINATION

.1 Supply a reviewed shop drawing to appropriate trade to indicate vent size and flashing materials supplied, and accurately locate building openings.

PART 2 - PRODUCTS

2.1 CONDENSING APPLIANCE TYPE BH FLUE GAS VENTS (AND COMBUSTION AIR INTAKES)

.1 Equal to Ipex "System 636" PVC (for vent gas to 65°C (130°F)) or CPVC (for vent gas to 90°C (195°F)) solvent weld vent pipe and fittings, in accordance with CSA B149.1, certified as type BH vents to ULC-S636, Standard for Type BH Gas Venting Systems, suitable for negative or positive venting and complete with an orange warning label to verify compliance with ULC-S636, and a moulded cap with screen for vertical termination, or low profile wall termination kit, as applicable.

2.2 DOUBLE WALL TYPE "A" VENT

.1 Sectional, prefabricated, double wall, type 316 stainless steel, insulated Type "A" all fuel vent, ULC listed and labelled to CAN/ULC-S604, maximum 540°C (1000°F) rated, with prefabricated mated fittings, couplings and accessories including a flashing accessory, storm collar counter-flashing piece, and a termination cap.

2.3 DOUBLE WALL TYPE "B" VENT

.1 Sectional, prefabricated, double wall Type "B" gas vent, ULC listed and labelled to CAN/ULC 605, maximum 243°C (460°F) rated, with an aluminium alloy inner wall, G90 galvanized steel outer wall, annular air space, prefabricated mated fittings, couplings and accessories including a flashing accessory, storm collar counter-flashing piece, and a termination cap.

2.4 DOUBLE WALL STAINLESS STEEL VENT FOR CONDENSING EQUIPMENT

.1 Positive pressure double wall stainless steel flue gas vent with a type 304 outer casing, an AL29-4C inner flue, and a 25 mm (1") annular air space, ULC-S636 listed and labelled, complete with

prefabricated mated fittings and accessories including a flashing accessory, storm collar counter-flashing piece, and a termination cap.

2.5 DOUBLE WALL TYPE "L" VENT

.1 Type "L" Neutral or negative pressure Type "L" double wall stainless steel flue gas vent, listed and labelled to CAN/ULC 609, with a type 304 stainless steel outer casing, type 304 stainless steel inner flue, and a 12 mm (½") annular air space, maximum 300°C (570°F) rated, complete with prefabricated mated fittings and accessories including a flashing accessory, storm collar counter-flashing piece, and a termination cap.

2.6 BAROMETRIC DAMPERS

.1 Equal to Field Controls UL/ULC listed and CSA certified Type M+MG2, field adjustable, single or double acting barometric damper to suit burner fuel, each complete with a gate which rests on a long, thin, stainless steel knife edge which in turn is supported by self-aligning and self-cleaning bearings, sized to suit the application, approved by equipment manufacturer, and complete with a field thermal switch accessory for dual fuel oil/gas fired burners.

PART 3 - EXECUTION

3.1 INSTALLATION OF TYPE BH FLUE GAS VENTS (AND COMBUSTION AIR INTAKES)

.1 Provide type BH flue gas vents and combustion air intakes for condensing appliances.

.2 Support spacing is to be in accordance with flue gas vent manufacturer’s instructions. Installation is to be in accordance with gas fired appliance manufacturer’s instructions and requirements of CSA B149.1.

.3 Route piping using shortest route possible to termination point while avoiding interference with other work. Slope vent piping for positive drainage.

.4 Equip termination of vent with a turn-down elbow with open end covered with bronze insect screen. Terminate exhaust vent a minimum of 3 m (10') away from fresh air intakes and operable windows.

.5 Confirm flue gas vent diameter prior to ordering.

3.2 INSTALLATION OF FLUE GAS VENTS

.1 Provide ULC listed and labelled flue gas vents for equipment. Confirm flue gas vent diameters prior to ordering.

.2 Secure horizontal sections in place by means of support hardware supplied with vents and conforming to flue diameter, and hanger rods attached to structure. Support spacing is to be in accordance with vent manufacturer’s instructions.

.3 Support vertical flue sections inside building at roof level and wherever else required by means of purpose made vertical support accessories supplied by manufacturer.

.4 Hand flashing collars to roofing trade at site on roof for installation and flashing into roof construction. Install counter-flashing pieces over collars.

.5 Equip termination of each chimney with a rain cap. Confirm height requirement for chimney above roof prior to installation, and ensure proper distance from fresh air intakes is maintained.

.6 Provide braided stainless steel aircraft cable guy wires attached to roof anchors and to stainless steel strap anchors on the vents as required and/or shown.

.7 Anchor and restrain vents in accordance with requirements of Section 20 05 48.16 - Seismic Controls for Mechanical Systems.

.8 Provide required accessories, including insulated thimbles at building wall penetrations, barometric damper(s), cleanout(s), fire stops, and expansion joints where shown and/or required.

.9 Locate and install barometric dampers in accordance with manufacturer's instructions and field adjust to suit operating conditions.

END OF SECTION

PART 1 - GENERAL

1.1 SUBMITTALS

.1 Submit shop drawings/product data sheets for boilers, including accessories, and all required wiring schematics. Include boiler flue product data sheets with the submission.

1.2 CLOSEOUT SUBMITTALS

.1 Submit with delivery of boiler(s) a copy of factory inspection and test report for each boiler, and include a copy of each report with O&M Manual project closeout data.

.2 Submit a site inspection and boiler start-up report from boiler manufacturer's representative as specified in Part 3 of this section.

.3 Submit signed copies of a manufacturer's non-prorated 10 year extended warranty for cast aluminium heat exchanger against corrosion, thermal stress, mechanical defects, and workmanship, and 2 year extended warranty for all other boiler components.

.4 Training attendance records.

1.3 MAINTENANCE MATERIAL SUBMITTALS

.1 Supply a complete spare charge of calcium silicate chips for each acid neutralizing tank.

1.4 QUALITY ASSURANCE

.1 Boilers and installation of boilers are to be in accordance with requirements of following:

.1 applicable Provincial Codes and Standards;

.2 CSA B51, Boiler, Pressure Vessel and Pressure Piping Code;

.3 CAN/CSA B149.1, Natural Gas and Propane Installation Codes;

.4 ULC/ORD-C795:2021, Commercial-Industrial Gas-Fired Package Boilers.

.2 Boiler installation tradesmen are to be journeyman tradesmen licensed to install boiler equipment.

PART 2 - PRODUCTS

2.1 CONDENSING HOT WATER BOILERS

.1 De Dietrich Products Gas 310 "ECO" Series, fully condensing, single-stage, factory assembled, factory pressure and fire tested hot water boilers in accordance with drawing schedule and with performance requirements are as follows:

.1 99.3% boiler efficiency with 15.5°C (60°F) entering water.

.2 Boilers complete with following construction features:

.1 690 kPa (100 psi) rated and stamped cast aluminium sectional heat exchanger designed such that all condensing occurs within heat exchanger and equipped with a heat exchanger cleanout on service side for cleaning;

.2 cast aluminium vent and condensate manifold with 250 mm (10") dia. flue connection with gravity drain for condensate elimination without a collection reservoir, and a port for cleaning and inspection;

.3 baked powder epoxy coated steel casing and framework mounted on casters for ease of moving boiler to its final location;

.4 factory supplied and certified seismic restraint anchor points.

.3 Boiler trim includes following:

.1 low water cut-off control supplied loose for site installation, which, when installed and wired to burner control circuit will prevent burner operation if boiler water falls below a safe level, an auxiliary low water cut-off as above, and a McDonnell & Miller Model TC-4 "Test-N-Check" valve above and below both low water cut-offs;

.2 ASME rated factory sized and set relief valve, and a flow switch, both shipped loose for site installation.

.4 Forced draft, 5:1 turn-down ratio, fully modulating premix stainless steel cylinder burner with perforated holes for precise air-fuel mixture producing a maximum of 30 ppm of NOx corrected to 3% excess oxygen, designed to return to low fire position prior to ignition and to remain in low fire position during ignition and until main flame has been proven, and constructed to burn specified quantity of fuel at between 4" to 14" w.c. (0.99 to 3.5 kPa) without objectionable noise, pulsation, or vibration. Each burner complete with:

.1 automatic electric spark ignition of premix gas pilot, and a flame detector to monitor pilot flame to prevent primary fuel valve from opening until pilot flame has been established;

.2 stainless steel cylinder with perforated holes for precise air-fuel mixture and velocity, and woven stainless steel fibre for flame stability and heat insulation;

.3 pulse width modulation controlled forced draft fan for optimum mixing of air and fuel between air-fuel valve and burner, mounted in front head above burner, direct connected to motor conforming to requirements specified in Section 20 05 00 – Common Work Results for Mechanical, equipped with an overload protected automatic motor starter with auxiliary contacts, and with maximum sound level of 60 dBA measured 1 m (3') in front of boiler;

.4 Honeywell or equal modulating air-gas ratio valve to meter natural gas input;

.5 gas piping train with primary motorized gas shut-off valve controlled to start or stop burner and to close automatically in event of power failure, flame failure, excessive pressure or temperature, high or low gas pressure, or low water condition, a manual shut-off valve located ahead of primary valve, a plugged leakage test connection with shut-off cock as a means of testing tightness of primary valve, a gas pressure regulator, and high and low gas pressure switches

.6 factory piped and wired pilot gas piping train with separate pilot gas cock, gas pressure regulator, and pilot safety shut-off gas valve.

.5 Burner controls, unless otherwise specified, are to factory installed in a dead front enclosure mounted on front head of boiler and equipped with disconnect switch, power and control wiring terminal blocks, motor starter, fuses, control circuit transformer, and control switches and relays as required. Controls include a Honeywell MCBA OEM or equal solid-state, microprocessor-based boiler and burner control which incorporates functions of temperature control, 100% shut-down combustion safeguard control, message annunciation, and fault diagnostic display, a flash card to permit replacement of control without need to re-commission boiler, and features as follows:

.1 3 levels of access; one for end user, one for advanced trained set-up and service technicians, and one for factory;

.2 hardware and circuitry for building automation system control and enable/disable contacts;

.3 ability to communicate with a PC or PDA with ReCom communication software and interface cable;

.4 adjustable water temperature operating limit between 20°C to 90°C (70°F to 140°F) by means of an internal set-point, indoor/outdoor reset controller, or a building automation system 0-10 VDC signal, or from a lead/lag control system, and fixed safety high temperature limit;

.5 on/off switch, and supply and return water temperature indication;

.6 blocked heat exchanger and blocked vent indication;

.7 operating, service, and fault diagnostic coding;

.8 ability to be set-up with or without a computer;

.9 hardware and circuitry for pre-operation and post-operation of burner fan;

.10 contacts for connection to Boiler Room ventilation system to prevent boilers from operating unless ventilation system is operating (ventilation system is to "fail-open" to permit boiler operation should fan or damper motors fail or a power failure occurs).

.6 Double wall stainless steel AL29-4C stainless steel flue gas vent for each boiler with a type 304 outer casing and AL29-4C inner flue supplied by boiler manufacturer. Each boiler is to operate under Category IV positive vent pressure conditions for room air dependent operation. Venting is to feature condensate disposal and have 50 mm (2") clearance to combustibles.

.7 Equal to JJM Boiler Works or Condensate Neutralizer condensate acid neutralizing PVC tube sized to suit the boiler condensate discharge, supplied with boiler, filled with 12 mm (½") and 20 mm (¾") aggregate calcium carbonate and complete with floor mounting galvanized steel strut clamps, threaded PVC inlet and outlet fittings, and a spare charge of calcium silicate.

.8 Manufacturers:

.1 De Dietrich Products;

.2 Viessmann Manufacturing Co.;

.3 Buderus.

2.2 BOILER PLANT SEQUENCING CONTROL PANEL

.1 Surface wall mounting, NEMA 2, dead front, enamelled steel, 115 volt, 1-phase, 60 Hz AC, electronic, microprocessor-based, CSA certified, fully automatic boiler plant master sequencing control panel supplied by boiler manufacturer for lead-lag control of boiler operation with simple on-off switching of individual boilers, and boiler water temperature control as indicated.

.2 Panel is to be complete with:

.1 key lock door, and a door interlock type disconnect switch;

.2 green "Power On" LED and a white "Boiler Operating" LED for each boiler;

.3 door mounted 2-position "Manual/Automatic" switch for each boiler, connected such that when a switch is in "Manual" position respective boiler is disconnected from automatic sequence and will operate independently through its own controls while remaining boilers operate automatically through sequencing controls;

.4 rotary type, door mounted lead boiler selector switch, connected such that regardless of which boiler is chosen as lead boiler remaining boilers will operate in required sequence in numerical order, and with circuits isolated in programmer circuit such that switch may be rotated at any time with any number of boilers operating without overloading its contacts, and such that boilers remaining on line will not recycle thereby permitting changing of lead boiler without material loss of load;

.5 fused 24 volt secondary control transformer;

.6 numbered terminal strips for power and control wiring connections;

.7 hardware and circuitry required for specified control and sequencing, including adjustable time delay which is to be activated before lead boiler reaches high fire to allow lead boiler sufficient time to satisfy system demand before first lag boiler is activated;

.8 permanent identification of door mounted LED's and switches;

.9 operating control components as required, supplied loose for site installation.

.3 Boiler plant control sequence as follows:

.1 on first call for heat, lead boiler will come on line at low fire, and if system demand is such that output of lead boiler will not satisfy demand at low fire, boiler will modulate to high fire;

.2 if lead boiler is unable to satisfy system demand by time it reaches 80% of its firing rate, and over a reasonable period of time, first lag boiler is to come on line at low fire and, if required, modulate to high fire;

.3 remaining lag boilers are brought on line as above as required to satisfy system demand;

.4 as system demand is satisfied, boilers are to modulate back to low fire and shut-off in reverse order.

.4 Panel suitable in all respects for interface connection into building automation system without site installation of additional hardware.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Provide condensing hot water boilers.

.2 Move boilers into position, remove casters, and secure each boiler in place, level, and plumb, on neoprene-steel-neoprene vibration isolation pads on a concrete housekeeping pad.

.3 Anchor each boiler and concrete base in accordance with requirements specified in Section 20 05 48.16 - Seismic Controls for Mechanical Systems. Provide flexible connections in piping connections to each boiler.

.4 Connect each boiler with piping and flue.

.5 Install condensate acid neutralizers adjacent to boilers and connect with piping from boilers to neutralizers and from neutralizers to drain in accordance with manufacturer's directions and drawing requirements.

.6 Install control components shipped loose for each boiler, including low water cut-offs, relief valve, and flow switch. Unless otherwise instructed, follow manufacturer's installation instructions. Provide pressure gauges and thermometers in boiler water supply and return piping connections.

.7 Wall mount lead/lag control panel where shown but confirm exact location prior to installation.

.8 Perform required control wiring in conduit to connect control components. Follow boiler manufacturer's control wiring schematics and conduit and conductor installation requirements specified as part of electrical work.

.9 When boiler plant installation is substantially complete, but prior to start-up, and prior to flushing and cleaning heating piping system as specified in Section 23 25 00 - HVAC Water Treatment, inspect each boiler and remove visible dirt, oil and debris, then cooperate with the boiler boil-out chemical supplier to ensure proper boil-out procedures are followed.

3.2 SYSTEM STARTUP

.1 For equipment/system manufacturer certification requirements, refer to Section 20 05 00 – Common Work Results for Mechanical.

.2 For equipment/system start-up requirements, refer to Section 20 05 00 – Common Work Results for Mechanical.

3.3 CLOSEOUT ACTIVITIES

.1 Include for a one day on-site boiler plant operation demonstration and training session. Training is to be a full review of all components including but not limited to a full boiler internal inspection, construction details, burner operation, maintenance, flame characteristics, and adjustments, gas train maintenance, boiler normal operation, abnormal events, normal shut-down, emergency shut-down, and setting up controls.

END OF SECTION

PART 1 - GENERAL

1.1 SUBMITTALS

.1 Submit shop drawings/product data sheets for heat exchangers, including accessories.

1.2 CLOSEOUT SUBMITTALS

.1 Submit with delivery of each unit a copy of the factory inspection report, and include a copy of each report with O&M Manual project closeout data.

.2 Submit a site inspection and start-up report from manufacturer's representative as specified in Part 3 of this section.

.3 Training attendance records.

1.3 QUALITY ASSURANCE

.1 Heat exchanger equipment is to be stamped with a Canadian Registration Number (CRN).

.2 Heat exchangers and accessories are to be in accordance with following:

.1 CSA B51, Boiler, Pressure Vessel, and Pressure Piping Code;

.2 ASME Boiler and Pressure Vessel Code;

.3 governing Provincial and/or Municipal Codes and Regulations.

PART 2 - PRODUCTS

2.1 PLATE TYPE HEAT EXCHANGERS

.1 Vertical plate type heat exchangers in accordance with drawing schedule, 1035 kPa (150 psi) working pressure rated, factory pressure tested and complete with:

.1 electro-galvanized carbon steel frames with baked epoxy enamel finish, same end ANSI 150 flanged connections, a fixed end panel and a removable end panel, and molybdenum greased electro-galvanized steel bolts protected by means of sleeves;

.2 type 316 stainless steel plates, fully supported and steered by upper and lower carrying bars to prevent misalignment in both vertical and horizontal directions, space between ports not feeding channels, and channels vented to atmosphere;

.3 one-piece snap-on nitrile rubber gaskets moulded in a groove around heat transfer area and plate portholes, and continually supported along inner and outer edges;

.4 heat exchangers for domestic water service shall be 316L stainless steel double wall construction and suitable in every respect for potable water applications;

.5 factory secured seismic restraint connection hardware.

.2 Manufacturers:

.1 S. A. Armstrong Ltd.;

.2 Alfa Laval Inc.;

.3 Baltimore Aircoil of Canada Inc.;

.4 Tranter Heat Exchangers (Canada) Ltd.;

.5 APV an SPX Brand;

.6 Danfoss Inc;

.7 GEA Canada Inc.;

.8 Taco (Canada) Ltd.

.9 Flo-Fab Inc.

PART 3 - EXECUTION

3.1 INSTALLATION OF PLATE TYPE HEAT EXCHANGERS

.1 Provide plate type heat exchangers.

.2 Secure each heat exchanger in place, level, and plumb, on a concrete housekeeping pad.

.3 Brace and secure each unit in accordance with requirements specified in Section 20 05 48.16 - Seismic Controls for Mechanical Systems.

.4 Connect with piping in accordance with drawing detail.

.5 When installation is complete and piping has been permanently filled, start-up each heat exchanger, check and test all safeties and operating controls, and set controls to design conditions.

3.2 SYSTEM STARTUP

.1 For equipment/system manufacturer certification requirements, refer to Section 20 05 00 – Common Work Results for Mechanical.

.2 For equipment/system start-up requirements, refer to Section 20 05 00 – Common Work Results for Mechanical.

3.3 TRAINING

.1 Include for a one half day on-site operation demonstration and training session. Training is to be a full review of all components including but not limited to a full operation and maintenance demonstration, with abnormal events.

END OF SECTION

PART 1 - GENERAL

1.1 SUBMITTALS

.1 Submit shop drawings/product data for all units. Include:

.1 certified fan performance curves;

.2 estimated sound power levels to be expected across individual octave bands in dB;

.3 certified power and control wiring diagrams which differentiate between factory and site wiring;

.4 dimensioned layouts, including dimensioned curb layouts and duct penetrations, as applicable;

.5 product data for fan motors and drives;

1.2 CLOSEOUT SUBMITTALS

.1 Submit with delivery of each unit a copy of the factory inspection and fire test report, and include a copy of each report with O&M manual project close-out data.

.2 Submit a site inspection and start-up report from manufacturer's representative as specified in Part 3 of this section.

.3 Submit signed copies of manufacturer's extended warranties as follows:

.1 stainless steel gas fired unit heat exchanger: 10 years;

.2 refrigerant compressor(s): 5 years;

.3 integrated modular control: 3 years.

.4 Training attendance records.

1.3 MAINTENANCE MATERIAL SUBMITTALS

.1 Submit spare air filters as specified in Part 2 of this section.

1.4 COORDINATION

.1 Supply reviewed copies of curb assembly shop drawings or product data sheets to trade who will cut roof openings for ductwork, and ensure openings are properly sized and located.

1.5 QUALITY ASSURANCE

.1 Heating and air conditioning equipment is to be rated (capacity, performance, efficiency and sound) and certified in accordance with requirements of following Air-Conditioning, Heating and Refrigeration Institute Standards:

.1 ANSI/AHRI 210/240, Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment;

.2 ANSI/AHRI 270, Sound Performance Rating of Outdoor Unitary Equipment;

.3 ANSI/AHRI 340/360, Performance Rating of Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment.

.2 Heating and air conditioning equipment is also to be in accordance with requirements of following Codes, Standards, and Regulations:

.1 CSA B52, Mechanical Refrigeration Code;

.2 CAN/CSA-C22.2 No. 236/UL 1995, Heating and Cooling Units;

.3 ANSI/ASHRAE/IES 90.1, Energy Standard for Buildings Except Low Rise Residential Buildings;

.4 CSA or ETL certification and labelling for all electrical components;

.5 CAN/CSA B149, Natural Gas and Propane Code;

.6 governing local Codes and Regulations.

.3 Gas fired heating and air conditioning units are to be installed by licensed journeyman gas fitters.

.4 Manufacturer to provide separate price to maintain the unit for the first 5 years including parts and labour.

.5 The Manufacturer shall provide 60-month parts and labour from the date of start up.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Daikin

.2 Trane Canada Corp.;

.3 Engineered Air

2.2 PACKAGED OUTDOOR AIR HANDLING UNITS

.1 Package type, factory assembled and tested, outdoor, weatherproof heating and air conditioning units in accordance with drawing schedule.

.2 Packaged units shall be shipped fully charged with R-32 Refrigerant and oil.

.3 Unit shall be provided with an outdoor air economizer section. The economizer section shall include outdoor, return, and exhaust air dampers. The economizer operation shall be fully integral to the mechanical cooling and allow up to 100% of mechanical cooling if needed to maintain the cooling discharge air temperature.

.4 Unit Construction

.1 Panel construction shall be double-wall construction for all panels. All floor panels shall have a solid galvanized steel inner liner on the air stream side of the unit to protect insulation during service and maintenance. Insulation shall be a minimum of 1" thick with an R-value of 7.0 and shall be 2 part injected foam. Panel design shall include no exposed insulation edges. Unit cabinet shall be designed to operate at total static pressures up to 1.24kPa (5.0 “ w.g);

.2 Casing to be constructed of pre-painted galvanized steel. Paint finish to include a base primer with polyester resin topcoat. Finished panel surfaces to withstand a minimum 1000-hour salt spray test in accordance with ASTM B117 standard for salt spray resistance;

.3 Service doors shall be provided on the fan section, filter section, control panel section, and heating vestibule in order to provide user access to unit components. All service access doors shall be mounted on multiple, stainless steel hinges and shall be secured by a latch system;

.4 The unit base shall overhang the roof curb and be seat on the roof curb gasket. Lifting brackets to be provided on the unit base;

.5 The outdoor air hood to be constructed from galvanized steel and finished with the same durable paint finish as the main unit

.5 Filters

.1 50mm (2”) prefilter rack and a 100mm (4”) final filter rack. A set of 50mm (2”) construction filters shall ship with the unit.

.2 Supply a spare set of 50mm (2”) Merv 8-30% and 100mm (4”) Merv 14-95% efficient filers.

.3 Outdoor air hood to include moisture eliminator filter.

.4 50mm (2") Merv 7 filters for energy recovery wheel outdoor air stream before the wheel.

.6 Dampers

.1 Modulating, parallel blade, spring return type dampers complete with direct coupled actuator for comparative enthalpy control.

.7 Supply Fan

.1 Fan to be capable of airflow modulation from 30% to 100% of the scheduled designed airflow. Fan not to operate in a state of surge at any point within the modulation range. Motor to have thermal overload and phase failure protection.

.2 Single inlet (SWSI) airfoil centrifugal supply fan. Class II construction with fan blades that are continuously welded to the hub plate and end rim. Direct drive fan mounted to the EC motor shaft.

.8 Exhaust Fan

.1 Fan not to operate in a state of surge at any point within the modulation range. Motor to have thermal overload and phase failure protection.

.2 Single inlet (SWSI) airfoil centrifugal exhaust fan. Class II construction with fan blades that are continuously welded to the hub plate and end rim. Direct drive fan mounted to the EC motor shaft.

.3 DDC controller shall provide building static pressure control.

.9 DX Cooling

.1 Draw through configuration, upstream of the supply air fan. The coil section complete with double sloped stainless steel drain pan, electronic controlled expansion valve.

.2 High efficiency copper tubing that is mechanically expanded into high efficiency aluminum plate fins.

.3 Condenser

.1 Cast Aluminum outdoor coils. Plate fins to be protected and brazed between adjoining flat tubes such that they shall not extend outside the tubes. A sub-cooling coil to be an integral part of the main outdoor air coil;

.2 Refrigeration system capable of operating down to -17°C (0°F) without installation of additional controls, complete with self-sealing discharge, suction and liquid line service gauge ports, freeze-stats, expansion valves, copper refrigerant tubing and insulation where required, liquid line filter drier, automatic reset high and low pressure compressor circuit controls, pressure transducers for the suction pressure and head pressure, temperature sensor for the suction temperature and refrigerant discharge temperature of the compressors, and fan control for -34°C (-30°F) low ambient operation;

.3 ECM type fan motor. Fan not to operate in a state of surge at any point within the modulation range. Motor to have thermal overload and phase failure protection;

.4 Low noise fan blade design. PVC coated condenser fan guard and condenser coil guard;

.5 Vibration isolated scroll type compressors. One of the compressors to be an inverter compressor providing proportional control. The inverter compressor to have a separate oil pump and low oil safety protection;

.10 Hot Gas Reheat

.1 Unit to be complete with a fully modulating aluminium hot gas reheat coil with hot gas coming from the unit condenser.

.11 Natural Gas Heating

.1 Gas furnace design shall be installed downstream of the supply air fan in the heat section. The heating module shall be a tubular design with in-shot gas burners. Induced draft fan to maintain a negative pressure.

.2 5:1 turndown

.3 Stainless steel heat exchanger tube construction.

.12 Heat Pump Heating

.1 The evaporator coil, condenser coil, compressors and refrigerant circuit to be designed for heat pump operation and shall included a 4 way reversing valve and electronic expansion valve to be controlled by unit controller.

.2 The refrigerant system shall have a pump-down cycle.

.13 Energy Recovery Wheel

.1 Provide rotary wheel air-to-air heat exchanger in a cassette frame complete with seals, drive motor and drive belt.

.2 The total energy recovery wheel to be coated with silica gel desiccant permanently bonded without the use of binders or adhesives. The substrate to be lightweight polymer.

.3 Wheels to be provided with removable energy transfer matrix. Wheel frame construction to be a welded hub, spoke and rim assembly of stainless, plated and coated steel and shall be self-supporting without matrix segments in place.

.4 Wheel bearings to be selected to provide an L-10 life in excess of 400,000 hours. Rim to be continuous rolled stainless steel. Wheels to be connected to the shaft by means of taper lock hubs.

.5 Controls to provide frost control for the energy recovery wheel. When a frost condition is encountered the unit controller shall slow down the wheel. When in the frost control mode the wheel shall be jogged periodically and not be allowed to stay in the stationary position.

.14 Electrical

.1 Each unit to be wired and tested at the factory before shipment. All wiring to be number coded per the electrical wiring diagrams. All electrical components to be labeled according to the electrical diagram and be CSA recognized.

.2 A terminal block to be provided for the main power connection and a terminal board to be provided for the low voltage control wiring. Knockouts to be provided in the bottom of the main control panel for field wiring entrance. Branch short circuit protection, 115-volt control circuit transformer and fuse, system switches, and a high temperature sensor to also be provided with the unit.

.3 Each compressor and condenser fan motor to be furnished with contactors and internal thermal overload protection. Supply fan motors to be supplied with external overload protection.

.4 A single non-fused disconnect switch to be provided for disconnecting electrical power at the unit. Disconnect switches to be mounted internally to the control panel and operated by an externally mounted handle

.15 Controller

.1 The unit control system to include all required temperature and pressure sensors, input/output boards, main microprocessor and operator interface. The unit control system to perform all unit control functions including scheduling, unit diagnostics and safeties.

.2 The DDC control system to permit starting and stopping of the unit locally or remotely. A set of contacts to be provided for outside air damper actuation, emergency shutdown, remote heat enable/disable, remote cool enable/disable, heat indication, cool indication, and fan operation.

.3 The unit control system to communicate with an Building Management System (BMS) via a direct BACnet communication connection. The independent BMS system to have access to “read only’ variables and “read & and write” variables. Communications not to require field mounting of any additional sensors or devices at the unit. The BMS system to be capable of interacting with the individual rooftop controllers in the following ways:

.1 Monitor controller inputs, outputs, set points, parameters and alarms

.2 Set controller set points and parameters

.3 Clear alarms

.4 Reset the cooling and heating discharge air temperature set point

.5 Set the heat/cool changeover temperature

.6 Set the representative zone temperature

.4 The following set points to be adjustable:

.1 Control mode (Off / Auto / Cool Only / Fan Only / Heat Only)

.2 Occupancy mode (Auto / Tenant Override / Occupied / Unoccupied)

.3 Changeover mode (return air, space temperature or network signal)

.4 Cooling and heating discharge air temperature control

.5 Compressor lockouts and timers

.6 Economizer changeover (enthalpy or dry bulb)

.7 Scheduling

.8 Building static pressure control

.5 The unit DDC controller to provide building static pressure control. The unit controller to provide proportional control of the exhaust fans from 25% to 100% of the supply air fan designed airflow to maintain the adjustable building pressure set point.

.6 Supply air reset options to include; return air temperature, outdoor air temperature, space temperature, airflow (VAV), network signal, external signal (1-5 vdc or 0-20 mA)

.7 The controller to be complete with night setback control. The controller shall use its internal time clock for scheduling and have an adjustable override timer. Provide wall mounted space sensor with an override button for field installation.

.16 Roof Curb

.1 Provide a prefabricated heavy gauge galvanized steel, mounting curb for field assembly on the roof prior to unit shipment. Full perimeter type with complete perimeter support of the air handling section and condensing section. The curb to be a minimum of 24" high and include a nominal 2"×4" wood nailing strip. Gasket to be provided for field mounting between the unit base and roof curb.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Provide outdoor heating and air conditioning units.

.2 Provide required rigging and hoisting/moving equipment required to move each unit to required locations. Perform rigging/hoisting/moving in accordance with unit manufacturer's directions and details.

.3 Hand a curb for each roof mounted unit to roofing trade on roof for installation and flashing into roof construction. Secure each unit in place on roof curb. Provide continuous gasketing around perimeter of each curb between curb and unit mounting frame.

.4 Install components shipped loose with units. Install in accordance with manufacturer's recommendations. Calibrate control components requiring field calibration.

.5 Extend condensate trapped drains using Schedule 40 galvanized steel piping to roof.

.6 Provide remote control panels. Confirm exact locations prior to roughing-in. Connect complete with 24 volt control wiring in conduit to standards of electrical work and in accordance with manufacturer's certified wiring diagram.

.7 Carefully coordinate installation of each unit with all other trades making connections to unit, in particular, power, interlock connections, and control connections.

3.2 SYSTEM STARTUP

.1 For equipment/system manufacturer certification requirements, refer to Section 20 05 00 – Common Work Results for Mechanical.

.2 For equipment/system start-up requirements, refer to Section 20 05 00 – Common Work Results for Mechanical.

3.3 CLOSEOUT ACTIVITIES

.1 Include for a 1/2 day on-site operation demonstration and training session. Training is to be a full review of all components including, but not limited to, a full operation and maintenance demonstration, with abnormal events.

END OF SECTION

PART 1 - GENERAL

1.1 SUBMITTALS

.1 Submit shop drawings/product data sheets for all make-up air units. Include following:

.1 certified fan performance curves;

.2 estimated sound power levels to be expected across individual octave bands in dB;

.3 certified power and control wiring diagrams which differentiate between factory and site wiring;

.4 dimensioned layouts, including dimensioned curb layouts and duct penetrations, as applicable;

.5 product data for fan motors and drives;

1.2 CLOSEOUT SUBMITTALS

.1 Submit with delivery of each furnace a copy of the factory inspection and fire test report as specified in Part 2 of this section, and include a copy of each report with O&M Manual project close-out data.

.2 Submit a site inspection and start-up report from manufacturer's representative as specified in Part 3 of this section.

.3 Training attendance records.

1.3 MAINTENANCE MATERIAL SUBMITTALS

.1 Submit spare air filters as specified in Part 2 of this section.

1.4 COORDINATION

.1 Supply reviewed copies of curb assembly shop drawings or product data sheets to trade who will cut roof openings for ductwork, and ensure openings are properly sized and located.

1.5 QUALITY ASSURANCE

.1 Make-up air units and installation are to be in accordance with requirements of following:

.1 all applicable Provincial Codes and Standards;

.2 CAN/CSA B149, Natural Gas and Propane Installation Codes;

.3 CSA or cETL listed and labelled electrical components.

.4 governing local Codes and Regulations.

.2 Make-up air unit installation tradesmen are to be journeyman and licensed gas fitters.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Daikin

.2 Trane Canada Corp.;

.3 Engineered Air

2.2 PACKAGED OUTDOOR AIR HANDLING UNITS

.1 Package type, factory assembled and tested, outdoor, weatherproof heating-only units in accordance with drawing schedule.

.2 Unit shall be provided with an outdoor air economizer section. The economizer section shall include outdoor, return, and exhaust air dampers. The economizer operation shall be fully integral to the unit and allow up to 100% of mechanical cooling if needed to maintain the cooling discharge air temperature.

.3 Unit Construction

.1 Panel construction shall be double-wall construction for all panels. All floor panels shall have a solid galvanized steel inner liner on the air stream side of the unit to protect insulation during service and maintenance. Insulation shall be a minimum of 1" thick with an R-value of 7.0 and shall be 2 part injected foam. Panel design shall include no exposed insulation edges. Unit cabinet shall be designed to operate at total static pressures up to 1.24kPa (5.0 “ w.g);

.2 Casing to be constructed of pre-painted galvanized steel. Paint finish to include a base primer with polyester resin topcoat. Finished panel surfaces to withstand a minimum 1000-hour salt spray test in accordance with ASTM B117 standard for salt spray resistance;

.3 Service doors shall be provided on the fan section, filter section, control panel section, and heating vestibule in order to provide user access to unit components. All service access doors shall be mounted on multiple, stainless steel hinges and shall be secured by a latch system;

.4 The unit base shall overhang the roof curb and be seat on the roof curb gasket. Lifting brackets to be provided on the unit base;

.5 The outdoor air hood to be constructed from galvanized steel and finished with the same durable paint finish as the main unit

.4 Filters

.1 50mm (2”) prefilter rack and a 100mm (4”) final filter rack. A set of 50mm (2”) construction filters shall ship with the unit.

.2 Supply a spare set of 50mm (2”) Merv 8-30% and 100mm (4”) Merv 14-95% efficient filers.

.3 Outdoor air hood to include moisture eliminator filter.

.4 50mm (2") Merv 7 filters for energy recovery wheel outdoor air stream before the wheel.

.5 Dampers

.1 Modulating, parallel blade, spring return type dampers complete with direct coupled actuator for comparative enthalpy control.

.6 Supply Fan

.1 Fan to be capable of airflow modulation from 30% to 100% of the scheduled designed airflow. Fan not to operate in a state of surge at any point within the modulation range. Motor to have thermal overload and phase failure protection.

.2 Single inlet (SWSI) airfoil centrifugal supply fan. Class II construction with fan blades that are continuously welded to the hub plate and end rim. Direct drive fan mounted to the EC motor shaft.

.7 Exhaust Fan

.1 Fan not to operate in a state of surge at any point within the modulation range. Motor to have thermal overload and phase failure protection.

.2 Single inlet (SWSI) airfoil centrifugal exhaust fan. Class II construction with fan blades that are continuously welded to the hub plate and end rim. Direct drive fan mounted to the EC motor shaft.

.3 DDC controller shall provide building static pressure control.

.8 Natural Gas Heating

.1 Gas furnace design shall be installed downstream of the supply air fan in the heat section. The heating module shall be a tubular design with in-shot gas burners. Induced draft fan to maintain a negative pressure.

.2 5:1 turndown

.3 Stainless steel heat exchanger tube construction.

.9 Energy Recovery Wheel

.1 Provide rotary wheel air-to-air heat exchanger in a cassette frame complete with seals, drive motor and drive belt.

.2 The total energy recovery wheel to be coated with silica gel desiccant permanently bonded without the use of binders or adhesives. The substrate to be lightweight polymer.

.3 Wheels to be provided with removable energy transfer matrix. Wheel frame construction to be a welded hub, spoke and rim assembly of stainless, plated and coated steel and shall be self-supporting without matrix segments in place.

.4 Wheel bearings to be selected to provide an L-10 life in excess of 400,000 hours. Rim to be continuous rolled stainless steel. Wheels to be connected to the shaft by means of taper lock hubs.

.5 Controls to provide frost control for the energy recovery wheel. When a frost condition is encountered the unit controller shall slow down the wheel. When in the frost control mode the wheel shall be jogged periodically and not be allowed to stay in the stationary position.

.10 Electrical

.1 Each unit to be wired and tested at the factory before shipment. All wiring to be number coded per the electrical wiring diagrams. All electrical components to be labeled according to the electrical diagram and be CSA recognized.

.2 A terminal block to be provided for the main power connection and a terminal board to be provided for the low voltage control wiring. Knockouts to be provided in the bottom of the main control panel for field wiring entrance. Branch short circuit protection, 115-volt control circuit transformer and fuse, system switches, and a high temperature sensor to also be provided with the unit.

.3 A single non-fused disconnect switch to be provided for disconnecting electrical power at the unit. Disconnect switches to be mounted internally to the control panel and operated by an externally mounted handle

.11 Controller

.1 The unit control system to include all required temperature and pressure sensors, input/output boards, main microprocessor and operator interface. The unit control system to perform all unit control functions including scheduling, unit diagnostics and safeties.

.2 The DDC control system to permit starting and stopping of the unit locally or remotely. A set of contacts to be provided for outside air damper actuation, emergency shutdown, remote heat enable/disable, remote cool enable/disable, heat indication, cool indication, and fan operation.

.3 The unit control system to communicate with an Building Management System (BMS) via a direct BACnet communication connection. The independent BMS system to have access to

"read only' variables and "read & and write" variables. Communications not to require field mounting of any additional sensors or devices at the unit. The BMS system to be capable of interacting with the individual rooftop controllers in the following ways:

.1 Monitor controller inputs, outputs, set points, parameters and alarms

.2 Set controller set points and parameters

.3 Clear alarms

.4 Reset the heating discharge air temperature set point

.5 Set the representative zone temperature

.4 The following set points to be adjustable:

.1 Control mode (Off / Auto / Fan Only / Heat Only)

.2 Occupancy mode (Auto / Tenant Override / Occupied / Unoccupied)

.3 Heating discharge air temperature control

.4 Economizer changeover (enthalpy or dry bulb)

.5 Scheduling

.6 Building static pressure control

.5 The unit DDC controller to provide building static pressure control. The unit controller to provide proportional control of the exhaust fans from 25% to 100% of the supply air fan designed airflow to maintain the adjustable building pressure set point.

.6 Supply air reset options to include; return air temperature, outdoor air temperature, space temperature, airflow (VAV), network signal, external signal (1-5 vdc or 0-20 mA)

.7 The controller to be complete with night setback control. The controller shall use its internal time clock for scheduling and have an adjustable override timer. Provide wall mounted space sensor with an override button for field installation.

.12 Roof Curb

.1 Provide a prefabricated heavy gauge galvanized steel, mounting curb for field assembly on the roof prior to unit shipment. Full perimeter type with complete perimeter support of the air handling section and condensing section. The curb to be a minimum of 24" high and include a nominal 2"×4" wood nailing strip. Gasket to be provided for field mounting between the unit base and roof curb.

PART 3 - EXECUTION

3.1 INSTALLATION OF MAKE-UP AIR UNIT

.1 Provide a gas fired make-up air unit on roof.

.2 Unless otherwise specified or required, provide required rigging and hoisting/moving equipment required to move units to required location. Perform rigging/hoisting/moving in accordance with unit manufacturer's directions and details.

.3 Hand a curb for each roof mounted unit to roofing trade on roof for installation and flashing into roof construction. Secure each unit in place on roof curb. Provide continuous gasketing around perimeter of each curb between curb and unit mounting frame.

.4 Install components shipped loose with units. Install a discharge air temperature sensor in supply ductwork approximately 2 m (6-½') downstream of unit and in accordance with manufacturer's recommendations.

.5 Provide remote control panels. Confirm exact locations prior to roughing-in. Connect complete with 24 volt control wiring in conduit to standards of electrical work and in accordance with manufacturer's certified wiring diagram.

.6 Carefully coordinate installation of each unit with all other trades making connections to unit, in particular, power, interlock connections, and control connections.

3.2 SYSTEM STARTUP

.1 For equipment/system manufacturer certification requirements, refer to Section 20 05 00 – Common Work Results for Mechanical.

.2 For equipment/system start-up requirements, refer to Section 20 05 00 – Common Work Results for Mechanical.

3.3 CLOSEOUT ACTIVITIES

.1 Include for a 1/2 day on-site operation demonstration and training session. Training is to be a full review of all components including but not limited to a full operation and maintenance demonstration, with abnormal events.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 23 23 00 – Refrigerant Piping.

1.2 SUBMITTALS

.1 Submit shop drawings/product data sheets, complete with control components, and piping and wiring schematics.

1.3 CLOSEOUT SUBMITTALS

.1 Submit a start-up and certification letter from equipment supplier as specified in Part 3 of this section.

.2 Prepare and submit a schematic layout of refrigerant piping showing all piping components required for satisfactory operation and maintenance of the system(s), including but not limited to pipe sizes, charging valve, isolating valves, sight glasses, strainers, driers, traps, etc. Schematic diagram must be reviewed with and approved by air conditioning equipment supplier prior to submittal to the Consultant.

1.4 QUALITY ASSURANCE

.1 Split system air conditioning equipment and installation of equipment are to be in accordance with requirements of following:

.1 All applicable Provincial Codes and Standards.

.2 ANSI/AHRI Standard 210/240, Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment.

.2 Split system air conditioning system installation tradesmen are to be journeyman refrigeration mechanics.

PART 2 - PRODUCTS

2.1 SPLIT SYSTEM AIR CONDITIONING EQUIPMENT

.1 Factory assembled and tested, package type equipment consisting of an indoor evaporator unit and an exterior condensing unit in accordance with drawing schedule, CSA or ETL listed and labelled, AHRI rated and certified and with a minimum system efficiency of 13 SEER.

.2 Wall mounting evaporator assembly consisting of a white moulded high-strength plastic cabinet with front access panel, a motorized horizontal vane to automatically direct air flow in a horizontal and downward direction and which closes when fan operation is stopped, motorized vertical vanes controlled remotely, and a mounting plate supplied loose. Evaporator complete with:

.1 double inlet, forward curve fan(s) direct driven by a single 4-speed motor;

.2 removable and washable return air filter;

.3 factory pressure tested multi-angled coil of non-ferrous construction with aluminium fins, copper tubes with silver alloy solder joints, and an insulated condensate drain pan sloped to a drain connection for positive drainage.

.3 Factory run tested, weatherproof condensing unit equipped with a control board to interface with indoor unit and perform all necessary operation functions. Pre-charge unit with R-410a refrigerant

for a minimum of 21 m (70') of refrigerant tubing. Unit is to be capable of operation at -18°C (0°F) without additional low ambient controls, and capable of a height difference between condensing unit and evaporator of 30 m (100'). Each condensing unit complete with:

.1 galvanized steel plate cabinet with an electrostatically applied thermally fused polyester powder finish, and an ABS plastic fan grille;

.2 draw-through direct driven balanced fan with horizontal air discharge, mounted in front of coil, arranged to pull air across coil, and equipped with a raised fan guard;

.3 "L" shaped coil with copper tubes and aluminium fins, factory pressure tested, complete with an integral metal guard and refrigerant flow controlled by a linear expansion valve metering orifice controlled by a microprocessor controlled step motor;

.4 vibration isolated DC rotary compressor driven by an inverter circuit to dynamically control compressor speed to match room load, complete with an accumulator, high pressure safety switch, and circuitry to permit a minimal amount of current to be applied to motor to maintain enough heat during off cycle to prevent liquid from accumulating.

.4 System controls consisting of a microprocessor in each indoor and outdoor unit, and an indoor wall mounted controller site connected to indoor evaporator unit. System is to be capable of automatic restart after power interruption, and have self-diagnostics ability and indication of total compressor run time, and following:

.1 Indoor unit microprocessor is capable of monitoring return air temperature and evaporator coil temperature, receiving and processing commands from wall mounted controller, providing emergency operation, and controlling outdoor unit through its microprocessor and interface board;

.2 controller is complete with an integral temperature sensor, able to perform input and output functions necessary to operate system, and equipped with following:

.1 large DOT liquid crystal display to indicate diagnostic codes for both indoor and outdoor units, compressor run time, a weekly timer with up to 8 pattern settings per day, set temperature, room temperature, refrigerant piping temperatures, compressor operating conditions, and linear expansion valve opening pulses, sub-cooling and discharge super heat;

.2 On/Off button, Increase/Decrease Set Temperature buttons, a Cool/Dry/Fan mode selector, a Timer Menu button, a Timer On/Off button, Set Time buttons, a Fan Speed selector, a Vane Position selector, a Louvre Swing button, a Ventilation button, a Test Run button, and a Check Mode button.

.5 Suitable anchoring connection hardware factory installed on equipment to suit requirements of Section 20 05 48.16 – Seismic Controls for Mechanical Systems.

2.2 MANUFACTURERS

.1 Mitsubishi Electric Sales Canada Inc.;

.2 LG Electronics Canada Inc.;

.3 Panasonic Canada Inc.;

.4 Fujitsu General America Inc.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Provide split system air conditioning equipment consisting of an exterior condensing unit and an indoor evaporator.

.2 Secure condensing unit in place, level and plumb, on vibration isolation pads on a concrete housekeeping pad.

.3 Secure condensing unit in place, level and plumb, on vibration isolation pads on pressure treated wooden sleepers as indicated.

.4 Anchor equipment in accordance with requirements specified in Section 20 05 48.16 – Seismic Controls for Mechanical Systems. Provide flexible connections in all piping connections to equipment.

.5 Mount indoor evaporator unit. Confirm exact location prior to roughing-in.

.6 Connect condensing unit and indoor evaporator with refrigerant piping in accordance with piping shop drawing schematic. Refer to Section 23 23 00 – Refrigerant Piping. Provide any required additional refrigerant.

.7 Install loose control components and perform required control wiring (except building automation system connections) between condensing unit and evaporator in conduit in accordance with manufacturer's control wiring schematic and wiring standards of electrical work.

3.2 SYSTEM STARTUP

.1 For equipment/system manufacturer certification requirements, refer to Section 20 05 00 – Common Work Results for Mechanical.

.2 For equipment/system start-up requirements, refer to Section 20 05 00 – Common Work Results for Mechanical.

3.3 CLOSEOUT ACTIVITIES

.1 Include for 4 hours of on-site operation demonstration and training session. Training is to be a full review of all components including, but not limited to, a full operation and maintenance demonstration, with control set-up and abnormal events.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Variable Refrigerant Flow (VRF) air conditioning system consisting of one or more outdoor compressor units and multiple indoor fan coil units.

1.2 RELATED REQUIREMENTS

.1 Section 23 23 00 – Refrigerant Piping.

1.3 SUBMITTALS

.1 Submit shop drawings/product data sheets, complete with control components, and piping and wiring schematics.

.2 Prepare and submit a schematic layout of refrigerant piping showing all piping components required for satisfactory operation and maintenance of the system(s), including but not limited to pipe sizes, charging valve, CSA B52 refrigerant charge analysis, isolating valves, sight glasses, strainers, driers, traps, etc. Schematic diagram must be reviewed with and approved by air conditioning equipment supplier prior to submittal to the Consultant.

1.4 CLOSEOUT SUBMITTALS

.1 Submit a start-up and certification letter from equipment supplier as specified in Part 3 of this Section.

1.5 QUALITY ASSURANCE

.1 Split system air conditioning equipment and installation of equipment are to be in accordance with requirements of following:

.1 All applicable provincial codes and standards;

.2 ANSI/AHRI Standard 210/240, Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment.

.3 ANSI/AHRI Standard 1230. Performance Rating of Variable Refrigerant Flow (VRF) Multi-Split Air-Conditioning and Heat Pump Equipment

.2 Split system air conditioning system installation tradesmen are to be journeyman refrigeration mechanics.

PART 2 - PRODUCTS

2.1 GENERAL

.1 VRF system shall automatically vary the target evaporating and condensing temperatures based on building load and weather conditions to increase part load efficiency (Variable Refrigerant Temperature). The condensing unit shall also feature customizable operating modes which allows for the manual setting of target evaporating and condensing temperatures.

2.2 MANUFACTURERS

.1 Daikin Industries Ltd.;

.2 Mitsubishi Electric Sales Canada Inc.;

.3 LG Canada.

2.3 VRF FAN COILS

.1 VRF fan coils shall monitor and maintain the unit superheat (cooling mode) or subcooling (heating mode) using a computerized PID control. Internal unit components shall be factory wired and piped, and complete with electronic proportional expansion valve, flare connections, condensate drain pan, self-diagnostics, and auto-restart function.

.2 Wall Mounted Unit

.1 Wall mounted fan coil unit for installation onto a wall within a conditioned space. A mildew-proof, polystyrene condensate drain pan and resin net mold resistant filter shall be included as standard equipment.

.2 The indoor unit's sound pressure shall range from 31 dB(A) to 41 dB(A) at low speed measured at 1 m (3.3 feet) below and 1 m (3.3 feet) away from the unit.

.3 The unit shall have an auto-swing louver which ensures efficient air distribution, which closes automatically when the unit stops. The remote controller shall be able to set five (5) steps of discharge angle. The front grille shall be easily removed for washing.

.4 The cabinet shall be affixed to a factory supplied wall mounting template and located in the conditioned space.

.5 The cabinet shall be constructed with sound absorbing foamed polystyrene and polyethylene insulation.

.6 The fan type shall be direct-drive cross-flow with statically and dynamically balanced impeller with high and low fan speeds available.

.7 Units shall be provided with a loose field installed condensate pump.

.3 Round Flow Ceiling Cassette Unit

.1 Indoor unit shall be a round flow ceiling cassette fan coil unit with a variable speed direct drive DC type fan for installation into the ceiling cavity, equipped with an air panel grill. It shall be a round flow 360° air distribution type with a fresh white, impact resistant decoration panel.

.2 The supply air is distributed via four individually controlled motorized louvers. The louvers can be manually and individually adjusted for multiple configurations, without requiring blank off plates.

.3 The indoor unit shall be equipped with built-in occupancy sensor and surface temperature sensor to optimize occupant comfort.

.4 The indoor unit's sound pressure shall range from 27 dB(A) to 34 dB(A) at low speed measured at 5 feet below the unit.

.5 Return air shall be through the concentric panel, which includes a resin net, mold resistant, antibacterial filter.

.6 The indoor units shall be equipped with a condensate pan with antibacterial treatment and factory-mounted condensate pump. The pump shall provide up to 33-1/2" of lift from bottom of unit to top of the drain piping with built-in safety shutoff and alarm.

.7 The fan shall have a variable speed direct drive DC motor with a statically and dynamically balanced impeller with 3 user-selectable fan speeds. The automatic fan speed mode shall allow the fan to vary between 5 speeds based on space load.

.8 The fan motor shall be equipped as standard with adjustable external static pressure (ESP) settings to allow operation with the high efficiency air filter options.

.9 Units shall be supplied with an accessory kit allowing for the installation of additional supply air branches from the fan coil. To be provided to select scheduled units.

.10 Units shall be supplied with an optional fresh air intake kit. The kit shall allow the cassette to pull up to 20% fresh air. The kit shall then mix the fresh air with the return air before being treated by the coil. Air intake kits that do not have the ability to pull fresh air directly and to introduce it before the coil to allow mixing and conditioning by the unit shall not be acceptable. To be provided to select scheduled units.

.4 4 Way Vista Flat Ceiling Cassette Unit

.1 The indoor unit shall be a ceiling cassette fan coil unit with a variable speed direct drive DC type fan for installation into the ceiling cavity, equipped with an air panel grill. It shall be a four-way air distribution type with fresh white or Daikin silver, impact resistant washable decoration panel. The supply air is distributed via motorized louvers which can be horizontally and vertically adjusted from 0° to 90°.

.2 The indoor unit's sound pressure shall range from 25.5 dB(A) to 33 dB(A) at low speed measured at 5 feet below the unit.

.3 The 4-way supply air flow shall be capable of field modification to 2-way or 3-way airflow to accommodate various installation configurations including corner installations.

.4 The decoration panel shall be a low-profile design, extending only 5/16" below the ceiling without any overlap with neighboring ceiling tiles, allowing for installation directly adjacent to other ceiling components such as lights, diffusers, and sprinklers, etc.

.5 Return air shall be through the concentric panel, which includes a resin net mold resistant filter. The indoor units shall be equipped with a condensate pan and a factory-mounted condensate pump with up to 21" of lift, and have a built-in safety shutoff and alarm.

.6 Three auto-swing positions shall be available to choose from, which include standard, draft prevention and ceiling stain prevention.

.7 The fan shall have a variable speed direct drive DC motor with a statically and dynamically balanced impeller with 3 user-selectable fan speeds. The automatic fan speed mode shall allow the fan to vary between 5 speeds based on space load.

.8 Units shall be supplied with an accessory kit allowing for the installation of additional supply air branches from the fan coil. To be provided to select scheduled units.

.9 Units shall be supplied with an optional fresh air intake kit. The kit shall allow the cassette to pull up to 20% fresh air. The kit shall then mix the fresh air with the return air before being treated by the coil. Air intake kits that do not have the ability to pull fresh air directly and to introduce it before the coil to allow mixing and conditioning by the unit shall not be acceptable. To be provided to select scheduled units.

.5 Concealed Ceiling Mounted Ducted Unit

.1 Ceiling mounted ducted fan coil unit with variable speed direct drive DC type fan and auto CFM adjustment at commissioning. Casing shall be constructed of galvanized steel. Configuration shall be horizontal discharge air with horizontal return air, with a maximum height of 9-5/8'' and be designed to fit in tight ceiling plenums.

.2 The indoor unit's sound pressure shall range from 28 dB(A) to 36 dB(A) at low speed measured 5 feet below the ducted unit.

.3 The indoor units shall be equipped with a condensate pan and condensate pump. The condensate pump shall provide up to 25” of lift from the center of the drain outlet and have a built-in safety shutoff and alarm.

.4 The fan shall have a variable speed direct drive DC motor with statically and dynamically balanced impeller with 3 user-selectable fan speeds. The automatic fan speed mode shall allow the fan to vary between 5 speeds based on space load. The unit shall have logic for automatically adjusting external static pressure settings of the fan motor (selectable during commissioning).

.5 The unit shall ship from the factory in a rear return configuration and shall be field convertible to a bottom return configuration.

.6 Complete with field installed MERV8 filters and filter kits with 2” or 4” filter depths.

.6 Concealed Ceiling Ducted Unit – Medium Static

.1 Ceiling mounted ducted fan coil unit shall be a built-in ceiling concealed fan coil unit with variable speed direct drive DC type fan and auto static adjustment at commissioning. Casing shall be constructed of galvanized steel. Configuration shall be horizontal discharge air with horizontal return air, with a maximum height of 11-13/16" and be designed to fit in tight ceiling plenums.

.2 The indoor unit’s sound pressure shall range from 29 dB(A) to 43 dB(A) at low speed measured 5 feet below the ducted unit.

.3 The indoor units shall be equipped with a condensate pan and condensate pump. The condensate pump shall provide up to 18-3/8” of lift from the center of the drain outlet and have a built-in safety shutoff and alarm.

.4 The fan shall have a variable speed direct drive DC motor with statically and dynamically balanced impeller with 3 user-selectable fan speeds. The automatic fan speed mode shall allow the fan to vary between 5 speeds based on space load. The unit shall have logic for automatically adjusting external static pressure settings of the fan motor (selectable during commissioning).

.5 Complete with field installed MERV8 filters and filter kits with 2” or 4” filter depths.

.7

2.4 AIR COOLED CONDENSING UNIT

.1 The condensing unit shall be factory assembled in North America and pre-wired with all necessary electronic and refrigerant controls. The refrigeration circuit of the condensing unit shall consist of Daikin inverter scroll compressors, motors, fans, heat exchanger, electronic expansion valves, solenoid valves, 4-way valve, distribution headers, capillaries, filters, shut off valves, oil separators, service ports, liquid receiver (heat recovery only) and suction accumulator.

.2 The system will automatically restart operation after a power failure and will not cause any settings to be lost.

.3 The unit shall incorporate an auto-charging feature to ensure proper refrigerant charge.

.4 The following safety devices shall be included on the condensing unit: high pressure sensor and switch, low pressure sensor, control circuit fuses, crankcase heaters, fusible plug, overload relay, inverter overload protector, thermal protectors for compressor and fan motors, over current protection for the inverter, and anti-recycling timers.

.5 The inverter scroll compressors shall be high efficiency reluctance DC (digitally commutating), hermetically sealed, variable speed type. Temperatures and pressures shall be read every 20

seconds and calculated. With each reading, the compressor capacity (INV frequency) shall be controlled to eliminate deviation from target value. Non inverter-driven compressors shall not be accepted.

.6 Neodymium magnets shall be adopted in the rotor construction to yield a higher torque and efficiency in the compressor instead of the normal ferrite magnet type. Upon complete stop of the compressor, the neodymium magnets will position the rotor into the optimum position for a low torque start.

.7 The compressors' motors shall have a cooling system using discharge gas, to avoid sudden changes in temperature resulting in significant stresses on winding and bearings.

.8 Inverter board shall be refrigerant-cooled to prevent inefficient and unstable operation that can result from air-cooled inverter boards due to varying ambient conditions.

.9 The compressor shall be internally isolated to avoid the transmission of vibration.

.10 In the case of multiple condenser modules, operation hours of the compressors shall be balanced by means of the Duty Cycling Function

.11 The variable speed inverter compressors in Air-Cooled systems shall also use Flash Vapor injection technology with back pressure control for reduced leakage and additional balancing weights on main shaft for increased for increased compressor lifetime.

.12 The fan motor shall have inherent protection and permanently lubricated bearings. The motor shall be provided with a fan guard to prevent contact with moving parts. The condensing unit shall consist of one or more propeller type, direct-drive 350 W or 750 W fan motors that have multiple speed operation via a DC (digitally commutating) inverter. Motors shall be capable of delivering design air at high external static pressures up to 0.32 in WG (factory set as standard at 0.12 in. WG) to accommodate field applied condensing unit discharge ductwork.

.13 Night setback control for low noise operation shall automatically limit the maximum speed of the fan motor.

.14 The heat exchanger on the condensing units shall be manufactured from Hi-X seamless copper tubes with N-shape internal grooves mechanically bonded on to aluminum fins to an e-Pass Design. The heat exchanger coil shall be of a waffle louver fin and rifled bore tube design to ensure high efficiency performance.

.15 The fins are to be covered with an anti-corrosion hydrophilic blue coating as standard with a salt spray test rating of 1000 hr (ASTM B117 and Blister Rating:10), Acetic acid salt spray test of 500 hr (ASTM G85 and Blister Rating:10).

.16 The outdoor unit shall be capable of heating operation down to -13°F ambient temperature. Tested factory data on heating capacity and efficiency shall be available. Continuous heating shall be provided during defrost mode for multi-module systems.

.17 The outdoor unit shall be capable of cooling operation down to +23°F without any additional low ambient controls.

.18 The outdoor coil shall have a three-circuit heat exchanger design. The lower part of the coil shall be used for inverter cooling, enhancing defrost during heating operation.

.19 The system shall have a factory standard technical cooling option to allow simultaneous heating and cooling down to -4°F. Manufacturers that cannot guarantee simultaneous heating and cooling down to -4°F, even when the system is cooling-dominant, shall provide separate systems for zones requiring year-round cooling.

2.5 BRANCH SELECTOR BOX

.1 Selector box cabinets shall have a galvanized steel plate casing and shall house multiple electronic expansion valves and a sub-cooling loop. The unit shall contain sound absorption thermal insulating material made of flame and heat resistant foamed polyethylene.

.2 Branch selector boxes shall not require drain pan and drain connections. Manufacturers with branch selector boxes requiring secondary drain pans and drain connections shall coordinate with the installing contractor at no extra cost to the owner.

.3 Manufacturers with branch selector box sizes, arrangements, or locations that differ from what is specified shall make the necessary arrangements to ensure their alternative branch selector boxes both fit in the space and that CSA B52 compliance is still met (CSA compliance shall include the life-safety maximum refrigerant charge allowance).

.4 Manufacturers shall provide sound data for all branch selector boxes. If sound data is unavailable or exceeds the values below, or if branch boxes make use of solenoid valves instead of electronic expansion valves, necessary precautions shall be taken. Precautions shall include the supply and install of sound blankets, or the relocation of branch boxes away from the occupied spaces, or extra insulation to the ceilings and walls around the branch selector boxes, all at no extra cost to the owner.

Mfgr	Model	Voltage	MCA	Operating Sound	Max Sound	W x H x D	Weight
			A	dB(A)	dB(A)	inch	lbs
[Daikin]	BSQ36TVJ	230 V 1ph	0.1	35	40	15.3x8.1x12.8	27
Daikin	BSQ60TVJ	230 V 1ph	0.1	41	45	15.3x8.1x12.8	27
Daikin	BSQ96TVJ	230 V 1ph	0.1	41	45	15.3x8.1x12.8	33
Daikin	BS4Q54TVJ	230 V 1ph	0.4	38	45	14.6x11.7x18.9	49
Daikin	BS6Q54TVJ	230 V 1ph	0.6	39	47	22.8x11.7x18.9	68
Daikin	BS8Q54TVJ	230 V 1ph	0.8	39	47	22.8x11.7x18.9	73
Daikin	BS10Q54TVJ	230 V 1ph	1.0	40	48	32.3x11.7x18.9	101
Daikin	BS12Q54TVJ	230 V 1ph	1.2	40	48	32.3x11.7x18.9	106

2.6 LOCAL CONTROLS

.1 Expansion valve controller shall be provided with all required thermistors for proper electronic control of expansion valve. Thermistors shall be field mounted in the appropriate airstream and both liquid and suction refrigerant lines.

.2 Connection of air handling unit DX coils to non-VRV condensing units (which do not include inverter compressors) shall not be acceptable

.3 All VRV condensing units on the project, for the VRV indoor units and for the air handling units, shall be from the same manufacturer.

.4 Fan coil units shall be supplied with individual zone controllers.

.5 Zone controllers shall be hard wired by installing contractor.

.6 Controllers shall be able to function as follows:

.1 The controller shall have single and dual setpoints for occupied periods, and independent setback setpoints for unoccupied periods.

.2 The controller shall have the ability to digitally prohibit individual buttons and functions, including custom mode selection.

.3 The controller shall have a self diagnosis function that constantly monitors the system for malfunctions.

.4 The controller shall be equipped with a thermostat sensor.

.5 Controller shall have built-in 7 day, weekday plus Saturday Sunday (5+1+1), weekday plus weekend (5+2) and everyday (1) scheduler.

2.7 CENTRAL CONTROLS

.1 Provide an advanced multi-zone controller for installation in a common area as shown on the plans. The controller shall have a display with the following screen views and functionalities:

.1 Central control of set points, schedules, fan speeds, heat/cool mode, and of setback (override) temperature settings during unoccupied periods.

.2 Adjustable temperature limits to restrict local wall mounted thermostat setpoint ranges.

.3 Visible and audible alarm indication of any system malfunctions with error code.

.4 Tiered hierarchy allowing for control of fan coil units independently or as a group.

.5 Remotely disable individual functions of the wall mounted zone controllers.

.6 Web enabled for remote access from PC, tablet or portable device and automatic alert and error emails.

.2 The following two automatic changeover methods shall be available. One shall be selected upon commissioning.

.1 Averaging Method – the central controller shall sum up the difference between room temperatures and set points for all indoor units in the system. Once this delta reaches the primary changeover dead band of ± 2°F (adjustable), the central controller shall change over the system automatically.

.2 Voting Method – The central controller shall evaluate the difference between individual room temperatures and set points, and only include a fan coil in the algorithm if the difference has passed the primary dead band for more than the guard timer, or past the secondary dead band. Heating priority option shall be available.

.3 For both automatic changeover options, a weight (0-3) can be added to each indoor unit. The automatic changeover algorithm shall use this weighting to prioritize changeover for the more heavily weighted fan coils.

.4 Upon any changeover, a guard timer shall prevent another changeover for a period of 15, 30, or 60 (default) minutes.

.5 The guard timer shall be ignored by a change of setpoint manually from either the central controller or the remote controller, by schedule, or if the secondary dead band is reached with either of the automatic changeover algorithms. The secondary changeover dead band shall be the sum of the primary changeover dead band (adjustable) ± 1°F (adjustable)

.6 The central controller shall have the capability for site floor plans to be uploaded as a background to create a graphics interface. Background shall be project specific floor plans rendered in “2D” or “3D”.

.7 Floor plan layout shall be displayed both on the local central controller, as well as accessible from the web.

.8 Floor plan will include capability to control indoor unit, and auxiliary inputs / outputs, such as designated lighting control, as follows:

.9 Up to 4 status points to be assigned to the control point icon (room name, room temperature, set point, and mode).

.10 Status and control points to display on corresponding location of zone served on floor plan.

.11 Digital input and output icons will display On/Off status.

.12 Analog input icons will display analog value.

.13 Up to 60 floor layout sections shall be possible depending on project scope.

.14 The BACnet Server Gateway Option shall be capable of making the controller work as a BACnet gateway using the BACnet/IP protocol. The BACnet Server Gateway Option shall be capable of exposing indoor unit management points as BACnet objects to the BMS.

.15 The BACnet Server Gateway Option shall allow the following functions:

.1 Support Change of Value (COV) notifications.

.2 Provide unique virtual BACnet device identification number (ID) for every indoor unit group address.

.3 The BACnet Server Gateway Option shall be capable of being configured as a foreign device. It shall be capable of communicating across BACnet Broadcast Management Devices (BBMD) in different subnet networks.

.16 In addition to the standard BACnet VRF points, the Building Management System shall monitor and/or control the following BACnet objects for indoor units:

.1 Occupancy Mode: Unoccupied, Occupied, Standby

.2 Cooling and heating setpoints during occupied and unoccupied modes.

.17 The Building Management System may choose to monitor and control the following BACnet objects linked to controller control logic:

.1 Enable/Disable Schedule operation.

.2 Enable/Disable Auto Changeover Operation.

.3 Set Timed Override Minutes - Monitor and configure timer extension for the indoor unit on controller (30, 60, 90, 120, 150, 180 minutes)

.4 System forced off - Enable/Disable all emergency stop programs that are registered on the controller.

.18 The BMS shall have the ability to utilize scheduling functions on the controller.

.19 The BMS shall have the ability to utilize automatic changeover function on the controller, removing the need to program automatic changeover sequences on the BMS.

.20 VRF manufacturer shall commission the BACnet server. BMS contractor shall provide VRF manufacturer with static IP address and instance number for commissioning. IP connection shall be by BMS contractor.

.21 All programming for monitoring and control of VRF system via the BACnet server shall be by BMS contractor, as per the Sequence of Operation.

.22 Centralized controller shall be complete with power distribution software with the ability to generate .csv files with power consumption data for each fan coil in the system. The software shall have the

ability to assess how the power consumption of the condensing units shall be distributed to each fan coil. The energy consumption files shall be accessible from the web via a restricted security access.

2.8 ELECTRICAL

.1 Provide Independent electrical power for fan coils and branch selector boxes.

.2 Provide individual disconnect switches for each fan coil and condensing unit.

.3 Control wiring shall be installed in a daisy chain configuration between all VRF components as per Manufacturer.

.4 The control voltage between the indoor and outdoor unit shall be 16VDC. The control wiring shall be communication type stranded non-shielded 18-2 AWG.

.5 Control wiring shall be installed in a daisy chain configuration between all VRF components as per manufacturer.

.6 If power is lost or disconnected to any of the fan coils, the condenser shall have the capability to remain in operation at all times.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Provide VRF equipment consisting of exterior condensing units and indoor evaporator units as scheduled and/or indicated on the drawings.

.2 Units shall be stored and handled according to the manufacturer’s recommendations. Units shall be kept clean and isolated from dust and debris.

.3 Contractor shall inspect all equipment upon delivery and notify shipping company and manufacturer immediately of any damage.

.4 Install condensing units on a flat surface level within 1/8 inch and elevate a minimum of 18” from ground or roof surface, on vibration isolation pads. Provide intermediate supports as recommended by the equipment manufacturer.

.5 Indoor evaporator units to be installed as located on the drawings. Confirm exact location prior to roughing-in.

.6 Install loose control components and perform required control wiring (except building automation system connections) between condensing unit and evaporator in conduit in accordance with manufacturer’s control wiring schematic and wiring standards of electrical work.

.7 Connect condensing unit and indoor evaporator units with refrigerant piping in accordance with piping shop drawing schematic. Refer to Section 23 23 00. Provide any required additional refrigerant.

.8 High/low pressure gas line, liquid, and suction lines must be individually insulated between the outdoor and indoor units.

.9 Use refrigeration best practice to allow pipes to expand and contract freely. Review manufacturer installation instructions to ensure expansion joints are properly designed.

3.2 STARTUP AND ADJUSTING

.1 Pressure test all systems to 550 psi after system has been vacuumed and held to below 500 microns for at least one hour. Review manufacturer installation instructions for proper pressure test procedures.

.2 Design and install all piping as per TSSA and CSA B52 regulations and apply and obtain TSSA certification for all systems.

.3 Contractor to carry the cost of a minimum of two (2) manufacturer field inspection to review installation and startup. Notify consultant minimum of five days prior to inspection.

.4 Refer to Section 20 05 00 – Common Work Results for Mechanical; for equipment/system manufacturer certification and start-up requirements.

END OF SECTION

PART 1 - GENERAL

1.1 SUBMITTALS

.1 Submit shop drawings/product data sheets for air-to-water heat pumps, including accessories, and all required power and control wiring schematics.

.2 Heat pump dimensional drawings with elevation overview. Provide required service clearances and location of all field installed piping and electrical connections.

.3 Complete unit specifications.

.4 A summary of all auxiliary utility requirements for normal system operation. Auxiliary utility requirements include: electrical, water, and air. Include with summary of auxiliary equipment quantity and quality of each specific auxiliary utility required.

.5 Shipping and operating weight.

.6 Heat pump control documentation: include heat pump control hardware layout, and wiring diagrams depicting factory installed wiring, field installed wiring with points of connection, and points of connection for BAS control/interface points.

.7 Manufacturer certified performance data at full load and project-specific operating conditions.

.8 Minimum system volume requirements for each hydronic system.

.9 Unit Short Circuit Current Rating (SCCR).

.10 Piping layouts deviating from the schematics and/or floorplans must be submitted to consultant for review and approval.

1.2 CLOSEOUT SUBMITTALS

.1 Submit with delivery of each unit a copy of the factory inspection report, and include a copy of each report with O&M Manual project close-out data.

.2 Submit a site inspection and start-up report from manufacturer's representative as specified in Part 3 of this section.

.3 Training attendance records.

1.3 QUALITY ASSURANCE

.1 Heat pump equipment, as required, is to be stamped with a Canadian Registration Number (CRN).

.2 Heat pumps and accessories are to be in accordance with following:

.1 AHRI 550/590 - Performance Rating of Water-Chilling and Heat Pump Water-Heating Packages Using the Vapor Compression Cycle, latest edition.

.2 ANSI/ASHRAE Standard 15 - Safety Standard for Refrigeration Systems, latest edition.

.3 CAN/CSA B52, Mechanical Refrigeration Code;

.4 CAN/CSA C22.2 No. 236, Heating and Cooling Equipment;

.5 ASME Boiler and Pressure Vessel Code Section VIII, latest edition.

.6 UL 1995, Heating and Cooling Equipment;

.7 ANSI/AHRI Standard 210/240, Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment;

.8 governing Provincial and/or Municipal Codes and Regulations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 AIM (ADVANCE INDUSTRIAL MECHANICAL)

.2 IBC;

2.2 AIR-TO-WATER HEAT PUMP

.1 Modular air-to-water heat pump in accordance with drawing schedule, charged with R-507 refrigerant, factory run tested, and certified and labelled electrically in accordance with ETL or CSA.

.2 Unit to consist of independent refrigerant circuits, each circuit equipped with a compressor, evaporator/heat exchanger, condenser with dual fans, and piping & controls,

.3 Heavy-gauge steel frame and enclosure. Exposed steel surfaces finished with a fused powder coat epoxy enamel finish. 11 gauge galvanized steel constructed frame and 18 gauge 304 galvanized steel sheet metal construction.

.4 Each module to be capable of heating if one or more refrigerant circuits fail.

.5 Provide easily removable, separate access panels to the control centre and the compressor compartment and removable top panel and condenser fan deck assemblies.

.6 Grooved end Schedule 40 steel supply and return piping connections suitable for Victaulic couplings and equipped with an integral mesh in-line strainer for inlet water connection.

.7 Brazed Plate Evaporator and Condenser- Mesh no larger than 0.9mm.

.8 Shell & Tube Condenser and Evaporator and Water Coils - 0.5mm to 1.5 mm mesh.

.9 Brazed plate type refrigerant to hydronic liquid heat exchanger constructed of type 316 stainless steel, designed, tested, and stamped in accordance with ASME Code for a 2480 kPa (360 psi) water-side working pressure.

.10 Vibration isolated, hermetic, reciprocating oil lubricated variable capacity compressor(s), each equipped with an overload protected motor and high discharge pressure and low suction pressure safety cut-outs. Compressor(s) to include shut-off valves suction and discharge, electronic oil monitoring, oil sight glass and thermally protected crankcase heater.

.11 Each compressor shall have three unloader steps and they shall be able to operate fully unloaded (0% capacity).

.12 Air-cooled evaporator shall be equipped with a “V” style coil with 2 independent refrigeration circuits. Fins shall be made of aluminum with a “sine wave” pattern. The coil casing shall be made of G90 galvanized steel. Evaporator fans shall be high efficiency direct drive EC controlled motors. Fans shall be variable speed for suction pressure control.

.13 The evaporator shall be defrosted through hot gas defrost sequence. The evaporator will have a 304 stainless steel drain pan below the coil. The drain pan shall be heat traced and the electrical connection shall be made within the unit control panel.

.14 Provide minimum one composite material multi-blade axial type fan. Fans to be driven by high efficiency ECM.

.15 Provide direct drive fan motors capable of variable speed operation based on refrigerant pressure control.

.16 Provide fan outlet guard.

.17 Provide each circuit with an electronic expansion valve, compressor suction and discharge service valves, manual liquid line shutoff valve with charging connection, replaceable core filter drier, liquid line sight glass with moisture indicator, liquid solenoid valve, purge valves, and relief valves.

.18 Provide each circuit with two pressure transducers, one for the evaporator and one for the condenser. Output signal directly to the microprocessor control system.

.19 Provide all refrigerant specialties including a properly sized refrigerant receiver to provide reliable operation down to the design ambient temperature indicated on the Air Source Heat Pump Schedule for each refrigerant circuit.

.20 Ship units with an operating charge R507A. Refrigerant R410A will not be accepted.

.21 Provide heat pump system with a single point power connection. Include pre-engineered wiring for field installation and connection to a factory mounted heat pump panel. Include panel with individual circuit protection and individual isolation for each module set and provide a single point of connection from the panel to building power. Setup to allow module(s) to be taken out of service while the remainder continue to operate. Provide centrally located field power connection, control interlock terminals and unit control system in a weatherproof enclosure.

.22 Provide the following power and starting components:

1. Circuit breaker for each compressor and each fan
2. Fusing for the control circuit
3. Compressor and fan starting contactors
4. Solid state compressor sequence start timer
5. Compressor overload protection in all three phases
6. Unit power terminal block for field connection to a single power supply and control power transformer.

.23 Factory secured seismic restraint connection hardware.

2.3 MASTER CONTROLLER

.1 Microprocessor-based master controller, factory installed and connected, designed to schedule various compressors in response to leaving hydronic liquid temperatures to suit system demand and such that a new lead compressor is selected every 24 hours. System response times and set-points are to be adjustable. A password shall be required to make system changes

.2 All programmable functions shall be entered on flash memory to ensure program retention should power fail.

.3 The screen shall display the following information:

.1 Date and time;

.2 Leaving hot water temperature set point;

.3 Ambient temperature;

.4 Unit stats (on, off, alarmed);

.5 System demand;

.6 Compressors suction pressure;

.7 Compressors discharge pressure;

.8 Compressors unloaders status (on,off);

.9 Compressor suction pressure setpoint;

.10 Water regulating valve opening position;

.4 The controller shall have the following functions:

.1 Compressor short-cycle control

.2 Compressor head and suction pressure control

.3 Automatic compressor sequencing

.4 Compressors load/unload control

.5 Compressor zero load timing

.6 High/Low pressure avoidance

.7 Evaporator defrost sequence

.8 Condenser Entering and Leaving Temp Sensor Failure

.9 Alarms for High or Low Pressure Sensors Failures

.10 Low Oil Flow Alarm

.11 Overload/SC Alarm

.12 Condenser Flow / Low flow Alarm

.13 Evaporator fan speed

.14 Voltage Phase Monitor

.5 Controller is to be complete with all required hardware and accessories for connection into building automation system in accordance with drawing requirements.

2.4 ADDITIONAL CONTROLS AND ACCESSORIES

.1 Heat pump assembly is to be complete with following additional controls and accessories:

.1 all required refrigerant circuit specialties including a properly sized refrigerant receiver and flooded head pressure control valves for operation in an ambient temperature as low as -28.8°C (-20°F);

.2 Display all temperatures with 0.1 deg. F. resolution Display all pressures with 0.1 psi resolution

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Provide air-to-water heat pumps.

.2 Install heat pump system in accordance with manufacturer’s written installation instructions. Ensure adequate clearances for servicing and maintenance. Provide ancillary components as required per manufacturer’s written literature.

.3 Install units on a flat surface, level within 0.125 mm (1/8 in.), and of sufficient strength to support concentrated loading.

.4 Provide a fine mesh strainer installed in the hydronic circuit upstream of the load water heat exchangers.

.5 Provide isolation valves, balancing valves, and flexible connections in water piping connections to each heat exchanger.

.6 Secure each heat pump assembly in place, level and plumb, on full length steel rails supplied with heat pump assembly and in accordance with manufacturer’s instructions.

.7 Provide all water piping so unit and water circuits are serviceable, without having to dismantle excessive lengths of pipe.

.8 Provide differential pressure gauge across all supply and return connections.

.9 Provide wells and taps for thermometers, sensors, and pressure gauges in water piping adjacent to inlet and outlet connections of each heat exchanger. Provide temperature and pressure gauges.

.10 Provide certified wiring schematics to the Electrical Division for the heat pump, associated equipment and controls. Provide all necessary control wiring as recommended by the manufacturer.

.11 Brace and secure each assembly in accordance with requirements specified in Section 20 05 48.16 – Seismic Controls for Mechanical Systems.

.12 Connect each heat pump assembly with valved piping with flexible connectors. Install components shipped loose with the assembly.

3.2 DELIVERY AND HANDLING

.1 Deliver heat pumps to the Place of the Work completely assembled and charged with refrigerant.

.2 Comply with the manufacturer's instructions for transporting, rigging, and assembly of heat pumps.

3.3 SYSTEM STARTUP

.1 For equipment/system manufacturer certification requirements, refer to Section 20 05 00 – Common Work Results for Mechanical.

.2 For equipment/system start-up requirements, refer to Section 20 05 00 – Common Work Results for Mechanical.

.3 Commence the warranty period at the date of initial startup, continuing for a period of two (2) years, not to exceed thirty (30) months from shipment. Provide manufacturer's warranty including all parts. Do not include refrigerant in the warranty.

.4 Provide the services of a factory authorized service engineer to provide complete start-up supervision.

3.4 CLOSEOUT ACTIVITIES

.1 Include for a 1/2 day on-site heat pump operation demonstration and training session. Training is to be a full review of all components including but not limited to a full heat pump internal inspection, construction details, operation, maintenance, abnormal events, and setting up controls.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 AHRI Standard 410-2023, Performance Rating of Forced-circulation Air-cooling and Air-heating Coils.

.2 CSA C22.2 No. 155-M86 (R2022), Electric duct heaters.

.3 CSA C22.2 No. 236-15, Heating and cooling equipment.

1.2 SUBMITTALS

.1 Submit shop drawings/product data sheets for heating coils, including accessories.

PART 2 - PRODUCTS

2.1 DUCT MOUNTED ELECTRIC REHEAT COILS

.1 Electric reheat coils in accordance with drawing schedule, each certified in accordance with CSA C22.2 No. 155, Electric Duct Heaters and CSA C22.2 No. 236, and each complete with frame members, terminal boxes and covers and associated sheet metal work constructed of heavy-gauge die-formed steel with an integral corrosion-resistant coating and fabricated into coil shape by spot welding, a corrosion protected sheathed heating element, an automatic reset and an auxiliary manual reset snap-action high temperature limit control to protect coils from overheating from any cause, and a pre-wired control panel for electrical power and control connections.

.2 Each control panel is to be complete with:

.1 disconnect switch;

.2 magnetic contactor(s);

.3 terminal blocks for power and control wiring connections;

.4 pre-wired differential pressure switch to shut-down coil upon sensing a "no-airflow" condition;

.5 fused control transformer;

.6 electronic step controller to suit the number of heating stages;

.7 fused SCR (silicon control rectifier).

.3 Manufacturers:

.1 INDEECO;

.2 Thermolec Manufacturing Ltd.;

.3 Chromalox Inc.;

.4 Condex Wattco Inc.

PART 3 - EXECUTION

3.1 INSTALLATION OF DUCT MOUNTED ELECTRIC REHEAT COILS

.1 Provide electric reheat coils in supply ductwork.

.2 Secure each coil in place from structure by means of hanger rods, independent of connecting ductwork and located for easy removal and access to power and control panel.

.3 Coordinate installation with electrical trade who will connect coil with power wiring.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 23 21 00 – Hydronic Piping and Pumps.

1.2 SUBMITTALS

.1 Submit shop drawings and/or product data sheets for following:

.1 cross-linked polyethylene (PEX) floor heating grid tubing, fittings and accessories, manifold assembly, control components and controls;

.2 copies of system manufacturer's loop layout design printouts indicating water flows and temperatures, floor profiles with floor covering(s), and heating outputs;

.3 certified tubing and piping layout and schematic for each system zone;

.4 certified power wiring schematic and a certified control wiring schematic with sequence of operation for each system zone;

.5 letter from system component manufacturer stating system components proposed meet all requirements of the Specification.

1.3 CLOSEOUT SUBMITTALS

.1 Submit, prior to Substantial Performance of the Work, start-up or test data specified in Part 3 of this section.

.2 Submit letters of installation certification from system manufacturer's representative as specified in Part 3 of this section.

.3 Training attendance records.

1.4 QUALITY ASSURANCE

.1 Radiant floor heating system is to be installed by journeyman tradesmen with a minimum of 3 years successful installation of PEX radiant floor system components supplied by manufacturer of components.

.2 Prior to installation of system components, meet on-site with system component manufacturer's representative and trades whose work is related to successful installation of system(s) to confirm floor areas involved are ready for tubing installation.

1.5 WARRANTY

.1 Submit, at Substantial Performance of the Work, a non-prorated transferable repair or replacement warranty in name of Owner, issued by and signed by system component manufacturer covering materials against failure due to defects in material and/or workmanship as follows:

.1 PEX tubing, 25 years;

.2 manifold assemblies, 5 years;

.3 controls and electrical components, 2 years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Uponor Inc.;

.2 Watts Radiant Inc.;

.3 Rehau Inc.

2.2 SYSTEM MATERIALS

.1 Uponor Inc. radiant floor heating system components as follows:

.1 cross-linked polyethylene (PEX) tubing to CAN/CSA B137.5, ASTM F876 and F877, and SDR-9 requirements with an oxygen barrier in accordance with German Standard DIN 4726, flame spread, and smoke developed ratings in accordance with CAN/ULC S102 and ASTM E84, supplied in coils, and with characteristics and accessories as follows:

.1 Plastic Pipe Institute certified temperature and pressure ratings of 550 kPa at 93°C (80 psi at 200°F), 690 kPa at 82°C (100 psi at 180°F), and 1100 kPa at 23°C (160 psi at 74°F);

.2 where required, "ProPEX" cold expansion type fittings in accordance with ASTM F877, CAN/CSA B137.5, and ASTM F1960, each consisting of a barbed adapter with an o-ring and an applicable sized PEX ring;

.3 minimum bend radius of 6 times the tubing OD, with factory supplied bend supports required for tubing with a bend radius less than 6 times the tubing OD;

.4 all required installation and connection accessories to suit floor construction, all in accordance with tubing manufacturer’s instructions and factory supplied with tubing.

.2 Package type copper or brass supply and return manifold assembly to suit number of heating zones, factory assembled and equipped with wall mounting brackets and following:

.1 main supply and return full flow ball type isolating valves, zone pipe connection couplings, and fill/drain valves for both supply and return manifolds;

.2 supply manifold automatic air vent, and zone on/off valves with 24 volt AC actuators to suit control system;

.3 return manifold pressure balancing by-pass valve, and zone balancing valves and flow rate indicators;

.4 combination pressure gauge and thermometer for each manifold, and individual zone return piping thermometers for accurate visual zone balancing by zone temperature drops;

.5 all other required fittings and connection accessories.

.3 Controls in accordance with drawing control diagram and sequence.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Provide hydronic radiant floor heating zones and piping manifold assemblies. System installation is to be in strict accordance with manufacturer’s instructions.

.2 Piping is to be as follows:

.1 for pipe inside building and aboveground, Schedule 40 black steel, screwed, ASTM A53, Grade B, ERW, or Type "K" hard temper copper with forged copper solder type fittings and 95% tin / 5% Antimony solder joints, all in accordance with Section 23 21 00 – Hydronic Piping and Pumps.

.2 for floor grid piping, PEX pipe installed in continuous lengths with all required support and installation accessories.

.3 Provide a strainer in piping to manifold supply header and clean strainer screen when system balancing is to commence.

.4 Ensure grid tubing has been successfully pressure tested prior to concealment. Be present when covering is being placed over grid tubing to ensure integrity of tubing is not compromised during placement of remainder of floor construction.

.5 Where tubing and/or piping penetrates fire rated construction, carefully coordinate with firestopping work specified in Division 07.

.6 Where tubing and/or piping penetrates fire rated construction, provide firestopping in accordance with requirements specified in Section 20 05 17 – Sleeves and Sleeve Seals for Mechanical Piping.

.7 Prior to system flow balancing, ensure all air is purged from system and system operates successfully at design temperatures and pressure for a minimum of 2 days. Supply system manufacturer’s software for final balancing flow adjustment settings.

3.2 SYSTEM STARTUP

.1 For equipment/system start-up requirements, refer to Section 20 05 00 – Common Work Results for Mechanical.

.2 For equipment/system manufacturer certification requirements, refer to Section 20 05 00 – Common Work Results for Mechanical. Ensure system manufacturer inspects grid tubing installation prior to concealment and certifies each zone correct in writing. Submit a copy of each certification letter prior to Substantial Performance of the Work.

3.3 TRAINING

.1 Include for 4 hours of on-site training for 2 groups of 6 people. Training is to be a full review of all components including but not limited to a full operation and maintenance demonstration, with abnormal events.

END OF SECTION

Updated through ADD#10

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 23 21 00 – Hydronic Piping and Pumps.

1.2 DESCRIPTION OF WORK

.1 Supply and install a complete hydronic snow melting system consisting of (but not limited to) the following main components:

.1 A gas-fired heating plant including boilers, pumps, expansion tanks, glycol fill equipment and accessories serving snow melting system and floor radiant heating system;

.2 Snow melting embedded tubing;

.3 Piping distribution for the heating agent, including manifolds, valves, gauges and accessories;

.4 Valve and manifold concrete chambers;

.5 A digital control system to be tied into the Owner's building automation;

.6 Ancillary drainage, water make-up and accessories; and

.7 All power supply and control wiring required to make the system fully operational.

.2 Complete design of the snow melting system, including calculation, layouts and schematic drawings to show control sequence, equipment layout , tubing patterns, manifold locations, appropriate cross-sections and special installation techniques to suit final architectural requirements and layout as required by code, standards and Authorities Having Jurisdiction.

.3 Misinterpretation of any requirement of the drawings and specifications will not relieve the contractor of responsibility. If in any doubt, the contractor shall contact the Consultant for written clarification prior to submitting a bid for the Work.

.4 Wherever differences occur between specifications, plans, schematics and drawings, the maximum conditions shall govern and the bid shall be based on whichever indicates the greater cost

.5 In addition to the Work specifically mentioned in the Specifications and shown on the drawings, provide all other items that are obviously necessary to make a complete working installation, including those required by the Authorities Having Jurisdiction over the Work.

1.3 SUBMITTALS

.1 Submit shop drawings and/or product data sheets for following:

.1 cross-linked polyethylene (PEX) floor heating grid tubing, fittings and accessories, manifold assembly, control components and controls;

.2 copies of system manufacturer's loop layout design printouts indicating water flows and temperatures, floor profiles with floor covering(s), and heating outputs;

.3 certified tubing and piping layout and schematic for each system zone;

.4 certified power wiring schematic and a certified control wiring schematic with sequence of operation for each system zone;

.5 letter from system component manufacturer stating system components proposed meet all requirements of the Specification.

.2 Submit to the Consultant shop drawings, calculation and report for the snow melting system. Further details and special requirements called for in these specifications shall be shown on the shop drawings.

.3 Submit Product data of all mechanical equipment including but not limit to:

.1 Boilers;

.2 Burners;

.3 Boiler Controls;

.4 Glycol automatic fill station;

.5 Expansion tank; and

.6 Pumps.

.4 Provide mechanical layout and schematic drawing indicating heat source, mechanical piping and accessories from heat source to manifolds, circulators, water tempering and zone controls. Indicate primary loop and second loop's supply and return water temperatures and flow rates to manifolds.

.5 Provide installation drawings indicating tubing layout, manifold locations, zoning requirements and manifold schedules with details required for installation of the snow melting system.

.6 Indicate piping, valves and fittings shipped loose by packaged equipment supplier, showing their final location in field assembly. Submit selection and verification samples of piping.

.7 Provide control schematic drawing and detailed sequence of operation for snow melting system.

.8 Provide samples of mechanical equipment as requested in the Specification at the same time as the shop drawing submission.

.9 Ensure that copies of all reviewed shop drawings are available on the job site for reference.

1.4 CLOSEOUT SUBMITTALS

.1 Submit, prior to Substantial Performance of the Work, start-up or test data specified in Part 3 of this section.

.2 Submit letters of installation certification from system manufacturer's representative as specified in Part 3 of this section.

.3 Training attendance records.

1.5 AS-BUILT DRAWINGS

.1 Maintain up to date "as built" drawings on site and submit to the Consultant at completion of the Project as specified in this Section

.2 Any subsequent changes found by the Consultant shall remain the responsibility of the Contractor at no charge to the Owner.

1.6 QUALITY ASSURANCE

.1 Radiant heating system is to be installed by journeyman tradesmen with a minimum of 3 years successful installation of PEX radiant floor system components supplied by manufacturer of components.

.2 Prior to installation of system components, meet on-site with system component manufacturer's representative and trades whose work is related to successful installation of system(s) to confirm floor areas involved are ready for tubing installation.

.3 Unless a written order reviewed by the Consultant and countersigned or otherwise approved by the Owner, no additional work shall be undertaken by the Contractor.

1.7 WARRANTY

.1 Submit, at Substantial Performance of the Work, a non-prorated transferable repair or replacement warranty in name of Owner, issued by and signed by system component manufacturer covering materials against failure due to defects in material and/or workmanship as follows:

.1 PEX tubing, 25 years;

.2 manifold assemblies, 5 years;

.3 controls and electrical components, 2 years.

.2 All tubes, supply lines, and return lines shall carry a twenty-five (25) year non-prorated warranty against failure due to defect in material and/or workmanship.

.3 The complete system shall be covered by a two (2) year warranty against failure due to defect in materials and/or workmanship.

.4 The complete system shall be covered by a ten (10) year limited system performance warranty. This warranty requires that the system detailed design, supervision, commissioning, and witnessing all pressure tests shall be performed by Authorized personnel employed by system supplier.

.5 All warranty periods are measured from date of Substantial Performance of the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Uponor Inc.;

.2 Wirsbo;

.3 Stadler

2.2 CROSSLINKED POLYETHYLENE TUBING

.1 Cross-linked polyethylene (PEX) manufactured by the "Engle method". Manufactured in accordance with ASTM F876 and ASTM F877 and tested for compliance by an independent third-party agency. Show compliance with ASTM E119 and ANSI/UL 263 through certification listings through UL.

.2 Standard grade hydrostatic design and pressure ratings as issued by the Plastics Pipe Institute (PPI), a division of the Society of the Plastics Industry (SPI).

.3 Minimum bend radius (cold bending) shall be no less than six times the outside diameter. Manufacturer's bend supports must be used if radius is less than stated.

.4 Oxygen Diffusion Barrier:

.1 Not exceed an oxygen diffusion rate of 0.10 grams per cubic meter per day at 40°C (104°F) water temperature in accordance with German DIN 4726;

.2 Provide tubing with nominal inside diameter in accordance with ASTM F876, as indicated.

.1 12.7 mm (½").

.2 19 mm (¾").

.3 25 mm (1").

2.3 HEATING AGENT DISTRIBUTION PIPING

.1 All piping between the exterior wall of the boiler room and the interior wall of the distribution manifolds chamber(s) to be pre-insulated pipe system for buried commercial hydronic heating applications.

.2 Pipes to be Cross linked polyethylene (PEX-a) Engel-method tubing with an EVOH oxygen barrier that conforms to German DIN 4726; smoothness value of 0.02 mil; NSF certified SDR-9.

.3 Pipes insulated with Multilayered, closed-cell, PEX-foam insulation with a thermal conductivity of 0.26 BTU in./sq. ft./hour/°F; vapor permeability of 0.1g/100 sq. in./day

.4 Cover jacket for insulated piping to be Corrugated seamless high-density polyethylene (HDPE), UV- protected.

.5 Operating Limits:

.1 -50°C to 95°C (58°F to 203°F) at 87 psig.

2.4 MAIN HOT WATER PIPING AND FITTING

.1 Exposed hot water heating piping inside the boiler room shall be standard black carbon steel schedule 40 to ASTM A-53. Up to 50 mm (2") threaded with 1,050 kPa (150 psi) malleable iron fittings, 65 mm (2 ½") and up shall be welded, Victaulic grooved or flanged 150 psi welded.

.2 All fittings, elbows, steel copper brass transitions, shrink caps, and miscellaneous items to be compression type and supplied by the pipe manufacturer.

2.5 MANIFOLDS (COMMERCIAL, VALVED COPPER)

.1 Use 2" valved copper manifolds manufactured from Type L copper material, offered by the respective PEX tubing manufacturer. Valving shall include ball isolation valves.

.2 Ensure manifold end cap offers tapping for ⅛" FNPT and ½" FNPT for vent and drain.

.3 Install supply and return piping to the manifold in a reverse-return configuration to ensure self-balancing.

.4 Use manifolds with an isolation valve on each outlet.

.5 Use manifolds that support PEX tubing.

.6 If the supply and return piping is in direct-return configuration, install and balance flow setters on the return leg of each manifold to the mains.

2.6 HEPEX SNOW MELTING TUBING

.1 Section Includes: Hydronic snow and ice melting systems for various slab constructions and control strategies, using cross-linked polyethylene (PEX) tubing and applicable fittings.

.2 Material: Cross-linked polyethylene (PEX) manufactured by the "Engle method".

.3 Material Standard: Manufactured in accordance with ASTM F876 and ASTM F877 and tested for compliance by an independent third-party agency

.4 Pressure Ratings: Standard grade hydrostatic design and pressure ratings as issued by the Plastics Pipe Institute (PPI), a division of the Society of the Plastics Industry (SPI).

.5 Show compliance with ASTM E119 and ANSI/UL 263 through certification listings through UL.

.6 Minimum Bend Radius (Cold Bending): No less than six times the outside diameter. Use the PEX tubing manufacturer's bend supports if radius is less than stated.

.7 Standard of Acceptance: Upnor, Wirsbo, Stadler or approved equivalent

.8 Oxygen Diffusion Barrier:

.1 The oxygen diffusion barrier does not exceed an oxygen diffusion rate of 0.10 grams per cubic meter per day at 40°C (104°F) water temperature in accordance with German DIN 4726; and

.2 Nominal Inside Diameter: Provide tubing with nominal inside diameter in accordance with ASTM F876, as indicated.

.1 12.7 mm (½").

.2 19 mm (¾").

.3 25 mm (1").

.9

.10 Insulation:

.1 Use a 100 mm (4") rigid layer of Styrofoam insulation under the tubing (per structural drawings)

.11 Installer's Experience:

.1 The installing Contractor shall have a minimum of ten (10) years of demonstrated experience on projects of similar size and complexity in Ontario.

.12 Glycol/Water Solution:

.1 The heating fluid shall be premixed glycol/water solutions. PEX tubing manufacturer allows site-mixed solutions if mixed to the proper concentration before entering the system.

.2 Mix the glycol/water solution to proper concentration levels to protect the system freezing during operation shutdown.

.3 System circulators must operate continuously for a minimum of thirty (30) days after the system is filled to ensure the glycol and water does not separate in a static system.

.4 Do not use ethylene glycol due to toxicity issues. Instead, use of propylene glycol. Also, refer to the boiler manufacturer's recommendations.

.13 Field Quality Control:

.1 Site Tests:

.1 To ensure system integrity, pressure test the system before covering tubing in concrete or when other trades are working in the vicinity of the tubing.

.2 Test all electrical controls in accordance with respective installation manuals.

.14 Cleaning:

.1 Remove temporary coverings and protection of adjacent work areas.

.2 Repair or replace damaged installed products.

.3 Clean installed products in accordance with manufacturer's instructions prior to owner's acceptance.

.4 Remove construction debris from project site and legally dispose of debris.

.15 Demonstration:

.1 Demonstrate operation of hydronic snow and ice melting system to Owner's personnel.

.2 Advise the Owner about the type and concentration of glycol/water solution used in the hydronic snow and ice melting system.

.3 The Owner monitors the solution effectiveness through an established maintenance program as outlined by the glycol manufacturer.

.16 Protection:

.1 Protect installed work from damage caused by subsequent construction activity.

2.7 FITTINGS

.1 Use fittings, connectors, wall sleeves and other accessories offered by the PEX tubing manufacturer, including connectors to metallic piping

.2 The fitting assembly must comply with ASTM F877 and CAN/CSA-B137.5 requirements

.3 Fitting assembly manufactured from UNS C3600 series brass material.

.4 Fitting assembly consists of a barbed insert, a compression ring and a compression nut. The barbed insert is manufactured with an o-ring to facilitate air pressure testing.

.5 Fittings manufactured in accordance with ASTM F1960.

.6 Fitting assembly manufactured from material listed in paragraph 5.1 of ASTM F1960.

.7 The fitting assembly consists of a barbed adapter and an applicable sized PEX ring. The barbed insert may include an o-ring to facilitate pressure testing with air.

2.8 MANIFOLD CHAMBER

.1 Pre-cast or poured in place concrete. Footprint and depth sized to avoid classification as "confined space". Coordinate with Structural Division.

.2 Access doors

.1 Cover and frame to be constructed out of 6.35mm (¼") aluminum. Cover to be checkered plate type, reinforced for 150 psf (732 kg/m2), live load. Frame to be extruded aluminum with built-in anchor flange around the perimeter.

.2 Continuous heavy-duty type 316 stainless steel hinges.

.3 Type 316 stainless steel slam lock latch with fixed interior handle and removable exterior turn/lift handle. Latch release is protected by a flush, gasketed, removable screw plug.

.4 Engineered composite compression spring operators enclosed in telescopic tubes. Automatic hold-open arm with grip handle release. Steel compression springs with electro coated acrylic finish

.5 Access doors to be finished with mill finish aluminum with a bituminous coating applied to the exterior of the frame.

2.9 GLYCOL AUTOMATIC FILL STATION

.1 Install in accordance to the manufacturer's instruction. Provide concrete support pad.

.2 Connect to power supply and controls; including tie-in to the Owner's building automation system.

.3 Start-up and adjustment: by equipment manufacturer. Cost to be covered by the Contractor.

2.10 CONCRETE

.1 All concrete work required to complete this Project, whether shown on the drawings or not, shall be the Contractor's responsibility.

2.11 METALS

.1 All steel construction required for the completion of this Project, whether shown on the drawings or not, shall be the Contractor's responsibility.

2.12 CUTTING, PATCHING, ROOFING AND X-RAY

.1 All cutting, patching, roofing and X-Rays required for the completion of this Project whether shown on the drawings or not, shall be the Contractor's responsibility. The cutting and patching work shall be performed in accordance with the following.

2.13 ACCESSORIES

.1 Non-ferrous sleeves shall be provided wherever tubing enters and exits the floor.

.2 Bend supports shall be provided for all 90° elbows.

2.14 VALVES

.1 Asbestos packing is not acceptable

.2 All valves of the same type shall be products of a single manufacturer. Provide gate and globe valves with packing that can be replaced with the valve under full working pressure.

.3 Provide chain operators for valves 100 mm (4") and larger when the centerline is located 2,400 mm (8') or more above the floor or operating platform.

.4 Standard of Acceptance: Crane, Jenkins, Toyo, Kitz or approved equivalent.

.5 Gate Valves:

.1 50 mm (2") and smaller: MSS SP80, bronze, 1,034 kPa (150 lb.), wedge disc, rising stem, union bonnet.

.2 65 mm (2 ½") and larger: Flanged, outside screw and yoke.

.3 MSS SP 70, iron body, bronze mounted, 861 kPa (125 psig) wedge disc.

.6 Globe, Angle and Swing Check Valves:

.1 50 mm (2") and smaller: MSS SP 80, bronze, 1034 kPa (150 lb.) Globe and angle valves shall be union bonnet with metal plug type disc.

.2 65 mm (2 ½") and larger: 861 kPa (125 psig), flanged, iron body, bronze trim, MSS SP 85 for globe valves and MSS SP 71 for check valves.

.3 Non Slam or Silent Check Valve: Spring loaded double disc swing check or internally guided flat disc lift type check for bubble tight shut off. Provide where check valves are shown in chilled water and hot water piping.

.4 Body: Cast iron, ASTM A126, Class B, or steel, ASTM A216, Class WCB, or ductile iron, ASTM 536, flanged, grooved, or wafer type.

.5 Seat, disc and spring: 18-8 stainless steel, or bronze, ASTM B62. Seats may be elastomer material.

.7 Butterfly Valves:

.1 May be used in lieu of gate valves. Provide stem extension to allow 50 mm (2") of pipe insulation without interfering with valve operation.

.2 MSS SP 67, flange lug type (for end of line service) or grooved end rated 1205 kPa (175 psig) working pressure at 93°C (200°F).

.3 Body: Cast iron, ASTM A126, Class B. Malleable iron, ASTM A47 electro- plated, or ductile iron, ASTM A536, Grade 65 45 12 electro-plated.

.4 Trim: Bronze, aluminum bronze, or 300 series stainless steel disc, bronze bearings, 316 stainless steel shaft and manufacturer's recommended resilient seat. Resilient seat shall be field replaceable, and fully line the body to completely isolate the body from the product. A phosphate coated steel shaft or stem is acceptable, if the stem is completely isolated from the product.

.5 Actuators: Field interchangeable. Valves for balancing service shall have adjustable memory stop to limit open position.

.6 Valves 150 mm (6") and smaller: Lever actuator with minimum of seven (7) locking positions, except where chain wheel is required.

.7 Valves 200 mm (8") and larger: Enclosed worm gear with handwheel, and where required, chain wheel operator.

.8 Ball Valves:

.1 Brass or bronze body with chrome-plated ball with full port and Teflon seat at 2,760 kPa (400 psig) working pressure rating. Screwed or solder connections. Provide stem extension to allow operation without interfering with pipe insulation.

.9 Water Flow Balancing Valves:

.1 For flow regulation and shut off. Valves shall be line size rather than reduced to control valve size and be one of the following types.

.2 Butterfly valve as specified herein with memory stop.

.3 Eccentric plug valve: Iron body, bronze or nickel plated iron plug, bronze bearings, adjustable memory stop, operating lever, rated 861 kPa (125 psig) and 121°C (250°F).

.10 Circuit Setter Valve:

.1 A dual purpose flow balancing valve and adjustable flow meter, with bronze or cast iron body, calibrated position pointer, valved pressure taps or quick disconnects with integral check valves and preformed polyurethane insulating enclosure. Provide a readout kit including flow meter, readout probes, hoses, flow charts or calculator, and carrying case.

.11 Automatic Balancing Control Valves:

.1 Factory calibrated to maintain constant flow (± 5%) over system pressure fluctuations of at least ten (10) times the minimum required for control. Provide standard pressure taps and four sets of capacity charts. Valves shall be line size and be one of the following designs.

.2 Gray iron (ASTM A126) or brass body rated 1205 kPa (175 psig) at 93°C (200°F), with stainless steel piston and spring.

.3 Brass or ferrous body designed for 2067 kPa (300 psig) service at 121° C (250°F), with corrosion resistant, tamper proof, self-cleaning piston/spring assembly that is easily removable for inspection or replacement.

.4 Brass or ferrous body designed for 2067 kPa (300 psig) service at 121°C (250°F), with corrosion resistant, tamper proof, self-cleaning piston/spring assembly that is easily removable for inspection or replacement.

.5 Provide a readout kit including flow meter, probes, hoses, flow charts and carrying case.

PART 3 - EXECUTION

~~**1.1 DESCRIPTION OF WORK**~~

~~.1 Supply and install a complete hydronic snow melting system consisting of (but not limited to) the following main components:~~

~~.1 A gas-fired heating plant including boilers, pumps, expansion tanks, glycol fill equipment and accessories serving snow melting system and floor radiant heating system;~~

~~.1 Snow melting embedded tubing;~~

~~.1 Piping distribution for the heating agent, including manifolds, valves, gauges and accessories;~~

~~.1 Valve and manifold concrete chambers;~~

~~.1 A digital control system to be tied into the Owner's building automation;~~

~~.1 Ancillary drainage, water make-up and accessories; and~~

~~.1 All power supply and control wiring required to make the system fully operational.~~

~~.1 Complete design of the snow melting system, including calculation, layouts and schematic drawings to show control sequence, equipment layout , tubing patterns, manifold locations, appropriate cross-sections and special installation techniques to suit final architectural requirements and layout as required by code, standards and Authorities Having Jurisdiction.~~

~~.1 Misinterpretation of any requirement of the drawings and specifications will not relieve the contractor of responsibility. If in any doubt, the contractor shall contact the Consultant for written clarification prior to submitting a bid for the Work.~~

~~.1 Wherever differences occur between specifications, plans, schematics and drawings, the maximum conditions shall govern and the bid shall be based on whichever indicates the greater cost~~

~~.1 In addition to the Work specifically mentioned in the Specifications and shown on the drawings, provide all other items that are obviously necessary to make a complete working installation, including those required by the Authorities Having Jurisdiction over the Work.~~

3.1 INSTALLATION

.1 Comply with manufacturer's product data, including product technical bulletins, installation instructions and design drawings.

.2 Verify that site conditions are acceptable for installation of the snow melting system. Do not proceed with installation of the snow and ice melt system until unacceptable conditions are corrected.

.3 Slab-on-grade Construction with Edge and Under-slab Insulation:

.1 When using high-density foam insulation board, install the tubing by wire tie to rebar.

.2 The submitted snow-melt design shall specify the tubing on-center distance(s) and loop lengths, based on output and tubing diameter. On- center distances will not exceed 305 mm (12").

.3 Do not install tubing closer than 152 mm (6") from the edge of the heated slab.

.4 Install the tubing at a consistent depth below the surface elevation as determined by the Consultant. Tubing installation will ensure sufficient clearance for all control joint cuts.

.5 Fibrous expansion joints may be penetrated following the PEX tubing manufacturer's and structural engineer's recommendation.

.6 Metal or plastic bend supports will be used to support the tubing when departing from the slab in a 90° bend.

.4 Ensure grid tubing has been successfully pressure tested prior to concealment. Be present when covering is being placed over grid tubing to ensure integrity of tubing is not compromised during placement of remainder of floor construction.

.5 Heating Agent Distribution Piping:

.1 Piping shall be installed in a schedule 40 PVC pipe sleeve; the sleeve size shall be two diameter sizes larger than the combined diameter of the distribution piping plus insulation plus jacket.

.2 Maintain minimum 4" horizontal distance between the PVC sleeves.

.3 Coordinate with the site services discipline the depth of the sleeves and the back-filling material, depending on the nature of the surface above (landscape, pedestrian traffic, vehicular traffic, train right of way, etc.).

.4 Respect the minimum bending radius recommended by the manufacturer.

.6 Where tubing and/or piping penetrates fire rated construction, provide firestopping in accordance with requirements specified in Section 20 05 17 – Sleeves and Sleeve Seals for Mechanical Piping.

.7 Provide snow melt radiant heating zones and piping manifold assemblies. System installation is to be in strict accordance with manufacturer's instructions.

.8 Provide a strainer in piping to manifold supply header and clean strainer screen when system balancing is to commence.

.9 Prior to system flow balancing, ensure all air is purged from system and system operates successfully at design temperatures and pressure for a minimum of 2 days. Supply system manufacturer's software for final balancing flow adjustment settings.

.10 Balancing Across the Manifold:

.1 Balance all loops across each manifold for equal flow resistance based on actual loop lengths and total **manifold** flow.

.2 Balancing is unnecessary when all loop lengths across the manifold are within 3% of each other in length. Install the supply and return piping to the manifold in a reverse-return configuration to ensure self-balancing.

.3 Balancing between manifolds is accomplished with a flow control device installed on the return piping leg from each manifold when direct return piping is used for the supply and return mains.

.4 Adjust all boiler and system controls after the system has stabilized to ensure proper operation in accordance with the system design.

3.2 SYSTEM STARTUP

.1 For equipment/system start-up requirements, refer to Section 20 05 00 – Common Work Results for Mechanical.

.2 For equipment/system manufacturer certification requirements, refer to Section 20 05 00 – Common Work Results for Mechanical. Ensure system manufacturer inspects grid tubing installation prior to concealment and certifies each zone correct in writing. Submit a copy of each certification letter prior to Substantial Performance of the Work.

.3 After all equipment has been installed, adjusted, balanced and started up, subject equipment to a series of performance tests, as soon as conditions permit.

.4 The timing of the tests shall be arranged to suit the convenience of the Consultant, and the manner and duration shall be as the Consultant deems necessary. Record the daily start and stop times, operating hours and functions performed. Ensure that the performance tests are witnessed by the Consultant.

.5 All major equipment including but not limited to boilers, and pumps, are to be inspected by the manufacturer to ensure that the equipment has been installed in accordance with their recommendations.

.6 Operate equipment under varying load conditions, demonstrate start-up sequence, normal shutdown, simulated emergency shutdown, operation of temperature, etc., and safety controls. Operate switches and electrical devices for correct wiring sequences. Adjust components to achieve a proper functional relationship among all the components of all the systems. Repeat these functions as many times as deemed necessary by the Consultant to achieve reliable operation.

.7 Repair defects and repeat tests as necessary. During test maintain lubrication schedule, set, align and tension drives.

.8 At the successful completion of Performance Tests and all testing and balancing, make the systems ready for final inspection and subsequent acceptance of the Owner. Replace and clean filters, flush out lines and equipment, remove and clean strainers, fill liquid systems and purge air as required by the codes. Disinfect all domestic water as required by current by-laws and Authorities Having Jurisdiction.

3.3 OPERATING AND MAINTENANCE MANUALS

.1 Provide minimum of four (4) copies of Mechanical Maintenance Manuals. Mechanical Maintenance Manuals to be delivered to the Consultant's office ten (10) days prior to the Substantial Completion of the Contract.

.2 Manuals to be bound in a hard cover neatly labeled: “OPERATING AND MAINTENANCE INSTRUCTIONS”.

.3 The Maintenance Manuals shall be divided into sections with neatly labeled and tabbed dividers between each section. The sections to be included in the manual and the information contained within each section are:

.1 Section I-General:

.1 A list giving name, address and telephone number of the Consultant, Engineers, and Contractor, Mechanical Trade and Controls Trade.

.2 Warranty certificates for the Mechanical Systems.

.3 A copy of the valve directory giving number, valve location, normal valve position, and purpose of valve (a framed copy of valve directory to be hung in the boiler room).

.4 Equipment lists and certificates shall be provided - certificates shall be signed and sealed by the appropriate suppliers.

.2 Section II & III-Metallic piping and pump Systems, plumbing fixtures and snow and ice melting plastic tubing/In-floor radiant heating tubing:

.1 A copy of all pressure tests and operational tests, a copy of Gas Operational Tests for gas fired equipment. A list giving the name, address and telephone number of all suppliers. A copy of all reviewed shop drawings for the mechanical equipment.

.3 Section IV-Automatic controls;

.1 Complete Control Diagrams, Wiring Diagrams and description of Control system and the functioning sequence of the system.

.4 Section V-Hydronic Balancing Reports:

.1 Complete results of the hydronic balancing.

3.4 TESTING, ADJUSTING AND BALANCING (TAB)

.1 Coordinate with the mechanical Contractor the TAB activity such that it does take place before the insulation is installed on ductwork and piping.

.2 In the absence of such coordination, the mechanical contractor shall be responsible for the repair to the ductwork and or piping insulation removed for TAB purposes, including the integrity of the vapor barrier material and the insulation jacket.

.3 General:

.1 Obtain applicable Contract Documents and copies of approved submittals for HVAC equipment and automatic control systems.

.4 Systems Inspection Report:

.1 Inspect equipment and installation for conformance with design.

.2 The inspection and report is to be done after air distribution equipment is on site and duct installation has begun, but well in advance of performance testing and balancing work. The purpose of the inspection is to identify and report deviations from design and ensure that systems will be ready for TAB at the appropriate time.

.3 Verify that all items such as ductwork piping, ports, terminals, connectors, etc., that is required for TAB are installed. Provide a report to the Consultant.

.4 Reports: Follow check list format developed by Associated Air Balance Council (AABC) or Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), supplemented by narrative comments

.5 Tab Report:

.1 Format to be in accordance with referenced standard listed above, but using design drawing units.

.2 Produce “as-built” full system schematics. Use as-built drawings for reference.

.3 Submit 1 copy of preliminary TAB reports, each in “D” ring binders, complete with index tabs for verification and approval of Consultant.

.4 Submit copies of final TAB reports after approval by the Consultant, to be incorporated into the Maintenance and Operations Manual, as indicated in section 15010 General Mechanical Requirements.

.6 Procedures:

.1 Tab shall be performed in accordance with the requirement of the Standard under which TAB agency is certified.

.2 Start final TAB only when building is essentially completed, including: normal operation of mechanical systems affecting TAB.

.3 General: During TAB all related system components shall be in full operation. Fan and pump rotation, motor loads and equipment vibration shall be checked and corrected as necessary before proceeding with TAB. Set controls and/or block off parts of distribution systems to simulate design operation of variable volume air or water systems for test and balance work.

.7 Water Balance and Equipment Test:

.1 Include all circulating pumps, heat exchangers, boilers, coils, chillers, coolers and condensers, as applicable to this Project.

.2 Adjust flow rates for equipment to the values indicated on the Contract Drawings and schedules. Set balancing valves and circuit setters to the values on indicated on the equipment schedules.

.3 Record final measurements for hydronic equipment on performance data sheets. Include entering and leaving water temperatures for heating and cooling coils, and for heat exchangers. Include entering and leaving air temperatures for all equipment (boilers, manifolds, mixing valves, etc).

.8 Verification:

.1 Reported measurements shall be subject to verification by Consultant. Provide instrumentation and manpower to verify results of up to 30 % of all reported measurements. Number and location of verified measurements to be at discretion of Consultant.

.2 Bear costs to repeat TAB, as required, to satisfaction of Consultant.

.9 Marking Of Settings:

.1 Following approval of TAB final Report, the setting of all HVAC adjustment devices including valves, splitters and dampers shall be permanently marked by the TAB Specialist so that adjustment can be restored if disturbed at any time. Style and colours used for markings shall be coordinated with the Consultant

3.5 DIGITAL CONTROLS

.1 System Hardware:

.1 The system architecture will be comprised of PCUs (Primary Control Units), PACs (Programmable Application Controllers), ASCs (Application Specific Controllers) and any required communications or interface components networked together.

.2 All required site database and graphics files shall reside on the owner’s central server. The connection between the central server and the BAS controllers (to be reserved for future) serving a specific building shall be through the WAN.

.3 The building Staff shall be able to log into the local workstation, access and review on a read-only basis the graphical user interface showing the system layout and operational parameters.

.4 The owner specialized trades shall be capable of accessing and modifying the parameters and schedules using direct connectors at the control panels and portable computers (laptops, notebooks, etc.).

.5 Supply PCU's, PAC's and ASC's as required to interface to all specified equipment.

.6 Allow for a minimum of 25% spare program and trend memory capacity in each PCU and PAC.

.7 For each specified control point, the contractor shall supply the hardware point type (e.g. AI, AO, DI, DO) as indicated on the controls points list. The use of alternate hardware point types or the use of external interface cards or devices to simulate the function of a specified hardware point type is not acceptable. For example, the use of a DO point and an external PWM card to simulate the function of a physical AO point shall not be accepted.

.2 Primary Control Units (PCU):

.1 Use only Primary Control Units to directly control any major mechanical equipment. Major mechanical equipment includes air handling units, boiler plants, chiller plants, cooling towers, roof-top units and other critical equipment.

.2 Each PCU shall contain a real time clock and sufficient memory to store its own application database, operating parameters, user programs and trend data storage.

.3 Battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of seventy-two (72) hours to eliminate operating data reload in case of power failure.

.4 Each PCU output shall include a Hand/Off/Auto (HOA) selector switch for each analog and digital output.

.5 Each PCU shall have a minimum of 10% spare capacity for each type of input and output channels and 10%.

.3 Programmable Application Controllers (PAC):

.1 Programmable Application Controllers (PAC) are fully programmable controllers used for controlling distributed equipment including, but not limited to pumps, exhaust fans, VAV boxes, heat pumps, force flow units and unit ventilators.

.2 PACs shall not be used for controlling major mechanical equipment as described above.

.3 Each PAC shall contain a real time clock and sufficient RAM to store its own application database, operating parameters, user programs and trend data storage.

.4 Battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of seventy-two (72) hours to eliminate operating data reload in case of power failure.

.4 System Software:

.1 Trend Data:

.1 Provide trend logs for all hardware inputs and outputs.

.2 All trends should be accessible via the graphical interface.

.3 Trends should contain all related variables of a control loop (i.e. setpoint, measured variable and control output) and have the ability to be plotted simultaneously on the same graph.

.4 Field Devices individual trends should provide an appropriate “snapshot” of the variable. Slow reacting variables such as space temperatures should be sampled every thirty (30) to sixty (60) minutes while other variables such as mixed air or boiler water temperatures should be sampled every five (5) to ten (10) minutes.

.5 Provide the maximum number of trend samples within the controller while maintaining the requirement for spare memory capability.

.6 The primary input sensor for all control loops must physically be wired to the same panel containing the control loop output (e.g. boiler water temperature and burner control output).

.7 Trend data storage must be in the same panel as the hardware or logical points being trended.

.5 User Access:

.1 Provide the Owner-standard user IDs and passwords for operations, maintenance and engineering staff.

.6 Alarms:

.1 Alarms shall be assigned the following categories:

.1 Maintenance Alarms;

.2 Mismatch of equipment control and status for more than thirty (30) minutes; and

.3 Any other miscellaneous alarm not specifically noted herein.

.2 Alarms shall not require any acknowledgment before automatic reset by the system.

.3 An alarm notification shall not be issued when an alarm condition returns to normal.

.4 The Contractor shall provide additional alarms as directed by the Consultant and specified in this Section and customize the alarms to the operating characteristics of the specific the systems being controlled.

.7 Dynamic Graphics:

.1 Provide customized, site specific dynamic graphics to meet the requirements of the Consultant and/or the Owner.

.8 Sequence Of Operation:

.1 The heating plant shall serve the snow melting system and floor radiant heating system.

.2 The heating plant shall be enabled/disabled based on outdoor of temperature 12°C.

.3 The snow melting system shall be enabled/disabled based on outdoor air temperature 4°C.

.4 With the system enabled, the lead primary boiler pump shall start, while the lag pump shall be energized and in stand-by mode. The lead/lag status of the primary pumps shall alternate at one-hundred-sixty-eight (168) hour intervals (adjustable).

.5 Upon proof of flow in the primary loop, the boiler (B-3) shall start at minimum firing rate, while one of boilers (B-1 &2) shall be energized and another one shall be in stand-by mode. The lead/lag status of the boilers between B-1 & 2 shall alternate at 168 hour intervals (adjustable).

.6 After the boiler starts, its firing rate shall modulate as required to maintain the primary loop return temperature at 52°C (125°F), and subject to a maximum primary loop supply temperature of 66°C (150°F).

.7 If the boiler (B-3) fires at maximum rate for ten (10) minutes and cannot maintain the primary loop return temperature setpoint, another boiler shall start at minimum firing rate. If these two (2) boilers fire at maximum rate for ten (10) minutes and still cannot maintain the primary loop return temperature setpoint, the third boiler shall start at minimum firing rate, its burner shall ramp as required to achieve the maximum primary loop supply temperature of 66°C (150°F). The lead pump's capacity shall be changed by VFD panel to suit for the required water flow rate and pressure.

.8 With the snow melting system enabled, the lead secondary snow melting loop pump shall start, while the lag pump shall be energized and in stand-by mode. The lead/lag status of the secondary snow melting loop pumps shall alternate at one hundred sixty-eight (168) hour intervals (adjustable).

.9 With the floor radiant heating system enabled, the lead secondary pump shall start, while the lag pump shall be energized and in stand-by mode. The lead/lag status of the secondary snow melting loop pumps shall alternate at one hundred sixty-eight (168) hours intervals (adjustable), for detail refer to Section 15520 Hydronic Radiant Floor Heating System.

.10 The four-way mixing valve shall modulate as required to maintain the snow- melting slab temperature at the following temperatures:

.1 0°C (+32°F) if no snow or ice is detected on the surface of the slab by the respective sensor

.2 +4°C (+40°F) if snow or ice is detected on the surface of the slab.

.11 Additional settings for the operation of the 4-way mixing valve:

.1 Maintain the minimum primary loop return temperature of 52°C (125°F)

.2 Maintain the maximum temperature differential in the snow melting loop of 14°C (25°F) to prevent slab thermal shock.

.12 The system shall generate alarms in case of:

.1 Any pump failure (while automatically enabling the stand-by pump).

.2 Any boiler failure (while automatically enabling the stand-by boiler).

.3 Primary loop temperatures 6°C (±10°F) departure from the setpoint.

.4 Slab temperature 3°C (±5°F) departure from the setpoint.

.9 Installation of Snow Sensor:

.1 The installation of the snow sensor shall conform to the detail drawing.

.2 The contractor shall be responsible for the fabrication of the steel frame required to install the sensor at the prescribed elevation and maintain its position during the concrete pour.

.3 The installation procedure described on the detail drawing shall be followed accurately; at the conclusion of the installation work, a report shall be issued by the Contractor confirming that all installation steps have been followed and the installation of the sensor is in conformance with the detail.

.4 Installation of all wiring and tubing in the area of the sensor shall be as indicated on the detail.

.10 Installation Of Temperature Sensors In Piping:

.1 The Contractor shall ensure that thermowells are installed as described herein.

.2 For each immersion sensor, provide a compatible thermowell to the Mechanical Contractor for installation. Provide stainless steel thermowells where installed in piping carrying corrosive or chemically reactive fluids.

.3 Install thermowells in piping such that the bottom of the well does not make contact with the pipe. Install the well at a 90° elbow or tee where the pipe diameter is less than the well length.

.11 Cutting And Patching:

.1 All cutting, patching, painting and making good for the installation of the work shall be done by the Contractor. All cutting shall be performed in a neat and true fashion, with proper tools and equipment

.12 Identification And Labeling of Control Equipment:

.1 All panels must have a lamicoid tag (minimum 3”x1”) affixed to the front face indicating panel designation and function (i.e. “Panel 1” or “Relay Panel 3”).

.2 All field sensors or devices must have a lamicoid tag (minimum 3”x1”) attached with tie-wrap or adhesive indicating the point software name and hardware address (i.e. AHU1_MAT, 2.IP4). Tags must be secured by screws where mounted outside of the building, in un-heated spaces, in high humidity areas or where subject to vibration.

.3 All devices within a field enclosure shall be identified via a label or tag.

.4 All panel power sources must be identified by a label (minimum 3”x1”) indicating the source power panel designation and circuit number (i.e. “120vac fed from LP-2A cct #1).

.5 All field control equipment panels fed from more than one power source must have a warning label on the front cover.

.6 All wires shall be identified with the hardware address with a band-type self- adhesive strips or clip-on plastic wire markers at both ends.

.7 All rotating equipment shall have a tag or label affixed indicating that the equipment may start without warning.

.8 All panels will be supplied with a point’s list sheet (within a plastic sleeve) attached to the inside door.

.9 The points list shall identify the following for each point:

.1 Panel number;

.2 Panel location;

.3 Hardware address;

.4 Software name;

.5 Point description;

.6 Field device type;

.7 Point type (i.e. AI or DO);

.8 Device fail position;

.9 Device manufacturer;

.10 Model number or reference; and

.11 Wire tag reference.

.10 Provide laminated wiring diagrams for all field mounted relay enclosures. Securely attach to the inside door. Identify power panels and circuit numbers of the equipment being controlled.

.11 Provide laminated wiring diagrams or modify existing equipment wiring diagrams.Securely attach to the inside of the respective control cabinet.

.12 Provide lamcoid labels indicating the required operating sequences, on the boilers and valves, where the boiler plants have manual or automatic isolating valves. Submit actual wording to the Consultant for approval prior to fabrication and installation.

.13 Provide lamcoid or machine labels (as outlined above) for all interposing relays or contactors used in control circuits. The labels shall include the related point software name and hardware address.

.14 Provide a lamcoid label to identify the location of concealed devices above the ceiling space. Mount the label on the ceiling grid t-bar or a permanent surface adjacent to the devices.

.15 Provide lamcoid labels for all auxiliary HVAC equipment (e.g. force flow cabinets, unit ventilators, unit heater, window AC units, etc.). Mount the labels in the vicinity of the existing thermostat or power switch for the unit.

.16 Where directed by the Consultant, provide any and all additional labeling, diagrams, schematics or instructions as may be required to facilitate the correct operation and maintenance of controlled building systems.

.13 Systems Hardware Commissioning

.1 The Contractor shall be responsible for the “end to end” commissioning, testing, verification and start-up of the complete control system hardware including panels, sensors, transducers, end devices, relays and wiring. Where applicable, this shall include any points from an existing and/or re-used automation system in the building.

.2 The Contractor shall prepare a hardware commissioning report containing the following information and test results:

.1 Analogue inputs (i.e. temperatures, pressure, etc.) shall be verified with an approved calibration device. All actual temperature readings should be with ± 1°C of the readings observed at the workstation. Record calibration adjustments and settings.

.2 Analogue outputs shall be verified by manually commanding the output channel from the operator workstation to two or more positions within the 0-100% range and verifying the actual position of the actuator or device. All devices shall operate over their entire 0-100% range from a minimum control range of 10-90%. Record the actual output scale range (channel output voltage versus controller command) for each analogue end device.

.3 Digital outputs shall be verified by witnessing the actual start/stop operation of the equipment under control.

.4 Digital inputs shall be verified by witnessing the status of the input point as the equipment is manually cycled on and off.

.5 Record all out-of-season or unverified points in the commissioning report as “non-commissioned”.

.6 Identify any existing equipment (valves, dampers, fan starters, etc.) that are inoperative or require maintenance or repair.

.7 The panel power source shall be toggled on and off to ensure reboot functionality and power down memory retention of all parameters. During the power down test, all controlled system outputs shall go to their fail-safe position.

.8 Verify PID loop tuning parameters by applying a step change to the current setpoint and observing the response of the controlled device. Setpoint should be reached in an acceptable period of time without excessive cycling or hunting of the controlled device. Provide a graph of the trend response to setpoint change for important controlled devices (e.g. valves 1” or larger, dampers on major air handlers, etc.)

.9 Provide confirmation that a series of test alarms has been successfully received at designated remote monitoring workstations.

.10 Include with the hardware commissioning report a site floor plan indicating the location of all equipment installed in concealed or recessed locations (e.g. interposing relays in ceiling spaces).

.11 Provide testing of all LAN cabling to ensure that 100Mb bandwidth is supported.

.12 Verify conformance with TIA /EIA TSB-67 - Basic Link Test using a Level 2, bi-directional tester. Provide all equipment necessary to carry out the required tests.

.13 The hardware commissioning report must be signed and dated by the Contractor’s technician performing the tests and participating Owner’s trades staff.

.14 At the completion of site commissioning, submit four (4) copies of hardware commissioning report to the Owner.

.14 Substantial Completion Inspection:

.1 At the completion of the site hardware inspection, the Contractor shall test and verify that the system programming, graphics and alarm software is operating correctly and is in compliance all requirements of the Specifications.

.2 The Contractor shall provide written notification to the Owner that the site is ready for the Substantial Completion Inspection by the Consultant

.3 Issue a comprehensive site deficiency report to the Contractor for their immediate action.

.4 The Contractor shall correct all items noted in the site deficiency report within ten (10) business days of receipt.

.5 The Contractor shall provide written notification to the Owner that all items on the Consultant’s site deficiency report have been corrected

3.6 SENSORS AND DEVICES

.1 Snow Slab Sensor:

.1 The snow/ice sensor and socket are used with the main controller to automatically detect snow or ice on a driveway or walkway. The snow/ice sensor socket must be installed directly in the snow melt slab, halfway between the heating elements or pipes.

.2 Sensor weight: 2,000 g (4.4 lb), silicon brass. 20 m (65 ft) jacketed cable

.3 Socket weight: 830 g (1.8 lb), silicon brass

.4 Dimensions (sensor): 45 x 80 x 80 mm (1¾" H x 3-1/8" W x 3-1/8" D)

.5 Dimensions (socket):96 x 89 x 89 mm D (3¾" H x 3½" W x 3½")

.6 Operating range:-50 to 80°C (-60 to +175°F)

.7 Sensor: NTC thermistor, 10 kΩ @ 25°C ±0.2°C (77°F), ß=3892

.8 Standard of Acceptance: Tekmar type 094 in socket type or approved equivalent.

.2 In-Slab Sensor:

.1 Slab sensor has a PVC plastic sleeve which is designed for use in soils or concrete. The sensor is supplied with 40ft (12m) of 2 conductor cable.

.2 Packaged Weight: 0.7 lb. (320 g), PVC sleeve. 12 m ' (40) jacketed wire

.3 Dimensions: 13 o.d. x 51 mm (½" OD x 2")

.4 Operating range: -50 to 60°C (-60 to 140°F)

.5 Sensor-NTC thermistor, 10 kΩ @ 25°C ±0.2°C (77°F), ß=3892

.6 Standard of Acceptance: Tekmar 073 or approved equivalent.

.3 Outdoor Air Temperature Sensors:

.1 Provide outdoor air temperature sensors with the following minimum characteristics:

.2 Each sensor shall be a 6", 10K thermistor probe;

.3 Minimum two (2) sensors shall be installed for each site;

.4 Both sensors shall be mounted inside a heavy-duty (blow-proof) solar shield; and

.5 Provide a heavy-duty, metal, wire guard.

.6 Standard of Acceptance: Enercorp TS-O-T-10K, Honeywell, Johnson Controls or approved equivalent.

.4 Immersion Temperature Sensors:

.1 Use immersion temperature sensors with thermwells for all applications where a temperature of a fluid in a pipe is being sensed.

.2 Provide well-mounted water temperature sensors with the following minimum characteristics:

.1 The sensors shall be 10k ohm thermistor encapsulated in a 6 mm o.d., 50 m long probe, with screw fitting for insertion into a standard thermowell;

.2 Operating range -10 to +100°C;

.3 End-to-end accuracy ± 0.3°C over the entire operating range;

.4 The sensors shall be complete with brass thermowell;

.5 Provide a stainless steel thermowell where exposed to corrosive liquids;

.6 Use conductive gel when mounting the sensor in the thermowell; and

.7 The sensors to be mounted on insulated piping shall be installed clear of the insulation.

.3 Standard of Acceptance: Enercorp TS-P-4-T-10K, Honeywell, Johnson Controls or approved equivalent.

.5 Current Sensors (Analog):

.1 Current sensors (CT) shall be used for status monitoring of all motor-driven equipment, where specified.

.2 Technical Performance-Output should be only 4-20mA only. Voltage output will not be accepted. End-to-end accuracy ± 1% of full scale at each range.

.3 The current sensors shall be mounted inside the starter cabinets whenever possible. If this is not possible due to space limitation, provide an enclosure to house the sensor.

.4 Standard of Acceptance: Enercorp SA200, Honeywell, Johnson Controls or approved equivalent.

.6 Automatic Control Valve Actuators:

.1 Each automatic control valve shall be fitted with a “fail-safe” operator capable of tight shut-off against the differential imposed by the system.

.2 Operators for valves in electric-electronic control systems shall be single phase

.3 AC, 24V electric motor operators.

.4 Valve actuators on valves 3” diameter and larger shall be provided with a manual position override.

.5 Valve actuators shall accept a 0-10VDC or 4-20mA control signal for all proportional applications

.6 Floating point control of valves is not acceptable under any circumstances.

.7 Installed by the Contractor, unless specified otherwise.

.8 Each control valve shall be equipped with its own actuator.

.9 The Contractor shall ensure that each control valve assembly is properly connected and installed.

.10 The Contractor shall test, adjust and verify the operation of each control valve to ensure that it is properly functioning, as required and left in safe working order.

.7 Local Service Ports:

.1 Every DDC panel shall be provided with a local network access port to connect to laptop computer. A user connected to the local access port shall have the same level of system access and functionality as being connected to the networked Owner’s workstation

.2 Where points (four (4) or more) are located in a mechanical room that does not have a local panel installed, a remote network access port shall be provided. The access port shall be installed in a hinged metal enclosure with key-lock set and lamicoid ID label.

.8 LAN Cabling:

.1 All LAN cabling shall be Category V as defined by EIA/TIA 568A. The Contractor shall test all cabling to verify that 100Mb bandwidth is supported. See commissioning requirements.

.2 Cabling shall be four (4) pair, 100 Ω UTP, #24 AWG solid copper conductor PVC insulated, with blue or grey colour coded jacket. FT6 rated cable shall be used unless otherwise required to meet building codes or by-laws.

.3 Data outlets shall be RJ45, eight (8) pin connectors, with 50 microns of hard gold over nickel, minimum durability of 750 mating cycles and contact pressure of 100 grams per contact. Transmission characteristics shall meet TSB-40 Category V.

.4 Provide one RJ45 data outlet adjacent to each device to be terminated (e.g. workstation PC, DDC panel, hub, etc.) Use a flexible patch cable to connect from the data outlet to the end device.

.5 Provide protection from EMI sources in accordance withCAN/CSA-T530 article 4.

.6 The contractor shall test all cabling to verify conformance with TIA/EIA TSB-67Basic Link Test using a Level 2, bi-directional tester. See commissioning requirements.

.7 Where there are more than 2-90° in a conduit run, provide a pull box between sections so that there are two (2) bends or less in any one (1) section.

.8 Where a conduit run requires a reverse bend, between 100°and 180°, insert a pull box at each bend having an angle from 100° to 180°.

.9 Ream all conduit ends and install insulated bushings on each end. Terminate all conduits that protrude through the structural floor 2" above the concrete base. Do not use a pull box in lieu of a conduit bend. Align conduits that enter a pull box from opposite ends with each other.

.9 Automatic Control Valves:

.1 Automatic control valves shall be supplied by the Controls Contractor and installed by the Mechanical Contractor.

.2 Automatic control valves, unless otherwise specified, shall be globe type valves.

.3 Valves and actuators shall be ordered as one factory-assembled and tested unit.

.4 Submit to the Consultant for review, a valve schedule containing the following information for each valve:

.1 Valve type and size;

.2 Connection type;

.3 Line size;

.4 Valve manufacturer and model number;

.5 Valve flow coefficient;

.6 Design flow;

.7 Pressure drop across valve;

.8 Maximum close-off pressure;

.9 Actuator manufacturer and model number; and

.10 Actuator maximum torque.

.5 Valves 50 mm (2") and smaller shall be constructed of bronze. Valves 65 mm (2½") and larger shall have iron bodies and bronze mountings.

.6 All control valves shall have stainless steel stems.

.7 The bronze in bodies and bonnets of all bronze valves shall conform to ASTM B62 for valves rated up to 150psig (1,035 Kpa) working pressure and to ASTM B61 for valves rated at 200 psig (1,380 Kpa) working pressure.

.8 The bodies and bonnets of iron body valves shall conform to ASTM A126, Class B.

.9 Control valve discs and seats shall be of bronze for 100°C or less fluid temperature and of stainless steel for fluid temperatures above 100 °C.

.10 The control valves shall have tight shut-off. Flat disk valves are not acceptable.

.11 Control valves 50 mm (2") and smaller shall be complete with screwed ends type, except for bronze valves installed in soldered copper piping which shall be complete with soldering ends. Control valves larger than 50 mm (2") shall be complete with flanged end type and proper flanged adapters to copper shall be provided where flanged valves are installed in copper piping.

.12 The water control valves shall be sized for a pressure drop of 6 ft. water column or as indicated on mechanical drawings.

.13 Each automatic control valve must provide the design output and flow rates at pressure drops compatible with equipment selected.

.14 Each automatic control valve must be suitable for the particular system working pressure.

.15 Each automatic control valve shall be fitted with a position indicator.

.16 All the same type control valves shall be the products of a single manufacturer and have the manufacturer's name, pressure rating and size clearly marked on the outside of the body.

.17 Unless otherwise indicated, control valves for proportional operation shall have equal percentage characteristics, while the control valves for open/shut two- position operation shall have straight line flow characteristics.

.18 Standard of Acceptance:

.1 Siemens.

.2 Danfoss.

.3 Honeywell.

.4 Or approved equivalent.

3.7 TRAINING

.1 Include for 4 hours of on-site training for 2 groups of 6 people. Training is to be a full review of all components including but not limited to a full operation and maintenance demonstration, with abnormal events.

.2 Prior to providing training perform system demonstration as per requirements of Section 01800 Project Closeout.

.3 Supply certified personnel to instruct the Owner on operation of new mechanical equipment. Supply maintenance specialist personnel to instruct operating staff on maintenance and adjustment of mechanical equipment and any changes or modification in equipment made under terms of warranty.

.4 Provide minimum four (4) hours of instruction time during regular work hours prior to acceptance and turn-over to operating staff for regular operation.

.5 Use operation and maintenance data manual for instruction purposes. On completion of instruction, turn manuals over to the Consultant.

.6 Scheduling of the timing for the training of the operating staff shall be arranged with the Consultant ten (10) days prior to the completion of the Project.

END OF SECTION

SEE ADD#7
Q#237

PART 1 - GENERAL

1.1 SUBMITTALS

.1 Submit shop drawings/product data sheets for products specified in Part 2, including accessories.

.2 Submit, in shop drawing form, a schematic piping diagram for each refrigerant piping system indicating pipe sizes, slopes, valves, traps, and piping specialties. Piping schematics must be reviewed, approved, and signed by refrigeration equipment manufacturers prior to being submitted to the Consultant for review.

1.2 CLOSEOUT SUBMITTALS

.1 Submit with delivery of each unit a copy of the factory inspection report, and include a copy of each report with O&M Manual project close-out data.

.2 Submit a site inspection and start-up report from manufacturer's representative as specified in Part 3 of this section.

.3 Submit a signed copy of manufacturer's extended 2 year warranty.

.4 Training attendance records.

1.3 MAINTENANCE MATERIAL SUBMITTALS

.1 Submit 3 identified keys for cabinet doors for each humidifier prior to Substantial Performance of the Work.

.2 At Substantial Performance of the Work, hand to Owner a complete set of spare filters in "as shipped" packaging.

.3 Submit a spare steam/water cylinder for each humidifier prior to Substantial Performance of the Work.

1.4 QUALITY ASSURANCE

.1 Refrigerant equipment is to be in accordance with CSA B52, Mechanical Refrigeration Code, and any applicable local Codes and Regulations.

.2 Direct expansion refrigeration equipment must be installed by or under direct on site supervision of a licensed journeyman refrigeration mechanic.

PART 2 - PRODUCTS

2.1 ELECTRIC/ELECTRONIC STEAM HUMIDIFIER

.1 Nortec Air Conditioning Ltd. CSA certified, package type, 3-phase, 60 Hz, fully automatic electric/electronic steam humidifier in accordance with drawing schedule, capable of discharging pure steam with no mineral dust carryover, and complete with:

.1 1.3 mm (0.05") thick enamelled steel barriered wall mounting cabinet with hinged and lockable door with interlock switch for the 3-phase power electrical section, an additional door to isolate line voltage components, and a separate plumbing compartment;

.2 disposable plastic water/steam cylinders with mesh electrodes;

.3 solenoid drain and fill valves;

.4 control panel with self-diagnostic microprocessor-based control system with LCD display and keypad, steam capacity adjustment, manual drain activation pushbutton, rest pushbutton, digital operation and fault indication and display, and LED indication for current draw, humidistat demand, steam output, capacity adjustment, draining, normal operation and cylinder full, self-check on start-up, and automatic drain of cylinder at end of season;

.5 duct or plenum mounting steam distributor assembly with a length to suit mounting location, complete with condensate separator and return leg;

.6 required lengths of steam supply and condensate return hose;

.7 wall mounting steam distributing blower pack;

.8 wall mounting 24 volt adjustable tamper-proof humidistat with 10% to 90% RH range;

.9 duct mounting 24 volt adjustable humidistat with 10% to 90% RH range;

.10 duct mounting differential pressure switch for air flow proving interlock;

.11 duct mounting adjustable high limit humidistat.

.2 Manufacturers:

.1 Nortec Division (Climate Canada) Ltd.;

.2 Vapac Humidification;

.3 Armstrong International Ltd.;

.4 Hygromatic (Spirax Sarco);

.5 Carnes Co.;

.6 Northern Industrial Humidifiers "Neptronic".

2.2 GAS FIRED STEAM HUMIDIFIER

.1 Nortec GS Series, natural gas fired, CSA certified, package type, fully automatic steam humidifier in accordance with drawing schedule, capable of discharging pure steam with no mineral dust carryover, in accordance with requirements of CAN/CSA B149.1, and complete with:

.1 totally enclosed steel cabinet finished with a baked powder epoxy coating and equipped with 25 mm (1") thick insulation, top and front keyed access doors, and a cross-braced telescopic steel stand;

.2 fully piped, valved, 82% thermal efficiency combustion system with modulating variable speed forced draft blower, 100% premix burner, negative pressure regulator gas valve, and microprocessor controlled hot surface ignition system with flame system and 100% safety shutdown;

.3 type 304 stainless steel smooth flat surface heat exchanger and water tank, both removable and insulated with 25 mm (1") thick insulation meeting 25/50 flame spread/smoke developed ratings when tested to CAN/ULC S102 and complete with water level control consisting of a dual magnetic electronic float system with dual fill valves, an internal water supply air gap, internal water tempering for drain water cooling, a drain pump for scale removal, and timed periodic tank blow-down;

.4 control panel with self-diagnostic microprocessor-based control system capable of integration with building automation system and equipped with LCD display and keypad, steam capacity adjustment, modulating control demand status, tank water level indication, on/off control and safety (high limit, air proving) status, troubleshooting guide with scroll down menu, fault indication with date and time history, maintenance intervals, fill and drain status, drain/flush intervals and duration, capacity limitation, and 72 hours drain enable/disable;

.5 duct or plenum mounting stainless steel steam distributor assembly with a length to suit mounting location, complete with condensate separator and return leg;

.6 wall mounting steam distributing blower pack;

.7 wall mounting 24 volt adjustable tamper-proof humidistat with 10% to 90% RH range;

.8 duct mounting 24 volt adjustable humidistat with 10% to 90% RH range;

.9 duct mounting differential pressure switch for air flow proving interlock;

.10 duct mounting adjustable high limit humidistat;

.11 factory secured seismic restraint connection hardware.

.2 Manufacturers:

.1 Nortec Division Water Meier (Climate Canada) Ltd.;

.2 Vapac Humidification;

.3 Armstrong International Ltd.;

.4 Hygromatic (Spirax Sarco);

.5 Carnes Co.;

.6 Northern Industrial Humidifiers "Neptronic".

2.3 STEAM INJECTION HUMIDIFIER

.1 Spirax Sarco Canada Ltd. package type low pressure steam injection humidifier in accordance with drawing schedule, each capable of discharging clean dry steam without condensate drip or objectionable noise, and complete with:

.1 inlet strainer;

.2 stainless steel steam jacketed manifold, a dispersing tube, and a stainless steel noise attenuator;

.3 stainless steel separator;

.4 normally closed brass body control valve with a modulating motor operator to suit control system, and a temperature switch to prevent humidifier from operating until entire unit is up to steam temperature;

.5 cast iron float and thermostatic drip trap with stainless steel internal components for each manifold.

.2 Manufacturers:

.1 Spirax Sarco Canada Ltd.;

.2 Armstrong International Ltd.;

.3 DRI-STEEM Corp.

2.4 DEHUMIDIFIER

.1 Dectron Inc. "Dry-O-Tron" factory assembled and run tested, package type dehumidifier in accordance with drawing schedule, designed to operate with R410A refrigerant.

.2 Sectional cabinet constructed of formed and reinforced satin coated sheet steel with a #16 gauge base and #20 gauge panels, all phosphate degreased and coated with baked epoxy powder paint. Cabinet is equipped with:

.1 removable side service panels for access to all internal components;

.2 integral electrical power and control panel in a separate with #18 gauge subpanel for electrical components in a separate compartment so as not to disturb airflow during electrical servicing;

.3 integral filter rack with separate hinged access door with compression fasteners;

.4 15 mm (½") thick neoprene coated glass fibre duct liner meeting 25/50 flame spread/smoke developed ratings when tested to CAN/ULC-S102, for the entire evaporator coil section, mechanically secured in place and protected with reinforcing mesh.

.3 Factory pressure tested evaporator (dehumidifier) coil with seamless copper tubes mechanically expanded into plate type aluminium fins which are factory coated with "HyPoxy" corrosion resistant coating in accordance with ASTM B117/D1654 and ASTM D2126 corrosion resistance requirements. Coil casing and end plates are #16 gauge galvanized steel.

.4 Type 304 #20 gauge stainless steel drain pan constructed and sloped so as to eliminate standing water, and factory insulated on the bottom and sides with insulation meeting 25/50 flame spread/smoke developed ratings when tested to CAN/ULC S102.

.5 Factory pressure tested air reheat (hot gas) coil as specified above for evaporator coil.

.6 Double width, double inlet, multi-blade, forward curved, galvanized steel centrifugal blower wheel mounted on a silicon coated solid steel shaft, statically and dynamically balanced, direct connected to a motor conforming to requirements specified in Section 20 05 00 – Common Work Results for Mechanical, and secured in a galvanized steel housing with a baked enamel finish.

.7 Disposable, 50 mm (2") thick glass fibre media filters, ULC Class 2, minimum MERV 7 in accordance with ASHRAE 52.2.

.8 Resiliently mounted, overload protected, suction gas cooled hermetic compressor for use with R410A refrigerant, and equipped with time delay start to prevent short cycling, and a refrigerant circuit complete with following:

.1 in-line solder type liquid line filter drier;

.2 liquid and moisture indicator visible from outside unit;

.3 thermal expansion valve and head pressure control;

.4 receiver with fusible plug (water cooled units) or receiver with pressure relief valve (air cooled units);

.5 tamper-proof, hermetically sealed, non-adjustable high and low pressure controls;

.6 refrigerant service valves located outside air stream;

.7 minimum 15 mm (½") thick closed cell insulation meeting 25/50 flame spread/smoke developed ratings when tested to CAN/ULC S102, for refrigerant suction lines.

.9 Minimum NEMA 2 enamelled steel control panel, unit mounted, factory pre-wired, CSA certified, and complete with:

.1 protected blower motor and compressor motor contactors;

.2 power and control wiring terminal blocks;

.3 colour coded and numbered wiring;

.4 dry contact for remote on/off control;

.5 all other required contacts and hardware for control and/or monitoring connections as indicated on drawings;

.6 remote, electronic, adjustable tamper-proof thermostat and humidistat, each capable of independent control of unit operation without interfering with unit operation.

.10 Water cooled air conditioning, CSA certified, coaxial, corrosion resistant, copper tube, self-draining, counter flow design cooling water heat exchanger designed to reject all compressor heat and equipped with:

.1 self-aligning union fittings;

.2 cast brass, direct-acting, adjustable, modulating, head pressure actuated water regulating valve;

.3 2-way valve and a solenoid valve for positive shut-off for variable flow or water saving applications such as City water, or a 3-way valve for constant flow applications such as cooling towers or heat pump loops.

.11 Outdoor air cooled condenser, weather-proof #18 gauge satin coated formed and reinforced steel base and cabinet with a removable service panel for access to all internal components, mounting legs, a minimum of 2 coats of baked enamel finish, PVC coated steel fan outlet and air intake grilles, and following:

.1 factory pressure tested dual condenser coils with #16 gauge galvanized steel casings and end panels, and seamless copper tubing mechanically expanded into plate type corrugated aluminium fins;

.2 dynamically balanced condenser fan with dual (inlet and outlet) venturis with insulation in between;

.3 motor conforming to requirements of Section 20 05 00 - Common Work Results for Mechanical, factory wired to a unit mounted control panel with motor contactor, control transformer, and power and control wiring terminal strip.

.12 Factory secured seismic restraint connection hardware as required.

.13 Manufacturers:

.1 Dectron Inc.;

.2 PoolPak Technologies Corp.

PART 3 - EXECUTION

3.1 INSTALLATION OF ELECTRIC/ELECTRONIC STEAM HUMIDIFIERS

.1 Provide electric/electronic steam humidifiers.

.2 Secure each steam generator assembly in place, level, and plumb, in accordance with manufacturer’s instructions.

.3 Install steam distributor manifold assemblies and secure in place. Coordinate installation with sheet metal trade.

.4 Connect steam generators and distribution manifolds with steam and condensate hose kits supplied with humidifiers. Install in accordance with manufacturer’s instructions.

.5 Install humidistats and pressure differential air flow proving switches and connect with 24 volt control wiring in conduit to steam generator control panel.

.6 Supply a spare water/steam cylinder for each unit and 3 identified keys for each steam generator cabinet and hand to Consultant at site prior to Substantial Performance of the Work.

.7 For equipment/system manufacturer certification requirements, refer to Section 20 05 00 – Common Work Results for Mechanical.

.8 For equipment/system start-up requirements, refer to Section 20 05 00 – Common Work Results for Mechanical.

.9 Include for a 1/2 day on-site operation demonstration and training session. Training is to be a full review of all components including but not limited to a full operation and maintenance demonstration, with abnormal events.

.10 When installation is complete, arrange for the humidifier manufacturer to visit site to supervise start-up, testing and adjusting of each humidifier, including all controls and safeties, and when this work is complete, obtain from manufacturer and submit a letter stating humidifiers have been properly installed, started, adjusted, and are in proper operating condition.

3.2 INSTALLATION OF GAS FIRED STEAM HUMIDIFIERS

.1 Provide gas fired steam humidifiers.

.2 Secure each steam generator assembly in place, level, and plumb, on stand provided on a concrete housekeeping pad in accordance with manufacturer's instructions.

.3 Brace and secure each unit in accordance with requirements specified in Section 20 05 48.16 - Seismic Controls for Mechanical Systems.

.4 Install duct and/or plenum mounted steam distributor/manifold assemblies and secure in place. Coordinate installation with sheet metal trade.

.5 Provide blower packs and surface wall mount. Confirm exact locations prior to roughing-in.

.6 Connect humidifiers and distributor/manifold assemblies with valved steam and condensate piping. Install in accordance with humidifier manufacturer's instructions.

.7 Provide flue vent in accordance with Section 23 51 23 - Gas Vents.

.8 Install humidistats (duct or wall mounted as indicated) and duct mounted pressure differential air flow proving switches and high limit switches and connect with 24 volt control wiring in conduit to humidifier control panel.

.9 For equipment/system manufacturer certification requirements, refer to Section 20 05 00 - Common Work Results for Mechanical.

.10 For equipment/system start-up requirements, refer to Section 20 05 00 – Common Work Results for Mechanical.

.11 Include for a 1/2 day on-site operation demonstration and training session. Training is to be a full review of all components including but not limited to a full operation and maintenance demonstration, with abnormal events.

3.3 INSTALLATION OF STEAM INJECTION HUMIDIFIER MANIFOLD

.1 Provide steam injection humidifier manifold assemblies.

.2 Install each manifold assembly in accordance with manufacturer's instructions. Coordinate installation with sheet metal trade.

.3 Connect with valved steam and condensate piping.

.4 For equipment/system manufacturer certification requirements, refer to Section 20 05 00 – Common Work Results for Mechanical.

.5 For equipment/system start-up requirements, refer to Section 20 05 00 – Common Work Results for Mechanical.

.6 Include for a 1/2 day on-site operation demonstration and training session. Training is to be a full review of all components including but not limited to a full operation and maintenance demonstration, with abnormal events.

3.4 INSTALLATION OF DEHUMIDIFIERS

.1 Provide a dehumidifier.

.2 Secure indoor cabinet assembly in place, level, and plumb, from structure by means of galvanized steel hanger rods with galvanized steel hardware, and vibration isolation spring hangers. Ensure unit drain pan is connected with properly sized, insulated condensate drainage piping terminated over a suitable drain point.

.3 Secure outdoor unit in place on vibration isolation pads on support structure provided.

.4 Brace and secure equipment in accordance with requirements specified in Section 20 05 48.16 - Seismic Controls for Mechanical Systems.

.5 Provide valved piping to water cooled condenser as indicated and in accordance with unit manufacturer's instructions and requirements of Section 23 21 00 - Hydronic Piping and Pumps.

.6 Provide refrigerant piping from outdoor unit to indoor unit in accordance with unit manufacturer's instructions and piping schematics, and requirements of Section 23 23 00 - Refrigerant Piping. If unit is not factory charged with refrigerant, provide required refrigerant.

.7 Install thermostat and humidistat. Confirm exact locations prior to roughing-in.

.8 Perform required control wiring (except building automation system connection) in conduit in accordance with manufacturer's control wiring schematics and wiring standards of the electrical work.

.9 For equipment/system manufacturer certification requirements, Refer to Section 20 05 00 – Common Work Results for Mechanical.

.10 For equipment/system start-up requirements, refer to Section 20 05 00 – Common Work Results for Mechanical.

.11 Include for a 1/2 day on-site operation demonstration and training session. Training is to be a full review of all components including but not limited to a full operation and maintenance demonstration, with abnormal events.

END OF SECTION

PART 1 - GENERAL

1.1 SUBMITTALS

.1 Submit shop drawings/product data sheets for following:

.1 all control system components;

.2 identified schematic control diagrams with component identification, catalogue numbers, and sequence of operation for all systems;

.3 certified wiring diagrams for all systems.

.2 Submit following samples for review:

.1 control damper section with linkage, operator, and certified flow and leakage data;

.2 wall mounting control system flow diagram as specified in Part 2 of this Section;

.3 each type of thermostat to be used, each identified as to intended use.

1.2 CLOSEOUT SUBMITTALS

.1 Submit a site inspection and start-up report from manufacturer's representative as specified in Part 3 of this Section.

.2 Submit written confirmation from control component manufacturer that site installation personnel are qualified and experienced in installation of components, and have parts and service availability on a 24/7 basis.

1.3 QUALITY ASSURANCE

.1 Control systems are to be installed by control component manufacturer or by licensed personnel authorized by control component manufacturer. Submit written confirmation from control component manufacturer.

.2 Control wiring work is to be performed by licensed journeyman electricians, or under direct daily supervision of journeyman electricians.

PART 2 - PRODUCTS

2.1 AUTOMATIC CONTROL VALVES AND OPERATORS

.1 Each control valve must be suitable in all respects for the application, including system pressure, and must have design output and flow rates with maximum pressure drops as follows:

.1 chilled water valves for coils: __ kPa (__ psi);

.2 heating water/glycol solution valves for coils: ___ kPa (___ psi);

.3 heating water valves for radiation units: ___ kPa (___ psi);

.4 steam valves for coils: _____.

.2 Body and trim materials selected in accordance with specification for globe valves, ball valves, or high performance butterfly valves, and in accordance with manufacturer's recommendations for design conditions and service.

.3 Size control valves for pressure drops and heating and cooling loads as scheduled with same pressure rating as globe valves under same service and pressure conditions.

.4 Size valves for two port and three port, two position service;

.1 line size,

.2 ball valves, sizes NPS 1-1/2 and smaller,

.3 butterfly valves, sizes NPS 2 and larger.

.5 For two port and three port modulating service;

.1 use globe valves for CV rating 160 and smaller,

.2 use butterfly valves for CV rating above 160.

.6 Select butterfly valves based on CV rating at 70° rotation

.7 Hydronic system valves;

.1 two position service;

.1 straight through two port type, single seated, with replaceable disc or ball,

.2 quick opening linear or equal percentage flow characteristics.

.2 modulating service;

.1 straight through two port type, single seated,

.2 equal percentage flow characteristics.

.3 modulating diverting service; three port mixing valves,

.1 linear for each port to give constant total flow or,

.2 equal percentage flow characteristics with 25% valve authority (valve pressure drop equal to 33% pressure drop through load at full flow).

.4 actuator and trim selected for close-off pressure ratings as follows;

.1 two-way modulating or two position service; 150% of pump shut off head.

.2 three-way modulating service; 300% of pressure differential between ports A and B at design flow or 100% of pump shut off head.

.3 shut off head to be based on maximum rpm when pump is fitted with VFD.

.5 sized as follows;

.1 for two-position service; line size.

.2 for two-way modulating service unless otherwise shown; pressure drop at design flow equal to greatest of;

.1 200% of pressure drop through heat exchanger,

.2 100% of pressure drop through coil,

.3 50% of pressure difference between supply and return mains, or

.4 35 kPa (5 psi).

.3 for three-way modulating service; pressure drop equal to smaller of;

.1 twice pressure drop through coil or heat exchanger, or

.2 35 kPa (5 psi).

.4 for valves for radiation, terminal units and reheat coils;

.1 pressure drop of 7 kPa (1 psig)

.6 failed position on isolation from control signal as follows;

.1 Heating water and glycol zone valves; fail open.

.2 Heating coil valves in AHU; fail open.

.3 Chilled water control valves; fail closed.

.4 Chilled water differential pressure by-pass control valves; fail open.

.5 Hot water and glycol differential pressure by-pass control valves; fail closed.

.8 Steam valves:

.1 globe type, with equal percentage flow characteristics.

.2 actuator and trim selected for close-off pressure rating equal to 150% of operating (inlet) pressure.

.3 sized as follows:

.1 two-position service;

.1 pressure drop at design flow equal to 10%-20% of inlet steam gauge pressure.

.2 modulating service at inlet steam gauge pressure of 100 kPa (15 psig) or less;

.1 pressure drop at design flow equal to 80% of inlet steam gauge pressure.

.3 modulating service at inlet steam gauge pressure of 101-350 kPa (16-50 psig);

.1 pressure drop at design flow equal to critical pressure drop (45% of absolute inlet pressure).

.4 modulating service with inlet steam gauge pressure over 350 kPa (50 psig);

.1 pressure drop as scheduled.

.5 modulating steam loads greater than 570 kW (2000 lbs/hr) at all pressures;

.1 provide two valves, connected in parallel and controlled in sequence, with first valve in opening sequence sized for [a] and second for [b] of steam load.

.9 Valve actuators for service other than radiation, radiant panel and reheat coil valve applications;

.1 sized and selected in accordance with manufacturer’s specifications,

.2 electric/electronic for two position, or proportional control action, coupled to valves with linkage,

.3 electronic interface control board, solid state drive, reversible motor, oil immersed gear train,

.4 electronic overload or digital rotation sensing circuitry to protect damper operator through entire range of rotation,

.5 span and zero travel adjustment,

.6 position feedback signal on actuators used for proportional control,

.7 provision for manual positioning of valve when actuator is not powered,

.8 spring return mechanism to return valve to “normal” position on power failure (i.e. Normally Open (NO), or Normally Closed (NC)),

.9 control signals:

.1 0-10 VDC or 0-20 mA,

.2 modulate damper position with 2 to 10 VDC or 4-20 mA input signal operating range when in proportional service.

.3 input type and range as suitable for interfacing to output of BAS controller.

.10 feedback signals:

.1 two independent adjustable travel limit switches and wiring to BAS for indication of valve position.

.11 general purpose, drip proof NEMA 2 die-cast housing with corrosion resistant steel cover for indoor applications, watertight NEMA 4 enclosure for outdoor use,

.12 electric actuators suitable for operation down to -35°C where installed outdoors.

.10 Valve actuators for service on radiation, radiant panel, and reheat coil valve applications;

.1 output shaft driven by gear train mechanism.

.2 reversible motor with automatic load limit,

.3 input type and range as suitable for interfacing to output of BAS controllers,

.4 adjustable span and offset travel,

.5 position feedback signal on actuators used for proportional control,

.6 general purpose, dustproof, die-cast aluminum housing,

.7 actuator rotation limit.

.11 Chilled water “energy valves”:

.1 Belimo Energy Valve, pressure independent complete with Power Control and Belimo Delta T Manage logic built in to monitor coil performance and optimize the available energy of the coil by maintaining Delta T, standard analog signal and feedback wiring and connection to the BAS via BACnet MS/TP and built-in web server for visualization of the valves’ operation in real time.

.12 Unless otherwise specified, pneumatic valve operators are to be renewable neoprene diaphragm piston type. Pneumatic operators used to sequence multiple valves must be equipped with a pilot positioner to ensure proper sequence of each valve and allow for an adjustable "dead band" between heating and cooling valves.

2.2 CONTROL DAMPERS AND OPERATORS

.1 T. A. Morrison & Co. Inc. "TAMCO" 100 mm (4 in) deep, flanged, AMCA low leakage certified aluminium dampers. Dampers for modulating and mixing applications are to be parallel blade type. Dampers for open-shut service are to be opposed blade type. Maximum blade length is to be 1 m (4 ft). Dampers greater than 2 sections wide are to be complete with a jackshaft. Each damper is to be complete with:

.1 extruded 6063T5 aluminum frame and airfoil blades, each with an integral slot to receive a gasket;

.2 extruded TPE frame gaskets and extruded EPDM blade gaskets;

.3 slip-proof aluminium and corrosion resistant plated steel linkage of a metal thickness to prevent warping or bending during damper operation, concealed in frame, equipped with seal-sealing and self-lubricating bearings consisting of a Celcon inner bearing fixed on hexagonal blade pin and rotating in a polycarbonate outer bearing inserted in frame.

.2 For standard damper(s), Series 1000 as above.

.3 For insulated damper(s), Series 9000 as above but with all 4 sides of frame insulated with polystyrene, and blades thermally broken and insulated with expanded polyurethane foam.

.4 For stainless steel dampers, as above but constructed of type 316 stainless steel and equipped with Teflon blade bearings.

.5 Each damper motor is to be shaft mounted, spring return, fail safe in the normally open or normally closed position, sized to control damper against maximum pressure or dynamic closing pressure, whichever is greater, to suit sizes of dampers involved, and to provide sufficient force to maintain damper rated leakage characteristics. Each operator is to be complete with a damper position indicator, and external adjustable stops to limit length of stroke in either direction, and is to be mounted on a corrosion resistant adjustable bracket. Operating arms are to have double yoke linkages and double set screws for fastening to damper shaft. Operators for dampers to be connected to building fire alarm system or to freeze protection devices are to be equipped with additional relays to permit dampers to respond and go to required position in less than 15 s upon receipt of a signal. Operator enclosures are to be suitable in all respects for environment in which they are located.

.6 Electric damper operators are to be equal to Belimo EF Series 24 V or 120 VAC spring return, direct coupled electric motor operators for either modulating or 2-position control as required. Each operator is to be overload protected and complete with an enclosure to suit the mounting location.

.7 Pneumatic damper operators are to be replaceable elastomer diaphragm piston type, suitable in all respects for damper sequence.

2.3 LOCAL CONTROL PANELS

.1 NEMA 1 (NEMA 2 in sprinklered areas) wall mounting, enamelled steel barriered enclosures sized to suit the application with 20% spare capacity, a perforated sub-panel, numbered terminal strips for all low and line voltage wiring, hinged door, and slotted flush latch.

2.4 CONTROL SYSTEM COMPONENTS

.1 Components specified below are required for control of equipment and systems in accordance with drawing control diagrams and sequences of operation. Not all required components may be specified.

.2 Sensor/transmitter input devices must be suitable in all respects for the application and mounting location. Devices are as follows:

.1 unless otherwise specified, temperature sensors are to be resistance type, either 2-wire 1000 ohm nickel RTD or 2-wire 1000 ohm platinum RTD with accuracy (includes errors associated with sensor, lead wire, and A to D conversion), equipped with type 316 stainless steel thermowells for pipe mounting applications, as follows:

.1 chilled water, room temperature, and duct temperature points, ±1°C (±0.5°F);

.2 all other points, ±0.75°C (±1.3°F).

.2 room temperature sensors constructed to be selected in accordance with the following classifications:

.1 Type 1: Space temperature sensor (private/non-public areas);

.1 for measurement of space temperature only as shown on the floor plans and/or as described in the Sequence of Operation;

.2 set-point adjustment shall be accessible through the cover;

.3 sensor operating temperature range from 4°C to 60°C (40°F to 140°F);

.4 surface mounted plastic mono-chromatic guard with surface mounting plate and wall anchors;

.5 mono-chromatic guard secured to mounting plate by screws;

.2 Type 2: Space temperature sensor (public areas or secure areas);

.1 for measurement of space temperature of space temperature only in areas subject to vandalism as shown on the floor plans and/or as described in the Sequence of Operation;

.2 sensor operating temperature range from 4°C to 60°C (40°F to 140°F);

.3 stainless steel flat plate surface type with sensor epoxy-bonded to back of cover plate;

.4 tamperproof/secure concealed fasteners;

.5 set-point adjustment is to be concealed behind the cover.

.3 Type 3: Adjustable space temperature sensor with display (Private Areas, Office areas);

.1 for measurement and adjustment of space temperature as shown on the floor plans and/or as described in the Sequence of Operation;

.2 digital set point operating temperature adjustment range from 4°C to 60°C (40°F to 140°F);

.3 surface mounted plastic mono-chromatic guard with surface mounting plate and wall anchors;

.4 mono-chromatic guard secured to mounting plate by screws;

.5 on/off button to allow occupant override feature;

.6 three-digit LED digital temperature display with 0.2° display resolution;

.7 5% to 95% relative humidity, non-condensing;

.8 minimum/maximum limit set point values adjustable from the BAS operator interface and controller.

.9 set-point adjustment is to be accessible through the cover.

.3 outside air sensors designed and constructed for an ambient temperature of -25°C to 60°C (-13°F to 140°F) and 5% to 95% relative humidity, non-condensing, complete with a NEMA 3R enclosure, solar shield, a weatherproof seal at all wall penetrations, and a perforated plate surrounding sensor element where exposed to wind velocity pressure;

.4 insertion duct mounting sensors type with lock nut and mounting plate, designed to mount in an electrical box (weatherproof with gasket and cover where outside) through a hole in duct;

.5 for ducts greater than 1.2 m (4 ft) or for ducts where air temperature stratification occurs, averaging type sensors with multiple sensing points, and for plenums for applications such as mixed air temperature measurement to account for air turbulence and/or stratification, an averaging string of sensors with capillary supports on the sides of duct/plenum;

.6 Where both temperature and humidity are shown to be measured at same location or in same airstream, use of single measuring unit is permitted provided that features and performance of both temperature sensor and humidity sensor are in accordance with requirements of this specification.

.3 factory solid-state relative humidity sensors with an element that resists contamination, weather-proof with a NEMA 3R enclosure for outside air applications, supplied with a type 304 stainless steel probe with mounting bracket and hardware for duct mounting, each complete with a factory calibrated humidity transmitter which is accurate (including lead loss and analog to digital conversion) to 3% between 25°C to 60°C (-13°F to 140°F) and 5% to 95% relative humidity, non-condensing and complete with non-interactive span and zero adjustments, and a 2-wire isolated loop powered, 4-20 mA, 0 to 100% linear proportional output;

.4 carbon dioxide sensors for air quality control purposes having a maximum 20 s response time, suitable for operating conditions from 0°C to 50°C (32°F to 122°F) and 0 to 100% RH non-condensing, complete with a calibration kit (to be handed to Owner) and characteristics as follows:

.1 measurement range: 0 to 2000 ppm;

.2 accuracy: ±100 ppm;

.3 repeatability: ±20 ppm;

.4 drift: ±100 ppm per year;

.5 output signal: 0-10 VDC proportional over the 0 to 2000 ppm range.

.5 Pressure transmitters are to be constructed to withstand 100% pressure over-range without damage and to hold calibrated accuracy when subject to a momentary 40% over-range input. Pressure transmitters are to transmit a 0 to 5 VDC, 0-10 VDC, or 4-20 mA output signal. Differential pressure transmitters used for flow measurement are to be sized to the flow sensing device and supplied with a tee fitting and shut-off valves in the high and low sensing pick-up lines to allow permanent ease of use connection for balancing, etc. Transmitter housing is to suit mounting location. Standalone pressure transmitters are to be mounted in a minimum NEMA 1 (NEMA 2 in sprinklered area) by-pass valve assembly panel with high and low connections piped and valved, air bleed units, by-pass valves, and compression fittings. Transmitters are to be as follows:

.1 low differential water pressure, 0 to 5 kPa (0 to 20" wc): equal to Setra or Mamac industrial quality transmitter capable of transmitting a linear 4-20 mA output signal in response to variation of flow meter differential pressure or water pressure sensing points, each complete with non-interactive zero and span adjustments adjustable from outside the cover, and performance as follows:

.1 maintain accuracy up to 20 to 1 ratio turndown;

.2 reference accuracy: +0.2% of full scale.

.2 medium to high differential water pressure, over 5 kPa (20" wc): equal to Setra or Mamac transmitters as specified above for low pressure transmitters but with a pressure range of from 2.5 kPa (10" wc) to 2070 kPa (300 psi), a reference accuracy of ±1% of full span (includes non-linearity, hysteresis, and repeatability);

.3 building differential air pressure: equal to Setra or Johnson Controls Inc. industrial quality transmitter with a range suitable for the application, capable of transmitting a linear 4-20 mA output in response to variation of differential pressure or air pressure sensing points, each complete with non-interactive zero and span adjustments adjustable from outside the cover, and performance as follows:

.1 maintain accuracy up to 20 to 1 ratio turndown;

.2 reference accuracy: +0.2% of full span.

.4 low differential air pressure, 0 to 1.25 kPa (0" to 5" wc): equal to Setra or Johnson Controls Inc. industrial quality transmitter with a range suitable for the application, capable of transmitting a linear 4-20 mA output signal in response to variation of differential pressure or air pressure

sensing points, each complete with non-interactive zero and span adjustments adjustable from outside the cover, and performance as follows:

.1 maintain accuracy up to 20 to 1 ratio turndown;

.2 reference accuracy: +0.2% of full span.

.5 medium differential air pressure, over 1.5 kPa (5" wc): equal to Setra or Johnson Controls Inc. transmitters as specified above for low pressure air transmitters but performance requirements as follows:

.1 zero and span: (c/o F.S./°F); 0.04% including linearity, hysteresis, and repeatability;

.2 accuracy: 1% F.S. (best straight line); static pressure effect: 0.5% F.S.;

.3 thermal effects: less than +0.33 F.S./°F over 40°F to 100°F (calibrated at 70°F).

.6 Air and water flow monitoring stations and probes are to be Air Monitor Corp., Tek-Air Systems Inc., Ebtron, or Dietrich Standard products as follows:

.1 Fan Inlet Air Flow Measuring Station: At fan inlet and near exit of inlet sound trap, air flow traverse probes are to continuously monitor fan air volume and system velocity pressure, and traverse probes are to be as follows:

.1 each probe is to be of a dual manifold, cylindrical, anodized type 3003 extruded aluminium construction probe with sensors located along the stagnation plane of approaching air flow, and the static pressure manifold is to incorporate dual offset static tops on opposing sides of averaging manifold so as to be insensitive to flow angle variations for as much as ±20° in approaching air stream;

.2 each probe is not to introduce a measurable pressure drop, nor is sound level within duct to be amplified by its singular or multiple presence in air stream, and each probe is to contain multiple static and total pressure sensors places at equal distances along its length in accordance with ASHRAE Standards for duct traversing.

.2 Single Probe Air Flow Measuring Sensor: Duct mounting hot wire anemometer type which utilizes 2 temperature sensors, one is a heater element temperature sensor and the other is to measure downstream temperature, with temperature differential related directly to air flow velocity. Sensor insertion length is to be adjustable up to 200 mm (8 in), and transmitter is to produce a 4-20 mA or 0-10 VDC signal linear to air velocity.

.3 Duct Flow Measuring Stations: 14 gauge galvanized steel casing with duct connection flanges of a size to mate with connecting ductwork, and complete with an air directionalizer and a 98% free area parallel cell 20 mm (3/4") honeycomb profile suppressor across entering air stream to equalize velocity profile and eliminate turbulent and rotational flow from the air stream prior to measuring point, mechanically fastened to casing so as to withstand velocities of up to 1828 m (6000 ft) per minute. Additional requirements as follows:

.1 total pressure measurement side (high side) is to be designed and spaced to requirements of Industrial Ventilation Manual, 16th Edition, page 9-5, and self-averaging manifolding is to be constructed of brass and copper components;

.2 static pressure sensing probes (low side) is to be bullet-nose shaped, per detailed radius, as illustrated in Industrial Ventilation Manual referred to above, page 9-5;

.3 main take-off point from both total pressure and static pressure manifolds is to be symmetrical, and manifolds are to terminate with external ports for connection to control tubing;

.4 each station is to be equipped with a label on casing indicating unit model number, size, area, and specified air flow capacity;

.5 each station is to have a self-generated sound rating of less than NC 40, and sound level within duct is not to be amplified nor is additional sound to be generated.

.4 Static Pressure Traverse Probe: Duct mounting, complete with multiple static pressure sensors located along exterior surface of cylindrical probe.

.5 Shielded Static Air Probe: Indoor type or outdoor type as required, each with multiple sensing ports, an impulse suppression chamber, and air flow shielding.

.6 Water Flow Monitoring: Equal to Onicon microprocessor-based electromagnetic water flow meters with an accuracy of 0.25%.

.7 Power (amps) monitoring is to be performed by a combination of a current transformer and a current transducer with transformer sized to reduce full amperage of monitored circuit to a maximum 5 A signal which will be converted to a 4-20 mA DDC compatible circuit for use by building automation system. Current transformer and current transducer are as follows:

.1 equal to Veris Industries split core current transformer with an operating frequency of from 50 Hz to 400 Hz, 0.6 kV class, 10 kV BIL insulation, and 5 A secondary;

.2 equal to Veris Industries current to voltage or current to mA transducer with an accuracy of ±5%, a minimum load resistance of 30 kOhm, an input of 0 to 20 A and an output of 4-20 mA, and a 24 VDC regulated power supply.

.8 Duct mounting smoke detectors supplied as part of electrical work for mounting as part of control system work.

.9 Double contact switches to monitor equipment status and safety conditions, and generate alarms when a failure or abnormal condition occurs. Status and safety switches are to be as follows:

.1 current sensing switches: equal to Veris Industries self-powered dry contact output switches for sensing run status of motor loads, each calibrated to indicate a positive run status only when motor is operating under load, and each consisting of a current transformer, a solid-state current sensing circuit, adjustable trip point, solid-state switch, SPDT relay, and a LED to indicate on or off status;

.2 air filter status switches: equal to Johnson Controls Inc. or Cleveland Controls automatic reset type differential pressure switches, each complete with SPDT contacts rated for 2 A at 120 VAC, a scale range and differential pressure adjustment appropriate for the service, and an installation kit which includes static pressure taps, tubing, fittings, and air filters;

.3 air flow switches: equal to Johnson Controls Inc. or Cleveland Controls pressure flow switches, bellows actuated mercury switch or snap-acting micro-switch type with an appropriate scale range and pressure adjustment;

.4 air pressure safety switches: equal to Johnson Controls Inc. or Cleveland Controls manual reset switches, each complete with SPDT contacts rated for 2 A at 120 VAC and an appropriate scale range and pressure adjustment;

.5 water flow switches: equal to Johnson Controls Inc. Model P74;

.6 low temperature limit switches: manual reset type equal to Johnson Controls Inc. Model A70, each complete with DPST snap acting contacts rated for 16 A at 120 VAC, a minimum 4.5 m (15 ft) sensing element for mounting horizontally across duct/plenum with sensing reaction from coldest 450 mm (18 in) section of element, and where sensing element does not provide full coverage of air stream, additional switches are to be supplied as required.

.10 Control relays as follows:

.1 control pilot relays: equal to Johnson Controls Inc. or Lectro modular plug-in design with snap-mount mounting bases, retaining springs or clips, DPDT, 3 PDT or 4 PDT as required for the application, with contacts rated for 10 A at 120 VAC;

.2 lighting control relays: latching type with integral status contacts rated for 20 A at 120 VAC, each complete with a split low voltage coil that moves the voltage contact armature to On or Off latched position, each controlled by a pulsed tri-state output (preferred) or pulsed paired binary outputs, and each designed so power outages will not result in a change-of-state and so multiple same state commands will simply maintain commanded state.

.11 Electronic signal isolation transducers equal to Advanced Control Technologies for installation whenever an analog output signal from building automation system is to be connected to an external control system as an input (i.e. equipment control panel), or is to receive as an input signal from a remote system, and to provide ground plane isolation between systems.

.12 Each manual override station is to be complete with contacts rated minimum 1 A at 24 VAC and is to provide following:

.1 integral H-O-A switch to override controlled device pilot relay;

.2 status input to building automation system to indicate whenever switch is not in the Auto position;

.3 status LED to illuminate whenever output is On;

.4 override LED to illuminate whenever H-O-A switch is in either the Hand or Off position.

.13 Electronic/pneumatic transducers equal to Johnson Controls Inc. transducers with an output of from 3 psig to 15 psig, an input of from 4-20 mA or 0-10 VDC, manual output adjustment, a pressure gauge, and an external replaceable supply air filter.

.14 Thermostats:

.1 Wall mounting adjustable set-point thermostats, each suitable in all respects for equipment (and operating sequence) they are provided for, equipped with a thermometer, a cover and any required mounting and connection accessories.

.2 Pneumatic thermostats are to be of bimetal element construction, double valve type, operating without constant waste of air.

.3 Line voltage thermostats are to be 115 V.

.4 Low voltage thermostats are to be 24 V electronic type.

.5 Set-point adjustment for thermostats in public spaces is to be concealed behind cover. Set-point adjustment for other thermostats is to be accessible through cover.

.6 Covers are to be removable, tamper-proof covers with temperature set-point and thermometer displays.

.7 Guards for thermostats are to be clear, ventilated acrylic covers with Allen key locking hardware.

.15 Humidistats:

.1 Direct or reverse acting (to suit system), proportional type, adjustable humidity controllers, each corrosion resistant, suitable in all respects for the application and complete with a nylon element, replaceable cartridge type air filter, internally adjustable limit stops for maximum and minimum settings, a cover, and required mounting and connection accessories.

.2 Pneumatic humidistats are to be 2 pipe type and complete with plug-in air connections.

.3 Electric humidistats are to be line voltage (115 V), or 24 V electronic type.

.4 Wall mounting humidistats are to be complete with a tamper-proof display type cover.

.5 Duct mounting humidistats are to be complete with a display type cover, duct sampling chamber with 300 mm (12 in) long extruded pick-up tube for duct mounting, a moulded mounting base, and a ventilated cover.

.16 Hardware to permit building automation system control and monitoring of input/output points in accordance with Section 25 05 02 – Building Automation System, points schedule, and drawing control diagrams and operation sequences. All such hardware is to be suitable in all respects for interface with the building automation system.

2.5 SYSTEM WIRING MATERIALS

.1 System wiring, conduit, boxes, and similar materials are to be in accordance with requirements specified in appropriate Section(s) of Electrical Work specification.

2.6 AIR COMPRESSOR SET AND ACCESSORIES

.1 Package type, duplex, receiver mounted, automatic, CSA certified air compressor set selected to meet all requirements of control system while operating not more than 33% of the time with a maximum of 6 starts per hour. Compressor set complete with a low resistance air intake filter/silencer, and motors and V-belt drives with guards in accordance with requirements of Section 20 05 00 – Common Work Results for Mechanical, and following:

.1 suitably sized, ASME rated and stamped steel receiver in accordance with CSA B51 and Provincial requirements with support feet, rubber-steel-rubber type vibration isolation pads, automatic tank drain, adjustable pressure switch, safety relief valve, check valve, self-lubricating ball type outlet valve, manual drain valve, and a flexible tank to air piping flexible connection supplied loose for site installation;

.2 separate (supplied loose) surface wall mounting starter and control panel factory pre-wired for single point site connection of electric power, complete with NEMA 2 enclosure, door interlock disconnect switch, a fused overload protected magnetic starter for each motor, control transformer, 2 NO and 2 NC auxiliary contacts, a green "power on" LED and a white LED for each working compressor, and an alternator to automatically alternate the working compressor after each start and to automatically start lag compressor if working compressor fails;

.3 packaged type refrigerated air dryer sized to suit and supplied lose for site installation, complete with hot gas by-pass to maintain continuous operation and stable dew point, power on and high temperature indicating lights, overload protected motor starter, an integral automatic condensate drain trap, and a manual 3-valve by-pass to permit removal of heat exchanger for servicing without disrupting control system;

.4 coalescing type oil removal filter supplied loose by compressor set manufacturer for site installation, sized to control air piping main size, and equipped with automatic drain and an indicator piping kit for media maintenance inspection.

.2 Acceptable manufacturers are:

.1 DeVilbiss (Canada) Ltd.;

.2 Compair Kellog;

.3 Atlas Copco Compressors Canada.

2.7 CONTROL AIR FILTER AND PRV ASSEMBLIES

.1 Combination filter/PRV assembly with quantities to suit control system capacity requirements, each assembly complete with:

.1 oil/particle filter with drain port and replaceable coalescing filter element in a transparent polycarbonate bowl with perforated metal shield;

.2 adjustable pressure reducing valve with inlet and outlet pressure gauges and outlet safety pressure relief valve;

.3 wall mounting bracket.

.2 Each filter is to remove both 0.08 micron diameter particles and 0.01 micron diameter oil aerosol, and filter elements are to be removable without disconnecting any piping.

2.8 CONTROL AIR PIPING AND TUBING

.1 High pressure piping mains are to be Type M hard drawn seamless copper with forged copper soldering type fittings and 95% tin / 5% Antimony solder joints.

.2 Low pressure tubing is to be:

.1 seamless hard drawn phosphorized copper tubing with proper soldering type copper fittings and 50% lead / 50% tin solder joints;

.2 annealed soft copper with Garlock compression fittings;

.3 type "FR" plenum rated flame retardant polyethylene control tubing, single, twin or bundled as required, and colour coded.

PART 3 - EXECUTION

3.1 GENERAL RE: INSTALLATION OF CONTROLS

.1 Provide complete systems of control and instrumentation to control and supervise building equipment and systems in accordance with this Section and drawings.

.2 Control systems are to generally be as indicated on drawing control diagrams and are to have all the elements therein indicated or implied.

.3 Control diagrams show only the principal components controlling the equipment and systems. Supplement each control system with all relays, transformers, sensors, etc., required to enable each system to perform as specified and to permit proper operation and supervision.

.4 Brace and secure control system equipment in accordance with requirements specified in Section 20 05 48.16 – Seismic Controls for Mechanical Systems.

3.2 INSTALLATION OF CONTROL AIR PIPING AND TUBING

.1 Provide required control air piping and tubing.

.2 Connect new control air piping/tubing to existing pneumatic control air supply.

.3 Piping/tubing is to be as follows:

.1 for piping mains and branches, type "M" seamless copper;

.2 for exposed connections to control components, hard or soft copper tubing;

.3 for tubing in accessible ceiling spaces, plenum rated polyethylene, neatly bundled with plastic ties and properly supported;

.4 for connections to control components within control cabinets, soft copper or plenum rated polyethylene tubing.

.4 Properly install and support piping and tubing. Provide suitably sized trap legs with drain valves at all low points to prevent condensation pockets.

.5 Solder all copper joints except at instruments or panels where compression fittings are to be used.

3.3 SUPPLY OF CONTROL AIR DAMPERS AND OPERATORS

.1 Unless otherwise specified, supply required control dampers. Hand dampers to sheet metal trade at site in location where they are required for installation as part of sheet metal work. Ensure each damper is correctly located and mounted.

.2 Unless otherwise specified or scheduled, insulated dampers to be provided for all outdoor air intake and exhaust air applications.

.3 Provide linkage and operators for dampers. Wherever possible locate damper operators so they are accessible from outside duct, plenum, and equipment casings. Bracket mount operators on ducts or plenums clear of insulation where applicable.

.4 Where sequence operation is indicated, or where multiple operators drive a series of dampers, provide pilot positioners to couple their action.

.5 Ensure dampers located in ductwork other than galvanized steel are constructed of type 316 stainless steel.

3.4 SUPPLY OF AUTOMATIC CONTROL VALVES AND OPERATORS

.1 Unless otherwise specified, supply required automatic control valves. Hand valves to appropriate piping trades at site in locations they are required for installation as part of piping work. Ensure each valve is properly located and installed.

.2 Provide an operator for each valve.

3.5 INSTALLATION OF THERMOSTATS

.1 Unless otherwise noted, provide required thermostats.

.2 Provide a ventilated clear acrylic cover for each thermostat located in finished areas, and a wire type guard for each thermostat located in unfinished areas and in areas such as mechanical rooms where thermostat is subject to damage.

.3 Unless otherwise indicated, mount room thermostats 1.5 m (5 ft) above finished floor level. Thermostats intended to be used by building occupants in a barrier-free path of travel to be mounted at 1.2 m (4 ft). Confirm exact location of all thermostats prior to roughing-in.

.4 Provide stand-off mounting and an insulated sub-base for thermostats on outside walls.

.5 Perform control wiring associated with installation of electric or electric-electronic thermostats.

3.6 INSTALLATION OF CONTROL SYSTEM COMPONENTS

.1 Provide required control system components and related hardware. Refer to drawing control diagrams and sequences.

.2 Where components are pipe, duct, or equipment mounted supply components at proper time, coordinate installation with appropriate trade, and ensure components are properly located and mounted.

3.7 CONTROL WIRING

.1 Perform required control wiring work for control systems except:

.1 power wiring connections to equipment and panels, except as noted below;

.2 control wiring associated with mechanical plant equipment and systems whose control is not part of work specified in this Section;

.3 starter interlock wiring.

.2 Except as specified below, install wiring in conduit. Unless otherwise specified, final 600 mm (2 ft) connections to sensors and transmitters, and wherever conduit extends across flexible duct connections is to be liquid-tight flexible conduit.

.3 Control wiring in ceiling spaces and wall cavities may be plenum rated cable installed without conduit but neatly harnessed, secured, and identified.

.4 Wiring work is to be in accordance with certified wiring schematics and instructions, and wiring standards specified in appropriate Sections of Electrical Work Specification.

3.8 INSTALLATION OF CONTROL AIR COMPRESSOR SET AND DRYER

.1 Provide a duplex air compressor set. Secure set in place on vibration isolation on a concrete housekeeping pad. Install flexible piping connections supplied with set and connect with required piping, including drain piping extended and terminated at nearest drain.

.2 Wall mount power and control panel(s) adjacent to equipment. Connect compressor set panel pressure switch with copper tubing to compressor set.

3.9 IDENTIFICATION AND LABELLING OF EQUIPMENT AND CIRCUITS

.1 Refer to identification requirements specified in Section 20 05 00 – Common Work Results for Mechanical.

.2 Identify equipment as follows:

.1 enclosures and components: engraved laminated nameplates with wording listed and approved prior to manufacture of nameplates;

.2 wiring: numbered sleeves or plastic rings at both ends of conductor, with numbering corresponding to conductor identification on shop drawings and "as-built" record drawings.

3.10 TESTING, ADJUSTING, CERTIFICATION, START-UP, AND TRAINING

.1 When control work is complete, check installation of components and wiring connections, make any required adjustments, and coordinate adjustments with personnel doing HVAC testing, adjusting, and balancing work.

.2 For equipment/system manufacturer certification requirements, refer to Section 20 05 00 – Common Work Results for Mechanical.

.3 For equipment/system start-up requirements, refer to Section 20 05 00 – Common Work Results for Mechanical.

.4 Include for 2 full, 8 hour days on-site operation demonstration and training sessions. Training is to be a full review of all components including but not limited to a full operation and maintenance demonstration, with abnormal events.

.5 Include for 2 follow-up site training and troubleshooting visits, one 6 months after Substantial Completion and other at end of warranty period, both when arranged by Owner and for a full, 8 hour

day to provide additional system training as required, and to demonstrate troubleshooting procedures.

END OF SECTION

SEE ADD#6, Q#112 & ADD#10, Q#311

PART 1 - GENERAL

1.1 ABBREVIATIONS AND DEFINITIONS

.1 Abbreviations used in this Specification are as follows:

.1 BAS building automation system;

.2 DDC direct digital controls;

.3 LAN local area network;

.4 PC personal computer.

1.2 SUBMITTALS

.1 Submit shop drawings/product data sheets for BAS components. As a minimum, submit the following:

.1 BAS network architecture, including modes and interconnections;

.2 systems schematics, sequences, and flow diagrams;

.3 points schedule for each point in BAS, including point type, object name, expanded ID, display units, controller type, and address;

.4 samples of graphic display screen types and associated menus;

.5 detailed Bill of Materials for each system or application, identifying quantities, part numbers, descriptions, and optional features;

.6 control damper schedule including a separate line for each damper and a column for each of damper attributes including code number, fail position, damper type, damper operator, duct size, damper size, mounting and actuator type;

.7 control valve schedules including a separate line for each valve and a column for valves as for control dampers;

.8 room schedule including a separate line for each HVAC terminal unit indicating type, location and address;

.9 details of BAS interfaces and connections to other systems;

.10 product data sheets or marked catalogue pages including part number, photograph and description for BAS hardware and software.

1.3 CLOSEOUT SUBMITTALS

.1 Submit a site inspection and start-up report from manufacturer’s representative as specified in Part 3 of this Section.

.2 Record "as-built" drawings are to include:

.1 schematic outline of BAS for quick reference of overall system scope;

.2 adequate record of work as installed, including locations and routing of system wiring.

.3 O&M Manual is to include:

.1 hardware specification manual which gives a functional description of hardware components;

.2 operator’s manual which outlines concise instructions for operation of system and an explanation and recovery route for system alarms;

.3 engineering manual which outlines and defines system set-up, definition and application;

.4 data manual which indicates applications data programmed into system;

.5 system software documentation.

1.4 DESCRIPTION OF THE BUILDING AUTOMATION SYSTEM

.1 Building automation system is to consist of a modular, BACnet protocol, open architecture system incorporating direct digital control and monitoring of equipment and systems and consisting of all hardware and software required for complete, functional DDC control system. BAS is to be accessible through standard personal computers within building through a wireless application protocol device, or remotely through Internet by means of a standard web browser.

.2 BAS is to be field expandable, with a distributed architectural design to eliminate dependence upon any single device for alarm reporting and control execution. Failure of any single component or network connection is not to interrupt execution of control strategies at other operational devices. BAS is to maintain all settings and overrides through a system re-boot, and is to incorporate, as a minimum, following integrated features, functions, and services:

.1 graphic user interface for accessing and viewing BAS information, commanding points, changing setpoints, responding to alarms, programming time-of-day schedules;

.2 operator information, alarm management, and control features;

.3 enterprise-level information and control access;

.4 information management including monitoring, transmission, archiving, retrieval, and reporting functions;

.5 diagnostic monitoring and reporting of BAS functions;

.6 off-site monitoring and management access;

.7 energy management;

.8 standard applications for terminal HVAC systems.

.3 BAS is to include, but not be limited to, following:

.1 personal computer based server for networking and integrating all hardware components into a single BAS;

.2 personal computer based operator work station with colour monitor for colour graphic displays, and a colour printer;

.3 portable operator’s terminal;

.4 network of standalone network automation engine(s);

.5 network of field equipment controllers;

.6 input/output modules;

.7 local display devices;

.8 distributed user interfaces;

.9 network processing, data storage and communication equipment;

.10 all other components required for a complete and operating BAS.

1.5 QUALITY ASSURANCE

.1 BAS hardware and software is to be installed by experienced personnel employed and trained by manufacturer/supplier of field equipment controllers. System wiring is to be installed by journeyman electricians or under direct on-site supervision of journeyman electricians.

PART 2 - PRODUCTS

2.1 GENERAL RE: BUILDING AUTOMATION SYSTEM

.1 Control system components (field devices) other than those specified in this Section are generally specified in Section 25 05 01 – Automatic Control Systems. Components factory installed with equipment or supplied with equipment are specified in mechanical work Sections with equipment.

.2 BAS specified in this Section is an expandable DDC building automation system in accordance with drawing control diagrams and sequences, and points lists.

.3 Manufacturers:

.1 Johnson Controls Inc.;

.2 Siemens Building Technologies Inc.;

.3 Honeywell International Inc.;

.4 Trane Controls;

.5 Distech Controls;

.6 Delta Controls;

.7 Schneider Electric;

.8 Alerton.

2.2 BAS ARCHITECTURE

.1 BAS is to be based industry standard Ethernet TCP/IP communications protocol. Where used, LAN controller cards are to be standard "off-the-shelf" products available through normal PC vendor channels. BAS is to be capable of operating at a communication speed of 100 Mbps, with full peer-to-peer network communication. BAS is to be compatible with other enterprise-wide networks, and where indicated, BAS is to be connected to the enterprise network and share resources with it by way of standard networking devices and practices.

.2 Network automation engines are to provide supervisory control over control network and are to support BACnet Standard MS/TP bus communication protocol (ASHRAE SSPC-135, Clause 9). Control networks are to provide either a "peer-to-peer", master-slave, or supervised token passing communications and are to operate at a minimum communication speed of 9600 baud. DDC controllers are to reside on control network.

.3 BAS is to include appropriate hardware and software to allow BACnet bi-directional data communications between BAS and building equipment/system control panels. BAS is to receive, react to, and return information from connected equipment and systems. Data required by application is to be mapped into automation engine’s data base and is to be transparent to operator. Point inputs and outputs from building equipment/system control panels is to have real-time interoperability with BAS software features such as control software, energy management, custom process programming, alarm management, historical data and trend analysis, totalization, and local area network communications.

2.3 DEDICATED WEB BASED USER INTERFACE

.1 User interface is to be web based and is to operate on a personal computer for command entry, information management, network alarm management, and database management functions. Real-time control functions including scheduling, history collection, and alarming are to be resident in appropriate components of BAS network to facilitate greater fault tolerance, availability, and reliability.

.2 Architecture of personal computer is to be implemented to conform to industry standards such that it can accommodate applications provided with BAS and mechanical systems and equipment, including but not limited to Microsoft Office Applications. Specifically, it must conform to following interface standards:

.1 Microsoft Edge (or other standard browser) for user interface functions;

.2 Microsoft Office Professional for creations, modification and maintenance of reports, and sequencing other necessary building management functions;

.3 Microsoft Outlook or other email program for supplemental alarm functionality and communication of system events, and reports;

.4 required network operating system for exchange of data and network functions such as printing of reports, trends, and specific system summaries.

.3 Personal computer server or operator workstation is to be configured at minimum as follows:

.1 memory: 8 GB;

.2 processor: Intel;

.3 hard drive: 500 GB free hard drive;

.4 graphics card: 1 GB DDR3;

.5 ports: 1 HMDI, 2 serial, one parallel, and 2 USB-C ports;

.6 keyboard: 101 keyboard and 2-button mouse;

.7 monitors: 584 mm (23 in) LCD monitor with 1920 x 1080 resolution;

.8 LAN communications: 10/100/1000 network card.

.4 Operating System Software: Windows 7 Professional 64-bit Microsoft SQL 2008 Server and SQL 2008 Server Express are automatically installed by EBI. Where user interface is not provided via browser, PC is to be equipped with a complete workstation software package including any software or hardware keys, and package is to include original installation discs and licenses for all software, device drivers, peripherals, and software registration cards which are to be handed to Owner.

.5 Printer is to be at minimum equal to Hewlet Packard "DeskJet" colour printer with a speed of 600 DPI black and 300 DPI colour, and 64 kB input print buffer.

2.4 DISTRIBUTED WEB BASED USER INTERFACE

.1 Features and functions of dedicated web-based user interface described above are to be available on any computer connected directly or via a wide area or virtual private network to BAS network, which conforms to the following specifications:

.1 software is to run on Microsoft Edge (or other standard browser);

.2 minimum hardware requirements are:

.1 2 GB RAM;

.2 2.0 GHz clock speed Pentium 4 microprocessor;

.3 120 GB hard drive;

.4 keyboard with 83 keys minimum;

.5 SVGA 1024 x 768 resolution display with 64 k colours and 16 bit colour depth;

.6 mouse or other pointing feature.

2.5 REMOTE ACCESS VIA SMART PHONE AND/OR TABLET DEVICES

.1 Available with an operator interface designed for use on various modern smart phone devices with network connectivity with the follow features:

.1 Mobile user interface operating over standard TCP network connection, performing well down to standard mobile 3G speeds, and optimized to ensure very high performance across different network topologies.

.2 Solution written with HTML5 web standards and browser agnostic, not deploying or using ActiveX controls, nor requiring installation of Java Runtime engine.

.3 Mobile solution incorporating full scope of responsibilities of BAS operators for remote mobile users, allowing them to view or control points within their assigned facility locations.

.4 Without alternation, mobile user interface operable within any standard internet browser from a normal personal computer.

.2 Along with optimized smart phone user interface, a dedicated tablet access user interface, optionally providing full operator workstation functionality, on a tablet style device. Tablet interface is to support standard operator workstation features including full operator scope of responsibility, and operable using commercial off-the-shelf technology.

2.6 USER INTERFACE APPLICATION COMPONENTS

.1 Integrated browser based client application is to be used as user operator interface program. System is to employ an event-driven rather than a device polling methodology to dynamically capture and present new data to user. Additional features are as follows:

.1 inputs, outputs, set-points, and other parameters as defined in Part 3 of this Section, shown on drawings, or required as part of system software are to be displayed for operator viewing and modification from operator interface software;

.2 user interface software is to provide help menus and instructions for each operation and/or application;

.3 system is to support customization of user interface configuration and a home page for each operator;

.4 system is to support user preferences in alarm, trend, display, and applications screen presentations;

.5 controller software operating parameters are to be displayed for operator to view/modify from user interface, and these parameters are to include set-points, alarm limits, time delays, PID tuning constants, run times, point statistics, schedules, etc.;

.6 operator interface is to incorporate comprehensive support for functions including but not limited to following:

.1 user access for selective information retrieval and control command execution;

.2 monitoring and reporting;

.3 alarm, non-normal, and return to normal condition annunciation;

.4 selective operator override and other control actions;

.5 information archiving, manipulation, formatting, display and reporting;

.6 BAS internal performance supervision and diagnostics;

.7 on-line access to help menus;

.8 on-line access to current BAS as-built records and documentation;

.9 means for controlling, re-programming, and re-configuration of the BAS operation and for the manipulation of the BAS database information in compliance with applicable Codes and Regulations for individual BAS applications.

.7 system is to support a list of application programs configured by users that are called up by the Tools Menu, hyperlinks within graphic displays, and key sequences;

.8 operation of control system is to be independent of user interface, which is to be used for operator communication only.

.2 System is to have a minimum of 5 levels of nesting, and the capability of displaying multiple navigation trees to aid operator in navigating throughout all systems and points connected, adding custom trees, defining any logical grouping of points, and arranging them on a tree in any order, and nesting groups within other groups. Navigation trees are to be "dockable" to other displays such as graphics, meaning trees will appear as part of display but can be detached and then minimized to Windows task bar or closed altogether, however, a simple keystroke will reattach navigation to primary display of user interface.

.3 Alarms are to be routed directly from network automation engines to PC’s and servers, and it is to be possible for specific alarms from specific points to be routed to specific PC’s and servers. BAS is to annunciate diagnostic alarms indicating system failures and non-normal operating conditions, annunciate application alarms as required by points lists and sequences, and as a minimum, permit 4 categories of alarm sounds customizable through user defined wav files. Alarm management segment of user interface is to provide, as a minimum, following alarm functions:

.1 log, date, and time of alarm occurrence;

.2 generate a "pop-up" window or populate a dedicate section of screen with audible alarm to inform a user that an alarm has been received;

.3 permit a user with the appropriate security level to acknowledge, temporarily silence, or discard an alarm;

.4 provide an audit trail on PC hard drive for alarms by recording user acknowledgement, deletion or disabling of an alarm, name of the user, alarm, action taken, and time/date of alarm;

.5 facilitate ability to direct alarms to an email address or alphanumeric pager, in addition to pop-up window described above;

.6 any attribute of any object in system may be designated to report an alarm.

.4 Reports and summaries are to be generated and directed to user interface displays with subsequent assignment to printers or discs. Summaries and reports are to be accessible via standard user interface functions, and selection of a single menu item, tool bar item, or tool bar button is to print any displayed report or summary. System is to permit creation of custom reports and queries via a standard web services XML (Extensible Mark-up Language) interface and commercial of-the-shelf software such as Microsoft Access, Microsoft Excel, or Crystal Reports. As a minimum, BAS is to provide following reports and summaries:

.1 all points in BAS;

.2 all points in each BAS application;

.3 all points in a specific controller;

.4 all points in a user-defined group of points;

.5 all points currently in alarm;

.6 all points locked out;

.7 all BAS schedules;

.8 all user defined and adjustable variables, schedules, interlocks, etc.

.5 Graphical display for time-of-day scheduling and override scheduling of building operations is to be provided, with weekly schedules for each group of equipment with a specific time use schedule, and it is to be possible to define one or more exception schedules for each schedule including reference to calendars, with monthly calendars provided to permit simplified scheduling of holidays and special days for a minimum of 5 years in advance, user selected with the pointing device or keyboard. Changes to schedules made from user interface are to directly modify network automation engine schedule database. Selection of a single menu item or tool bar button is to print any displayed schedule. As a minimum, following functions are to be provided:

.1 weekly schedules;

.2 exception schedules;

.3 monthly calendars;

.4 global schedules.

.6 BAS Is to be complete with multiple-level password access protection to permit user/manager to user interface control and display, database manipulation capabilities deemed appropriate for each user, based on an assigned password. Password access protection features are to include:

.1 each user is to have a user name (24 characters minimum), a password (12 characters minimum), and access levels;

.2 each user may change his or her password at any time;

.3 when editing or entering passwords, system is not to echo actual characters for display on monitor;

.4 minimum of 500 unique password is to be supported;

.5 operators are to be able to perform only those commands available for their respective passwords, and display of menu selections is to be limited to only those items defined for access level assigned to password of each user;

.6 BAS is to automatically generate a report of log-on/log-off and system activity for each user, and any action that results in a change in operation or configuration of control system is to be recorded, including acknowledgement and deletion of alarms;

.7 minimum of 5 levels of access is to be supported individually or in any combination of following:

.1 Level 1 – view data;

.2 Level 2 – command;

.3 Level 3 – operator overrides;

.4 Level 4 – database modification;

.5 Level 5 – database configuration;

.6 Level 6 – all privileges including password add/modify.

.7 User interface is to be equipped with screen management capabilities that allows user to activate, close, and simultaneously manipulate a minimum of 4 active display windows plus a network of user defined navigation trees.

.8 Graphics application program is to be an integral part of user interface and is to include a create/edit function and a runtime function, and system architecture is to support a number of graphic documents (graphic definition files) limited only by memory and computing resources to be generated and executed. Graphics are to be capable of displaying and providing animation based on real-time data that is acquired, derived, or entered. Additional features include following:

.1 maximum of 16 graphic applications are to be able to be executed at any one time on a user interface or workstation with 4 visible to user, and each graphic application is to capable of following functions:

.1 all graphics are to be fully scalable;

.2 graphics are to support a maintained aspect ratio;

.3 multiple fonts are to be supported;

.4 unique background is to be assigned on a per graphic basis;

.5 colour of animations and values on displays is to indicate status of object attribute.

.2 it is to be possible to change values (set-points) and states in system controlled equipment by using drop-down windows accessible via pointing device;

.3 graphic editing tool is to be provided to permit creation and editing of graphic files, and graphic editor is to be capable of performing/defining animations, defining runtime binding, and:

.1 in general, facilitate creation and positioning of point objects by dragging from tool bars or drop-downs and positioning where required;

.2 be capable of adding additional content to any graphic by importing backgrounds in the SVG, BMP, or JPG file formats.

.4 many graphic displays representing part of building and various building components are exact duplicates, with exception that various variables are bound to different field values, consequently, it is to be possible to bind value of a graphic display to aliases, as opposed to physical field tags.

.9 Trend and change of value data is to be stored within the automation engines or server and uploaded to a dedicated trend database or exported in a selectable data format via a data export utility. Uploads to a dedicated database are to occur based on one of user-defined interval, manual command, or when trend buffers are full. Exports are to be as requested by user or on a time scheduled basis. System is to be equipped with a configurable data storage sub-system for collection of historical data which can be stored in either Microsoft Access or SQL database format. Each automation engine is to store, trend, and point history data for analog and digital inputs and outputs as follows:

.1 any point, physical or calculated, may be designated for trending, and methods of collection are to be defined time interval or a change of value;

.2 each automation engine or server is to capable of storing multiple samples for each physical point and software variable based on available memory, including an individual sample time/date stamp, and points may be assigned to multiple history trends with different collection parameters.

.10 Trend viewing utility with access to data points and capability of defining trend study displays to include multiple trends is to be provided, and is to include:

.1 capability of retrieving any historical database point for use in displays and reports by specifying point name and associated trend name;

.2 displays which are able to be single or stacked graphs with on-line selectable display characteristics such as ranging, colour, and plot style;

.3 display magnitude (zoom capability) and units selectable by operator at any time without reconfiguration of processing or collection of data;

.4 display magnitude is to be automatically scaled to show full graphic resolution of data being displayed;

.5 trend studies are to be capable of calculating and displaying calculated variables including highest value, lowest value, and time based;

.6 display is to support user's ability to change colours, sample sizes, and types of markers.

.11 BAS is to be equipped with a database manager that separates database monitoring and management functions by supporting 2 separate windows. Database secure access is to be accomplished using standard SQL authentication including ability to access data for use outside of BAS application. Additional features are as follows:

.1 database management function is to include summarized information on trend, alarm, event, and audit for backup, purge, and restore database management functions;

.2 database manager is to support 4 tabs as follows:

.1 statistics, which is to display database server information and trend, alarm (event), and audit information on BAS database;

.2 maintenance, which is to be an easy method of purging records from BAS server trend, alarm (event), and audit databases by supporting separate screens for creating a backup prior to purging, selecting database, and allowing for retention of a selected number of day's data;

.3 backup, which is to provide means to create a database backup file and select a storage location;

.4 restore, which is to provide a restricted means of restoring a database by requiring user to log into an Expert Mode in order to view Restore screen.

.3 status bar is to appear at bottom of BAS database manager tabs and is to indicate information on current display activity with icons as follows:

.1 Ready;

.2 Purging Record From Database;

.3 Action Failed;

.4 Refreshing Statistics;

.5 Restoring Database;

.6 Shrinking A Database;

.7 Backing-Up A Database;

.8 Resetting Internet Information Services;

.9 Shutting Down BAS Deice Manager;

.10 Action Successful.

.4 database manager monitoring functions are to be accessed through Monitoring Settings window and are to continuously read database information once user has logged in;

.5 system is to advise user via task bar icons and email messages when a database value has exceeded a warning or alarm limit;

.6 Monitoring Settings window is to have following sections:

.1 General: allow user to set and review scan intervals and start times;

.2 Email: allow user to create and review email and telephone text messages to be delivered when a warning or alarm is generated;

.3 Warning: allow user to define warning limit parameters, set reminder frequency, and link email message;

.4 Alarm: allow user to define alarm limit parameters, set reminder frequency, and link email message;

.5 Database Login: protect system from unauthorized database manipulation by creating a read access and write access for each trend, alarm (event), and audit databases as well as an Expert Mode required to restore a database.

.7 Monitoring Settings taskbars to display following informational icons:

.1 Normal: indicates by colour and size that databases are within their limits;

.2 Warning: indicates by colour and size that one or more databases have exceeded their warning limit;

.3 Alarm: which indicates by colour and size that one or more databases have exceeded their alarm limit.

.8 BAS is to indicate via taskbar icons and email messages when a database value has exceeded a warning or alarm limit;

.12 BAS is to be equipped with a demand limiting and load rolling program for purpose of limiting peak energy usage and reducing overall energy consumption. Program is to support both Sliding Window and Fixed Window methods of predicting demand. Additional features are as follows:

.1 system is to support 3 levels of sensitivity in Sliding Window demand calculations for fine tuning the system, as follows:

.1 Low Setting: sheds loads later and over shortest period of time and maximizes period of time equipment is on;

.2 Medium Setting: sheds loads earlier over a period of time greater than Low Setting, and increases time equipment is on and decreases probability of exceeding "Tariff Target";

.3 High Setting: sheds loads earlier and over a longer period of time than Medium Setting to minimize probability of exceeding "Tariff Target".

.2 system is to have both a Shed Mode and a Monitor Only Mode of operation, as follows:

.1 when Shed Mode is engaged, system is to actively control demand;

.2 when Monitor Mode is engaged, system is to simulate shedding action but will not take any action.

.3 Demand Limiting Program is to monitor energy consumption rate and compare it to a user defined "Tariff Target", and maintain consumption below target by selectively shedding loads based on a user defined strategy;

.4 Demand Limiting Program is to be capable of supporting a minimum of 10 separate load priorities, with each load user assigned, and a minimum of 12 separate "Tariff Targets" defining maximum allowed average power usage during current interval;

.5 system is to support a maximum shed time for each load as determined by user, and system is to restore load before maximum shed time has expired;

.6 system is to support a minimum shed time for each load as determined by user, and system is not to restore load before minimum shed time has expired;

.7 system is to support a minimum release time for each load as determined by user, and system is not to shed load until it has been off for minimum release time;

.8 system is to support three user defined options if meter does not function properly, as follows:

.1 shedding – currently shed loads will be released as their maximum shed time expires;

.2 maintain current shed rate – system will use demand limiting shed rate that was present when meter began to function improperly;

.3 use unreliable meter shed rate – system is to control to a user defined unreliable shed rate target.

.9 Load Rolling Program is to sum the loads currently shed and compare sum to a user defined load rolling target, and system is to maintain consumption below target by selectively shedding loads based on a user defined load priority;

.10 Load Rolling Program is to be capable of supporting a minimum of 10 separate load priorities with each load user defined to a load priority;

.11 Load Rolling Program is to be capable of supporting a minimum of 12 separate "Tariff Targets" defining amount of energy by which demand must be reduced;

.12 system is to equip user with a Load Tab that displays all demand limiting and load rolling parameters for any selected load;

.13 system is to be complete with a Load Summary that displays all loads associated with demand limiting and load rolling program, and status icons for each load are to indicate:

.1 Load Is Offline;

.2 Load Is Disabled;

.3 Load Is Shed;

.4 Load Is Locked;

.5 Load Is In Comfort Override.

.14 Load Summary is to include a load summary runtime view listing following load conditions:

.1 Load Priority;

.2 Shed Strategy;

.3 Load Rating;

.4 Present Value;

.5 Ineligible Status;

.6 Active Timer;

.7 Time Remaining;

.8 Last Shed time.

2.7 NETWORK AUTOMATION ENGINES

.1 Network automation engines are to be ULC listed and labelled, BACnet Testing Labs (BTL) certified and labelled, fully user programmable supervisory controllers to monitor a network of a minimum of 100 distributed application-specific controllers for a global strategy and direction and to communicate on a peer-to-peer basis with other network automation engines.

.2 Each network automation engine is to have ability to deliver a web based user interface as specified above, and computers connected physically or virtually to automation network are to have access to web-based user interface. Additional characteristics/requirements are as follows:

.1 web-based user interface software is to be imbedded in each network automation engine;

.2 each network automation engine is to support a minimum of 4 concurrent users;

.3 user is to be capable of accessing all system data through one network automation engine;

.4 remote users connected to network through an internet service provider or by telephone dial-up are also to have total system access through one network automation engine;

.5 each network automation engine is to be capable of generating web-based user interface graphics, and this capability is to be imbedded in network automation engine;

.6 user interface is to support following functions using a standard version of Microsoft Edge:

.1 configuration;

.2 commissioning;

.3 data archiving;

.4 monitoring;

.5 commanding;

.6 system diagnostics.

.7 each network automation engine is to permit temporary use of portable devices without interrupting normal operation of permanently connected modems.

.3 Each network automation engine is to be a multi-tasking, multi-user, microprocessor-based real time digital control processor sized to meet requirements of system with a minimum word size of 32 bits, and standard operating systems.

.4 Each network automation engine is to have sufficient memory to support its own operating system, databases, and control programs to provide supervisory control for control level devices.

.5 Each network automation engine is to include an integrated, hardware based real time clock.

.6 Each network automation engine is to be equipped with LED indicators to identify following conditions:

.1 Power, On/Off;

.2 Ethernet Traffic, Ethernet Traffic/No Ethernet Traffic;

.3 Ethernet Connection Speed, 10 Mbps/100 Mbps;

.4 FC Bus A, Normal Communications/No Field Communications;

.5 FC Bus B, Normal Communications/No Field Communications;

.6 Peer Communication, Data Traffic Between Network Automation Engines;

.7 Run, NAE Running/NAE in Start-up/NAE Shutting Down/Software Not Running;

.8 Battery Fault, Battery Defective/Data Protection Battery Not Installed;

.9 24 VAC, 24 VAC Present/Loss of 24 VAC;

.10 Fault, General Fault;

.11 Modem RX, NAE Modem Receiving Data;

.12 Modem TX, NAE Modem Transmitting Data.

.7 Each network automation engine is to be equipped with ports for operation of operator input/output devices such as industry standard computers, modems, and portable operator's terminals. Ports are to be as follows:

.1 2 USB ports;

.2 2 RS-232 serial data communication ports;

.3 2 RS-485 ports;

.4 one Ethernet port.

.8 Each network automation engine is to continually perform self-diagnostics, communications diagnostics, and diagnostics of all pane components, and transmit both local and remote annunciation of any detected component failure, low battery condition, and repeated failures to establish communication.

.9 In event of loss of normal power each network automation engine is to continue to operate for a user adjustable period of up to 10 minutes after which there is to be an orderly shut-down of all programs to prevent loss of database or operating system software, and:

.1 during a loss of normal power, control sequences are to go to normal system shutdown conditions, and critical configuration data is to be saved into Flash memory;

.2 upon restoration of normal power and after a minimum off-time delay, controller is to automatically resume full operation through a normal soft-start sequence without manual intervention.

2.8 FIELD EQUIPMENT CONTROLLERS

.1 Each field equipment controller is to be a fully user programmable BACnet Testing Labs (BTL) certified and labelled digital controller that communicates via BACnet MS/TP protocol. Each controller is to be housed in a plenum rated plastic housing with removable base to permit pre-wiring of analog and binary input/output field points without controller in place.

.2 Each controller is to employ a finite state control engine to eliminate unnecessary conflicts between control functions at crossover points in their operational sequences, and is to be factory programmed with a continuous adaptive tuning algorithm that sense changes in physical environment and continually adjusts loop tuning parameters appropriately.

.3 Each field equipment controller is to:

.1 include troubleshooting LED's to identify following conditions:

.1 Power On;

.2 Power Off;

.3 Download or Start-Up In Progress-Not Ready For Normal Operation;

.4 No Faults;

.5 Device Fault;

.6 Field Controller Bus-Normal Data Transmission;

.7 Field Controller Bus-No Data Transmission;

.8 Field Controller Bus-No Communication;

.9 Sensor Actuator Bus-Normal Data Transmission;

.10 Sensor Actuator Bus-No Data Transmission;

.11 Sensor Actuator Bus-No Communication.

.2 support universal inputs, configured to monitor any of following:

.1 analog input, voltage mode;

.2 analog output, current mode;

.3 analog input, resistive mode;

.4 binary input, dry contact maintained mode;

.5 binary input, pulse counter mode.

.3 support binary inputs configured to monitor either of following:

.1 dry contact maintained mode;

.2 pulse counter mode.

.4 support analog outputs configured to output either of following:

.1 analog output, voltage mode;

.2 analog output, current mode.

.5 support binary outputs, 24 VAC Triac;

.6 support configurable outputs capable of following:

.1 analog output, voltage mode;

.2 binary output mode.

.7 have ability to reside on a master-slave/token-passing field controller bus supporting BACnet standard protocol as follows:

.1 support communications, including input/output communications between field controllers and network automation engines;

.2 support a minimum of one hundred input/output modules and field equipment controllers in any combination;

.3 operate at a maximum distance of 4560 m (15,000 ft) between field controller and furthest connected device.

.8 have ability to monitor and control a network of sensors and actuators over a master-slave/token-passing sensor-actuator bus supporting BACnet standard protocol as follows:

.1 bus is to support a minimum of ten devices per trunk;

.2 bus is to operate at a maximum distance of 365 m (1200 ft) between field controller and furthest connected device.

.9 capability of executing complex control sequences involving direct wired input/output points as well as input and output devices communicating over field controller bus or sensor-actuator bus;

.10 support, but not limited to, following:

.1 hot water, chilled water/central plant applications;

.2 custom air handling units for special applications;

.3 terminal units;

.4 special programs as required for systems control.

.11 support a password protected local controller LCD back-lit display with 6 key keypad as an integral part of field controller or as a remote device communicating over sensor-actuator bus to permit user to view monitored points without logging into system, and to view and change set-points, modes of operation, and parameters.

2.9 INPUT/OUTPUT MODULES

.1 Input/output modules to facilitate additional inputs and outputs for use in field equipment controllers are to be similar to field equipment controllers but less display and with a minimum of 4 and a maximum of 17 points.

2.10 SYSTEM CONFIGURATION TOOLS

.1 System configuration tool is a software package supplied with BAS to enable a computer platform to be used as a stand-alone engineering configuration tool for a network automation engine and to permit programming of field equipment controllers. Configuration tool is to provide an archive database for configuration and application data and is to have same look and feel at user interface regardless of whether configuration is being done online or offline. Additional features and characteristics are as follows:

.1 tool is to include:

.1 basic system navigation tree for connected networks;

.2 integration of system enabled devices;

.3 customized user navigation tress;

.4 point naming operator parameter setting;

.5 graphic diagram configuration;

.6 alarm and event message routing;

.7 graphical logic connector tool for custom programming;

.8 downloading, uploading, and archiving databases.

.2 tool is to have capability to automatically discover field devices on connected buses and networks;

.3 tool is to be capable of configuring from a library of standard applications, simulating to verify applications, and commissioning field equipment controllers and field devices;

.4 tool is to be complete with a Bluetooth Wireless Technology wireless access point to enable a wireless enabled portable computer to make a temporary Ethernet connection to automation network.

.2 Bluetooth Wireless Technology converter is to provide temporary wireless connection between sensor-actuator bus or field-controller bus and a wireless enabled portable computer. Converter is to be powered through a connection to either sensor-actuator bus or the field-controller bus and is to support downloading and troubleshooting field equipment controllers and field devices from portable computer over wireless connection. Converter is to be complete with LED indicators for following conditions:

.1 Power: On/Off;

.2 Fault: Fault/No Fault;

.3 SA/FC Bus: Bus Activity/No Bus Activity;

.4 Bluetooth: Bluetooth Communication Established/Bluetooth Communication Not Established.

2.11 WIRING MATERIALS

.1 System wiring, conduit, boxes, and similar materials are to be in accordance with requirements specified in Division 26 – Electrical.

PART 3 - EXECUTION

3.1 GENERAL RE: INSTALLATION OF THE BAS

.1 Provide a complete building automation system in accordance with requirements of this Section of the Specification, Section 25 05 01 – Automatic Control Systems, drawings, and the input/output points list(s).

.2 Unless otherwise specified, perform BAS work in accordance with system manufacturer's instructions.

3.2 INSTALLATION OF DIRECT DIGITAL CONTROL SYSTEM COMPONENTS

.1 Provide required direct digital control hardware, software, accessories, and wiring for a complete BAS. Refer to drawing control diagrams and sequences, points list(s), and Section 25 05 01 – Automatic Control Systems.

.2 Provide operator workstation, including required power and data connections, in a location as directed by the Owner or as indicated on drawings.

.3 DDC work is to be performed by skilled technicians, properly trained and are qualified for this work.

.4 Materials and equipment used are to be standard components, regularly manufactured for this and/or other systems, and not custom designed especially for this project. Systems and components are to have been thoroughly tested and proven in actual use.

.5 System is to be modular, permitting expansion by adding hardware and software without changes in communication or processing equipment.

.6 Provide new communications bus as required complete with required ancillaries. Connect and extend existing communications bus.

.7 Provide 1 supervisory controller (SC) per cabinet fan (air handler). Provide necessary field equipment controllers (FEC).

.8 Provide necessary quantity of SC to accomplish requirements of this specification, and to minimize number of mechanical systems that would be inoperative in event of a FEC failure. A maximum of 2 major mechanical systems are to be controlled by 1 FEC.

.9 Surface wall mount SC and FEC control units in Mechanical Rooms ensuring they are not mounted on vibrating surfaces, and connect to 15 A/1-pole circuit breakers dedicated for control system applications, in branch panel circuit boards in adjacent spaces. Power wiring from control units to circuit breakers is to be the responsibility of the controls contractor. Wiring is to be in conduit and conduit and wiring are to be in accordance with standards and requirements of Division 26 – Electrical. Refer to electrical drawings for locations of branch circuit panelboards with dedicated circuits for controls system applications.

.10 Indicate via number, and systems controlled by SC and FEC. Indicate via a lamacoid label mounted inside panel the identification number of electrical panel supplying power to SC and FEC.

.11 Submit schedule(s) of input/output points to the Consultant for review. Directly connect each SC and FEC to point devices in accordance with control diagrams and schedule of miscellaneous

control points as shown on drawings. Sensor wires for each analogue input are to be 18 AWG twisted-shielded cable. Other types of wire required are to be as recommended by system supplier.

.12 Provide required sensors, remote devices, etc., and required interface accessories. Mount duct and/or plenum sensors half-way across duct or plenum.

.13 Differential pressure sensor used to provide space pressurization control through regulation of return air quantities must be mounted with snubbers on indoor pressure leg to prevent sudden fluctuations caused by door openings, etc. Mount outdoor air ports in locations that minimize effects of abnormal surface flow conditions and wind gusts.

.14 Supply and turn over to the Consultant prior to application for a Certificate of Substantial Performance of the Work, reports to be used in assisting Owner in defining and debugging DDC programs. These reports are to consist, as a minimum, of following:

.1 process control language (PCL) logs;

.2 control loop logs;

.3 PCL master point.

.15 Submit Point Data Input forms to Consultant that Owner will fill out with DDC system supplier's assistance. Input this point data into the system.

.16 Contacts will be supplied as part of mechanical work or electrical work for alarm and status points for systems and equipment other than building environmental systems and equipment. Connect to DDC system in accordance with point schedule.

3.3 IMPLEMENTATION OF ENERGY MANAGEMENT PROGRAMS

.1 Implement energy management programs indicated for building equipment and systems.

.2 Ensure energy management program adjustable parameters are accessible to and adjustable by building operations personnel at operator’s workstation.

.3 Configure energy management programs so they may be enabled/disabled on an individual basis for each system to which they apply.

3.4 CONTROL WIRING

.1 Perform required control wiring work for control systems except:

.1 power wiring connections to equipment and panels, except as noted below;

.2 control wiring associated with mechanical plant equipment and systems whose control is not part of work specified in this Section;

.3 starter interlock wiring.

.2 Except as specified below, install wiring in conduit. Unless otherwise specified, final 600 mm (2 ft) connections to sensors and transmitters, and wherever conduit extends across flexible duct connections is to be liquid-tight flexible conduit.

.3 Control wiring in ceiling spaces and wall cavities may be plenum rated cable installed without conduit but neatly harnessed, secured, and identified.

.4 Wiring work is to be in accordance with BAS manufacturer’s certified wiring schematics and instructions, and wiring standards specified in electrical work Division of this Specification.

3.5 IDENTIFICATION AND LABELLING OF EQUIPMENT AND CIRCUITS

.1 Refer to Section 20 05 00 – Common Work Results for Mechanical.

.2 Identify BAS equipment as follows:

.1 enclosures: engraved laminated nameplates with lettering such as BAS Panel CP2, or BAS Relays, or BAS E/P Transformers, with all wording listed and approved prior to manufacture of nameplates;

.2 panel points: a weather-proof input/output layout sheet for each controller with the name of each point connected to controller, and associated wire labelling information;

.3 wiring: numbered sleeves or plastic rings at both ends of conductor, with numbering corresponding to conductor identification on shop drawings and "as-built" record drawings;

.4 interface components: a weather-proof layout sheet clearly illustrating/identifying purpose of each component within enclosure such that an operator or service technician can quickly identify exact use of each relay, transducer, contactor, etc., with each sheet fastened securely to back of enclosure door.

3.6 SYSTEM STARTUP

.1 For equipment/system manufacturer certification requirements, refer to Section 20 05 00 – Common Work Results for Mechanical.

.2 For equipment/system start-up requirements, refer to Section 20 05 00 – Common Work Results for Mechanical.

3.7 CLOSEOUT ACTIVITIES

.1 Include for demonstration and training sessions for each of 2 groups of Owner’s operating and maintenance personnel as follows:

.1 3 full, 8 hour day orientation sessions at system manufacturer’s office to educate personnel on BAS architecture, hardware, and software, with an overview of BAS operation and capabilities including but not limited to operational programmes, equipment functions (both individually and as part of a total integrated system), BAS commands, advisories, alarms, and appropriate operator intervention required in responding to BAS operation;

.2 2 full, 8 hour day sessions at site using BAS for a "hands-on" demonstration of BAS functions and features with instruction regarding chronological flow of information from field devices, contacts and sensors to operator’s workstation, an overview of communications network describing interplay between initiating devices, field hardware panels, systems communications, and their importance within operating BAS, and alarm indications and appropriate responses;

.3 2 full, 8 hour day seasonal (summer-winter) site sessions to perform additional instruction regarding seasonal changes and how they affect BAS.

.2 Include for 2 follow-up site training and troubleshooting visits, one 6 months after Substantial Completion and other at end of warranty period, both when arranged by Owner and for a full day to provide additional system training as required.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Building Automation System integration requirements related to electrical systems.

1.2 RELATED REQUIREMENTS

.1 Division 26 – Electrical.

PART 2 - PRODUCTS

2.1 POINTS SPECIFIED BUT NOT DESCRIBED IN SEQUENCES

.1 Any remaining points not detailed in this section are to be monitored and available for trending data.

2.2 SECTION 26 24 13 – SWITCHBOARDS

.1 Customer meter at main utility service entrance.

.2 Provide BACnet gateways to suit meter protocol output.

2.3 SECTION 26 27 13 – ELECTRICITY METERING

.1 Customer meters to building automation system.

2.4 SECTION 26 32 13.16 – GAS-ENGINE-DRIVEN GENERATOR SETS

.1 Connect all generator alarm and status contacts.

2.5 SECTION 26 36 23.13 – BYPASS-ISOLATION AUTOMATIC TRANSFER SWITCHES

.1 Connect all transfer switch alarms and status contacts, typical of the following transfer switches:

.2 [Fire pump transfer switch]

.3 [Life safety automatic transfer switch ATS-X]

.4 [Non-life safety automatic transfer switch ATS-E].

PART 3 - EXECUTION

3.1 INSTALLATION

.1 In accordance with Section [25 00 00] [25 05 02].

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Common requirements for electrical work.

.2 Mounting heights for electrical equipment and devices.

1.2 RELATED REQUIREMENTS

.1 Provisions of this section apply to all sections of Division 26, Division 27, Division 28, and sections related to electrical utilities in Division 33.

.2 Section 07 60 00 – Flashing and Sheet Metal.

.3 Section 07 84 00 – Firestopping.

.4 Section 08 31 00 – Access Doors and Panels.

.5 Section 09 91 00 – Painting.

.6 All sections related to heat tracing.

.7 Building Automation System integration requirements for Electrical Systems as described in Section 25 96 00.

.8 This section is to be read in conjunction with Division 00 documents, and Division 01 specification sections, which take precedence as described in CCDC 2-2020.

.1 General Conditions.

.2 Supplementary General Conditions.

.3 General Requirements.

1.3 INTENT

.1 Include all material, labour, equipment, and plant construction as necessary to make a complete installation as shown and specified hereinafter.

.2 Leave complete systems ready for continuous and efficient satisfactory operation.

.3 Discipline and Trade Jurisdiction:

.1 In accordance with CCDC 2-2020 GC 1.1.9: Neither the organization of the Specifications nor the arrangement of Drawings shall control the Contractor in dividing the work among Subcontractors and Suppliers.

.2 MasterFormat's organizational structure used in a project manual does not imply how the work is assigned to various design disciplines, trades, or subcontractors. MasterFormat is not intended to determine which particular elements of the project manual are prepared by a particular discipline. Similarly, it is not intended to determine what particular work required by the project manual is the responsibility of a particular trade. A particular discipline or trade is likely to be responsible for subjects from multiple Divisions, as well as from multiple Subgroups.

1.4 DRAWINGS AND SPECIFICATIONS

.1 The drawings and specifications are complementary each to the other and what is called for by one to be binding as if called for by both. Should any discrepancy appear between the drawings and specifications, which leaves the Contractor in doubt as to the true intent and meaning of plans and specifications, a ruling is to be obtained from the Consultant in writing before submitting Bid. If this

is not done, the maximum, the most expensive alternate or option will be provided in base tender bid.

.2 All drawings and all Divisions of these specifications shall be considered as a whole, and work of this Division shown anywhere therein shall be furnished under this Division.

.3 Drawings are diagrammatic and indicate the general arrangement of equipment and pathways. Most direct routing of conductors and wiring is not assured. Exact requirements are governed by architectural, structural, and mechanical conditions of the job. Consult all other drawings in preparation of the bid. Extra lengths of wiring or addition of pull and junction boxes, etc. necessitated by such conditions are to be included in the bid. Check all information and report and apparent discrepancies before submitting the bid.

.4 Contractor shall determine the exact locations of equipment and rough-ins, and the exact routing of pathways so as to best fit the layout of the job. Plan, coordinate, and establish exact locations and routing of services with affected trades prior to installation such that services clear each other, as well as other obstructions.

.5 Determine final locations of major work within ceiling spaces based on the largest equipment first.

.6 Unless otherwise shown or specified, conceal work in finished areas, and conceal work in partially finished and/or unfinished areas to extent made possible by the area construction. Install services as high as possible to conserve headroom and/or ceiling space. Notify the Consultant where headroom or ceiling space appears to be inadequate prior to installation of the work.

.7 Scaling off the drawings will not be sufficient or accurate for determining these locations. Where job conditions require reasonable changes in indicated arrangement and locations, such changes shall be made at no additional cost to the Owner.

.8 Because of the scale of the drawings, certain basic items, such as junction boxes, pull boxes, conduit fittings, etc. may not be shown, but where such items are required by other sections of the specifications of where there are required for proper installation of the work, such items are to be furnished and installed.

.9 Before ordering any conduit, cable tray, conductors, wireways, raceway bus duct, fittings, etc., verify all pertinent dimensions at the job site and be responsible for their accuracy.

.10 If obvious ambiguities or omissions are noticed when tendering refer same to the Consultant for a ruling and obtain the ruling in writing in the form of an Addendum. Claims for extras for ambiguities or omission of items brought to the attention of the Consultant after the award of a contract which, due to the nature of the ambiguity or omission, should have been brought to the attention of the Consultant during the tendering period, will not be allowed.

.11 The drawings are performance drawings, diagrammatic, and show locations for apparatus and materials. The drawings are intended to convey the scope of work and do not intend to show Architectural and Structural details. The locations shown are approximate, and may be altered, when approved by the Consultant, to meet requirements of the material and/or apparatus, other equipment and systems being installed, and of the building. Do not scale drawings.

.12 Control devices, equipment requiring maintenance, junction boxes, and similar products, particularly such products located above suspended ceilings must be located for easy access for servicing and/or removal. Products which do not meet this location requirement are to be relocated to an accessible location at no additional cost.

.13 Be responsible for making necessary changes, at no additional cost, to accommodate structural and building conditions that were foreseeable by a review of existing conditions or a review of drawings prepared by other disciplines.

.14 Where drawings indicate that acoustic tile ceiling is being suspended below existing plaster ceilings, coordinate the design of framework used to support this suspended ceiling, lighting, diffusers, and other components that are mounted within or through ceiling. Do not mount devices to suspended

ceilings. Secure and mount to ceiling slab above. Seal ceiling openings to maintain required fire rating.

.15 Provide any fitting, offset, transformation, etc., required to suit architectural and structural details but not shown.

1.5 WORK RESTRICTIONS

.1 Refer to Section 01 14 00.

.2 Do all cutting, patching, and making good to leave in a finished condition and to make the several parts of the Work come together properly. Co-ordinate work to keep cutting and patching to a minimum.

.3 Quality of workmanship and materials used in patching, making good and refinishing of existing construction and/or compartments shall be of a standard equal to that specified for new construction and if not specified, equal to or exceeding that of original existing work.

.4 Prior to cutting openings, examine wall, floor, and ceiling construction for buried electrical cables and pipes; and take adequate protection. Conduct cable locating tests to locate buried cables in existing work.

1.6 SUBSTITUTION PROCEDURES

.1 Refer to Section 01 25 00 and General Provisions of the Contract.

.2 Additionally, "Approved equal" shall be defined as a substitution approved by the Consultant.

.3 If during the tender bid process, the bidding contractor wishes to substitute the specified equipment for an "Approved equal", the bidding contractor must submit shop drawings to the Consultant before the tender close for approval. If no substitution request is made, the as-specified equipment is that to be provided.

.4 Where several manufacturers' names are given, the first named manufacturer constitutes the basis for job design and establishes the equipment quality required to be used in this contract.

.5 This contractor, at his option, may use equipment as manufactured by any of the listed manufacturers. This Contractor is responsible to ensure that all items submitted by these other manufacturers meets are requirements of the drawings and specification and fits in the allocated space. The final determination of a product being equivalent is to be determined by the Consultant when a catalog number is not listed, or listed in part.

.6 Any material, article or equipment of other unnamed manufacturers which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Consultant as described in the General Provisions of the Contract for Submittals. The Contractor bears full responsibility for the unnamed manufacturers' equipment adequately meeting the intent of the design. The Owner or the Consultant may reject manufacturer at time of shop drawing submittal.

.7 In addition to manufacturer's products base specified or named as acceptable, other manufacturers of products may be proposed as substitutions to the Consultant for review and consideration for acceptance, listing in each case a corresponding credit for each substitution proposed. However, base Bid Price on products base specified or named as acceptable. Certify in writing to the Consultant that proposed substitution meets space, power, design, energy consumption, and other requirements of base specified or acceptable product. It is understood that there will be no increase in Contract Price by reason of any changes to associated equipment, mechanically, electrically, structurally, or architecturally, required by acceptance of proposed substitution. The Consultant has sole discretion in accepting any such proposed substitution of product. Indicate any proposed

substitutions in areas provided on Bid Form. Do not order such products until they are accepted in writing by the Consultant.

1.7 CONTRACT MODIFICATION PROCEDURES

.1 Refer to Section 01 26 00.

.2 Whenever the Consultant proposes in writing to make a change or revision to design, arrangement, quantity, or type of work from that required by Contract Documents, prepare, and submit to the Consultant for review, a quotation being proposed cost for executing change or revision.

.3 Quotation is to be a detailed and itemized estimate of product, labour, and equipment costs associated with change or revision, plus overhead and profit percentages and applicable taxes and duties.

.4 Unless otherwise specified in Division 00, Division 01, or as identified in the Owner/Contractor agreement, allowable maximum percentages for overhead and profit are to be 7% and 5% respectively.

.5 Unless otherwise specified in Division 00, or Division 01, following additional requirements apply to all quotations submitted:

.1 When change or revision involves deleted work as well as additional work, cost of deleted work (less overhead and profit percentages but including taxes and duties) is to be subtracted from cost of additional work before overhead and profit percentages are applied to additional work.

.2 Electrical material labour unit costs are to be in accordance with National Electrical Contractors Association (NECA) Manual of Labor Units (MLU), less 25%.

.3 Costs for journeyperson and apprentice labour must not exceed prevailing rates at time of execution of Contract and must reflect actual personnel performing work.

.4 Cost for site superintendent must not exceed 10% of total hours of labour estimated for change or revision, and change or revision must be such that site superintendent's involvement is necessary.

.5 Overhead percentage will be deemed to cover quotation costs other than actual site labour and materials, and rentals.

.6 Quotations, including those for deleted work, to include a figure for any required change to Contract time.

.6 The Consultant reserves the right to request backup quotations for any materials and/or rentals included within the quotation.

.7 Quotations submitted that are not in accordance with requirements specified above will be rejected and returned for re-submittal. Failure to submit a proper quotation to enable Consultant to expeditiously process quotation and issue a Change Order will not be grounds for any additional change to Contract time.

.8 Make requests for changes or revisions to work to Consultant in writing and, if Consultant agrees, will issue Notice of Change.

.9 Do not execute any change or revision until written authorization for the change or revision has been obtained from the Consultant.

1.8 COORDINATION

.1 Refer to Section 01 31 00.

.2 Coordinate work with other trades to avoid conflict and to provide correct rough-in and connection for equipment furnished under other trades that require electrical connection. Inform Contractors of

other trades of the required access to and clearances around electrical equipment to maintain serviceability and code compliance.

.3 Verify equipment dimensions and requirements with provision specified under this Section. Check actual job conditions before fabricating work. Report necessary changes in time to prevent needless work. Changes or additions subject to additional compensation, which are made without written authorization and an agreed price, shall be at Contractor's risk and expense.

.4 Read specifications and drawings of other trades and conform with their requirements before proceeding with any work specified in this Division related to other trades. Co-operate with all other trades on the job, so that all equipment can be satisfactorily installed, and so that no delay is caused to any other trades.

.5 Coordinate utility service outages with the owner. Obtain permission from Owner at least 24 hours before partially or completely disabling system. Minimize outage duration.

.6 Co-ordinate work with all trades to ensure a proper and complete installation. Notify all trades concerned of the requirement for openings, sleeves, inserts, and other hardware necessary for the installation and, where work is to be integrated with the work of other trades or is to be installed in close proximity with the work of other trades, carefully co-ordinate the work prior to installation.

.7 Working Detail Drawings

.1 The contractor is to prepare working detail drawings supplementary to the contract drawings, when deemed necessary by the Consultant, for all areas where a multiplicity of materials and or apparatus occur, or where the work due to architectural and structural considerations involves special study and treatment. Such drawings may be prepared jointly by all trades affected, or by the one trade most affected with due regard for and approval of the other trades, all as the Consultant will direct in each instance. Such drawings must be reviewed by the Consultant before the affected work is installed.

.2 Carry out all alterations in the arrangement of work which has been installed without proper study and approval, even if in accordance with the contract documents, in order to make such work come within the finished lines of walls, floors and ceilings, or to allow the installation of other work, without additional cost. In addition, make any alterations necessary in other work required by such alterations, without additional cost.

1.9 SUBMITTAL PROCEDURES

.1 Refer to Section 01 33 00.

.2 Before delivery to site of any item of equipment, submit shop drawings complete with all data, pre-checked and stamped accordingly, for review by the Consultant. Indicate project name on each brochure or sheet, make reference to the number and title of the appropriate specification section, type identifier such panelboard ID or luminaire type as indicated on appropriate schedule, and provide adequate space to accommodate the Consultant's review stamp(s).

.3 Verify field measurements and affected adjacent Work are coordinated, including passageway clearances for movement of equipment into location.

.4 Submit shop drawings to the Consultant in electronic (PDF) format, as coordinated after award of contract. Where submittals are derived from digital originals, do not print and rescan documents; submittals made as such will be immediately rejected.

.5 Submit a schedule of shop drawings within one week after award of contract. Group submittals by specification division as appropriate.

.6 Shop Drawings

.1 Submit for review, properly identified shop drawings showing in detail the design and construction of all equipment and materials as requested in sections of the specification governed by this Section.

.2 Obtain and comply with the manufacturer's installation instructions.

.3 Endorse each shop drawing copy "CERTIFIED TO BE IN ACCORDANCE WITH ALL REQUIREMENTS", stamp each copy with your company name, date each copy with the submittal date, and sign each copy. Shop drawings which are received and are not endorsed, dated, and signed will be returned for re-submittal.

.4 The Consultant will stamp shop drawings as follows:

.1 Reviewed ( )

.2 Reviewed as Modified ( )

.3 Revise and Re-Submit ( )

.4 Not Reviewed ( )

.5 If "REVIEWED" is checked-off, the shop drawing is satisfactory. If "REVIEWED AS MODIFIED" is checked-off, the shop drawing is satisfactory subject to requirements of remarks put on shop drawing copies. If "REVISE AND RE-SUBMIT" is checked-off, the shop drawing is entirely unsatisfactory and must be revised in accordance with comments written on shop drawing copies and resubmitted. If "NOT REVIEWED" is checked-off, the shop drawing is in error of submission, not applicable for this project.

.6 This review by the Consultant is for the sole purpose of ascertaining conformance with the general design concept. This review shall not mean that the Consultant approved the detail design inherent in the shop drawings, responsibility for which shall remain with the Contractor, and such review shall not relieve the Contractor of responsibility for errors or omissions in the shop drawings or of responsibility for meeting all requirements of the contract documents. Be responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation, and for co-ordination of the work as well as compliance with codes and inspection authorities such as CSA, etc.

.7 Confirm layouts of major electrical equipment rooms with the dimensions of as-procured equipment, and submit a layout sketch to the Consultant showing the major equipment and required clear spaces. The contractor may, at their option, revise the layout of the major electrical equipment rooms, but take responsibility for these new layouts and meeting the requirements of the local electrical utilities. Capture final room layouts on as-built drawings.

1.10 SUBMITTALS

.1 The Contractor is to submit dimensioned drawings or sketches that indicates the dimensions of the procured equipment, demonstrates that the equipment will fit in the allocated spaces, and demonstrates that manufacturer and code required clear spaces are provided.

.2 Include sketches for the following locations that includes at minimum, major equipment such as switchboards, panelboards, splitters, transformers, generators, transfer switches, major wall mounted or floor mounted telecommunications equipment, and fire alarm panels, passive graphics, and annunciator panels.

.1 Hanger.

.2 Telecommunications rooms.

.3 Mechanical rooms (layouts to be coordinated with mechanical trade).

1.11 SAFETY REQUIREMENTS

.1 Refer to Section 01 35 29.

.2 Be responsible for the safety of workers and the equipment on the project in accordance with all applicable safety legislation passed by Federal, Provincial, and local authorities governing construction safety. The more stringent regulations prevail.

1.12 REGULATORY REQUIREMENTS

.1 Refer to Section 01 41 00.

.2 Codes and Standards

.1 Ontario Electrical Safety Code including all bulletins and amendments.

.2 Ontario Building Code and its referenced standards.

.3 Applicable CSA and ULC standards.

.4 All work shall be in accordance with Owner’s Design Guidelines.

.3 Permits and Fees

.1 Obtain and pay for all permits and fees required for the execution and inspection of the electrical work and pay all charges incidental to such permits. Submit to Electrical Inspection Department and Supply authority necessary number of drawings and specifications for examination and approval prior to commencement of work. Arrange and pay for any special inspection of equipment specified if and when required.

.2 Apply, pay and obtain all permits as required for the electrical work.

.3 Upon substantial completion of your work, supply and turn over to the Consultant all required inspection certificates from governing authorities to certify that the work as installed conforms to the rules and regulations of the governing authorities.

.4 Patents

.1 Pay all royalties and licence fees, and defend all suits or claims for infringement of any patent rights, and save the Owner, Architect, Project Manager and Consultants harmless of loss or annoyance on account of suit, or claims of any kind for violation or infringement of any letters patent or patent rights, by this Subcontractor or anyone directly or indirectly employed by him or by reason of the use by him or them of any part, machine, manufacture or composition of matter on the work, in violation or infringement or such letters patent or rights.

1.13 REFERENCES

.1 CSA Group:

.1 CSA C22.1:21, Canadian Electrical Code, Part 1 (25th Edition), Safety Standard for Electrical Installations.

.2 CSA C235:19, Preferred voltage levels for AC Systems up to 50 000 V.

.3 Do underground systems in accordance with CSA C22.3 No. 7-15, Underground systems, except where specified otherwise.

.4 Ontario Electrical Safety Code (latest edition), and all bulletins.

.2 Electrical and Electronic Manufacturer's Association of Canada (EEMAC)

.1 EEMAC 2Y-1-1958, Light Gray Colour for Indoor Switch Gear.

.3 Health Canada / Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.4 Electrical utility requirements and local applicable codes and regulations.

.5 Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC)

.1 IEEE SP1122-2000, The Authoritative Dictionary of IEEE Standards Terms, 7th Edition.

.6 2012 Ontario Building Code.

.7 CAN/ULC-S1001-11, Integrated Systems Testing of Fire Protection and Life Safety Systems.

1.14 DEFINITIONS

.1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE SP1122.

1.15 QUALITY ASSURANCE

.1 Refer to Section 01 43 00.

.2 The specifications contained herein are set forth as the minimum acceptable requirements. This does not relieve the Contractor from executing other quality assurance measures to obtain a complete operating system within the scope of this project.

.3 Ensure that all workmanship, all materials employed, all required equipment and the manner and method of installation conforms to accepted construction and engineering practices, and that each piece of equipment is in satisfactory working condition to satisfactorily perform its functional operation.

.4 Provide quality assurance tests and operational check on all components of the electrical distribution system, all lighting fixtures, and communication systems.

.5 Only first class workmanship will be accepted, not only in regards to durability, efficiency and safety, but also in regards to neatness of detail. Present a neat and clean appearance on completion to the satisfaction of the Consultant. Any unsatisfactory workmanship will be replaced at no extra cost.

.6 Conform to the best practices applicable to this type of work. Install all equipment and systems in accordance with the manufacturer's recommendations, but consistent with the General Requirements of this specification. Electrical Contractor will be held responsible for all damage to the work of his own or any other trade, resulting from the execution of his work. Store all electrical equipment and materials in dry locations.

.7 Provide foreman in charge of this work at all times.

.8 The contractor shall be fully liable to provide and maintain in force during the life of this Contract, such insurance, including Public Liability Insurance, Product Liability Insurance, Auto Liability Insurance, Worker’s Compensation, and Employer’s Liability Insurance.

.9 Governing Federal, Provincial and Municipal codes and regulations will be considered minimum standards for the work and where these are at variance with the drawings and specification, the more stringent ruling will apply.

.10 Where any code, regulation, bylaw, or standard is quoted it shall mean the current edition including all revisions or amendments at the time of the tender.

.11 In case of conflict, the codes and regulations take precedence over the Contract Documents. In no instance reduce the standard or scope of work or intent established by the drawings and specifications by applying any of the codes referred to herein.

1.16 QUALITY CONTROL

.1 Refer to Section 01 45 00.

.2 Provide a full time Superintendent to oversee and coordinate all sub-trades in these divisions.

1.17 TEMPORARY UTILITIES

.1 Refer to Section 01 51 00.

.2 Do not use any of the permanent facility systems during construction except as may be specified, or unless written approval is obtained from the Consultant.

.3 The use of permanent facilities for temporary construction service will not affect in any way the commencement day of the warranty period.

.4 Temporary heating during the construction period will be provided as described in Division 01.

1.18 TEMPORARY FACILITIES AND CONTROLS

.1 Refer to Section 01 56 00.

.2 Prior to start of each work period in occupied area, install temporary protection to prevent damage to any personal property or furnishing. Coordinate with Owner's representative if any furniture must be relocated to facilitate work.

.3 Submit temporary protection plan to Owner's Representative for approval prior to use.

.4 Take necessary steps to ensure that required firefighting apparatus is accessible at all times. Flammable materials shall be kept in suitable places outside the building.

1.19 PRODUCT REQUIREMENTS

.1 Refer to Section 01 61 00.

.2 The design, manufacture and testing of electrical equipment and materials shall conform to or exceed the latest applicable CSA, IEEE, and ANSI standards.

.3 All materials must be new and be ULC or CSA listed. Any materials not covered by the aforementioned listing standards shall be tested and approved by an independent testing laboratory, Technical inspection Services, or other government agency.

.4 Materials and equipment are specifically described and named in this Specification in order to establish a standard of material and workmanship.

.5 Materials required for performance of work shall be new and the best of their respective kinds and of uniform pattern throughout work.

.6 Materials shall be of Canadian manufacture where obtainable. Materials of foreign manufacture, unless specified, shall be approved before being used.

.7 Equipment items shall be standard products of approved manufacturers. Identical units of equipment shall be of same manufacturer. In any unit of equipment, identical component parts shall be of same manufacturer, but the various component parts comprising the unit need not be of one manufacturer.

.8 Chemical and physical properties of materials and design performance characteristics and methods of construction and installation of items of equipment, specified herein, shall be in accordance with latest issue of applicable Standards or Authorities when such are either mentioned herein, or have jurisdiction over such materials or items of equipment.

.9 Materials shall bear approval labels as required by Code and/or Inspection Authorities.

.10 Install materials in strict accordance with manufacturer's recommendations.

.11 Include items of material and equipment not specifically noted on Drawings or mentioned in Specification but which are necessary to make a complete and operating installation.

.12 Remove materials, condemned as not approved for use, from job site and deliver and install suitable approved materials in their place.

.13 Unless otherwise noted, equipment and material specifications in Sections of the Specification governed by this Section are based on products of a manufacturer selected by the Consultant for the purpose of setting a standard of quality, size, performance, capacity, appearance, and serviceability.

.14 In most instances the names of acceptable manufacturers are also stated for materials and equipment, and you may base your tender price on equipment and materials produced by either the specified manufacturer or a manufacturer listed as acceptable.

.15 For any items of equipment, material, or for any system where acceptable manufacturers are not stated, you must provide only the equipment, material or system specified.

.16 If materials or equipment manufactured and/or supplied by a manufacturer named in the specifications are used in lieu of products of the manufacturer noted as “basis of design”, be responsible for ensuring that the substituted material or equipment is equivalent in size, performance and operating characteristics to the specified materials or equipment, and it shall be understood that all costs for larger starters, additional space, larger power feeders, and changes to associated or adjacent work required as a result of providing materials and equipment named as acceptable in lieu of the specified product will be borne by the Contractor.

.17 In addition to the manufacturers specified or named as acceptable, the Contractor may propose substitute manufacturers of equipment and/or apparatus to the Consultant for acceptance, listing in each case a corresponding credit for each substitute proposed, however, the tender price must be based on apparatus or materials specified or named as acceptable. Certify in writing to the Consultant that the substitute meets all space, power, design, and all other required of the specified or equivalent material or apparatus. In addition, it shall be understood that all costs for larger starters, space, power feeders, and changes to associated equipment, mechanical and/or electrical, required by acceptance of proposed substitutions, will be borne by the party making the proposal. Substitute equipment requiring greater than specified energy requirements or unduly limiting service space requirements will not be accepted.

.18 Where a manufacturer is not listed for a particular product, it will be deemed to mean that the Contractor will provide the specified manufacturer's product.

1.20 EXAMINATION AND PREPARATION

.1 Refer to Section 01 71 00.

.2 Examine the existing equipment, the site and surrounding areas and be fully informed as to the conditions and limitations under which the work has to be executed. Claims for additional costs will not be entertained with respect to conditions which could reasonably have been ascertained by an inspection prior to Tender closing.

.3 Examine work upon which your work depends. Report in writing defects in such work. Application of your work shall be deemed acceptance of work upon which your work depends.

.4 Drawings are, in part, diagrammatic and are intended to convey scope of work and indicate general and approximate location, arrangement and sizes of equipment, piping, and similar items. Obtain more accurate information about locations, arrangement and sizes from study and coordination of drawings, including shop drawings and manufacturers’ literature and become familiar with conditions and spaces affecting these matters before proceeding with work.

.5 Where job conditions require reasonable changes in indicated locations and arrangements, make such changes with approval of the Consultant at no additional cost to the Owner. Similarly, where existing conditions interfere with new installation and require relocation, such relocation is included in work.

1.21 CUTTING AND PATCHING

.1 Refer to Section 01 73 29.

.2 The Electrical Contractor will be responsible for all cutting and patching required for the electrical installation. Structural members are not to be cut without the consent of the Consultant.

.3 All cutting and patching required under Division 26, Division 27, and Division 28 shall be in accordance with Division 01. Layout such work for approval before undertaking same.

.4 Cutting shall be kept to an absolute minimum and performed in a neat and workmanlike manner using the proper tools and equipment. Caution shall be exercised in all cutting and procedures to ensure that concealed services are not affected. Do not cut if in doubt. Request the Consultant's presence to determine if concealed services exist.

.5 Assume responsibility for prompt installation of Work in advance of concrete pouring or similar Work. Should any cutting or repairing of finished/unfinished Work be required because such installation was not done, employ the particular trade, whose Work is involved, to do such cutting and patching. Pay for any resulting costs. Layout such Work for approval before undertaking same.

1.22 CLEANING AND WASTE MANAGEMENT

.1 Refer to Section 01 74 00.

.2 The Contractor and associated sub trades, at all times during construction, to keep the site free of all debris, boxes, packing, etc., resulting from work of this trade. At the completion of this work, the electrical installation is to be left in a clean and finished condition to the satisfaction of the Consultant.

.3 Clean and repair existing materials and equipment which remain or are to be reused.

.4 Assume responsibility for removing tools and waste materials on completion of Work, and leave Work in clean and perfect condition.

1.23 STARTING AND ADJUSTING

.1 Refer to Section 01 75 00.

.2 Conduct acceptance tests to demonstrate that the equipment and systems actually meet the specified requirements. Tests may be conducted as soon as conditions permit, and consequently make all changes, adjustments, or replacements required as the preliminary tests may indicate prior to the final tests. Tests shall be as specified in various sections of this Division. Carry out tests in the presence of the Consultant. Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project. The Electrical Contractor shall be in charge of the plant during tests. He shall assume responsibility for damages in the event of injury to the personnel, building, equipment, and shall bear all costs for liability, repairs, and restoration in this connection. Submit test results.

.3 Make tests of equipment and wiring at times requested.

.4 Tests shall include meggered insulation values, voltage and current readings to determine balance of panels and feeders under full load, and operation of each piece of equipment for correct operation.

.5 Supply meters, materials and personnel as required to carry out these tests.

.6 Test electrical work to standards and function of Specification and applicable codes in an approved manner. Replace defective equipment and wiring with new material and leave entire system in complete first class operating condition.

.7 Connect single phase loads so that there is the least possible unbalance of the supply phases.

.8 Submit all test results in report format.

.9 Trial Usage

.1 The Consultant reserves the right to use any system, piece of equipment, device, or material for such reasonable lengths of time and at such times as may be required to make a complete and thorough test of the same, or for the purpose of learning operational procedures, before the final completion and acceptance of the work. Such tests shall not be construed as evidence of acceptance of the work, and it is agreed and understood that no claim for damage will be made for injury or breakage to any part or parts of the above due to the aforementioned tests, where such injuries or breakage are caused by a weakness or inaccuracy of parts, or by defective materials or workmanship of any kind. Supply all labour and equipment required for such tests.

.2 Perform and pay for all costs associated with any testing required on the system components where, in the opinion of the Consultant the equipment manufacturer's ratings or specified performance is not being achieved.

1.24 CLOSEOUT PROCEDURES

.1 Refer to Section 01 77 00.

.2 The Consultant will carry out inspections and prepare deficiency list for action by the Contractor, during and on completion of project.

.3 Building Permit Compliance

.1 Provide a minimum of 10 business days notice to the Consultant for scheduling of Consultant’s occupancy inspection.

.2 Prior to requesting the Consultant’s letter “Review of General Conformance” for submission to the municipal building department to allow occupancy, the following items must be complete and submitted to the Consultant, as applicable:

.1 General

.1 Submit all applicable inspection reports from Authorities Having Jurisdiction.

.2 Continuity of fire separations at service penetrations must be complete.

.2 Electrical

.1 Provide Certificate of Acceptance from Electrical Inspection Department.

.2 Any devices not installed must have the wiring made safe and terminated in an outlet box complete with cover.

.3 All outlets must have cover plates installed. All electrical equipment not located in service rooms must have covers and/or doors installed complete.

.4 Emergency lighting system must be operational and tested by the Contractor. Where battery units and remote heads are indicated on the drawing, provide certification letter from equipment manufacturer indicating the system meets code requirements.

.5 Simulate normal power failure within the premises in the presence of the consultant and the owner's representative. Test and verify exit lights and emergency lighting operations under emergency conditions. Submit letter of certification copy to the Consultant stating that the systems have been tested, witnessed by the Consultant or the Owner's representative, etc., and the methods of installation and performance are satisfactory to all parties.

.6 All exit lights must be installed and operational.

.3 Electronic Safety and Security

.1 Fire alarm system and devices must be operational. Submit fire alarm verification report per CAN/ULC-S537, and submit audibility test. Indicate tap settings of all signalling devices.

.2 Functional testing of the fire alarm system and interconnected systems per CAN/ULC-S1001 must be completed.

.3 If any of the above items have not been completed at the time of Consultant's Inspection, and the letter of "assurance of professional field review and compliance" cannot be issued, any costs for subsequent Inspections will be charged to the Contractor.

1.25 CLOSEOUT SUBMITTALS

.1 Refer to Section 01 78 00.

.2 Project Record Documents

.1 Provide extra sets of white prints on which to make, as the job progresses, all approved changes and deviations from the original drawings. Complete as-built drawings accurately marked up in red ink must be submitted for review by the Consultant before the contract is considered to be completed.

.2 Changes and deviations include those made by addenda, change orders, and supplemental instructions, and changes and deviations to be marked on the white print record drawings indicated on supplemental drawings issued with addenda, change orders, and supplemental instructions. Maintain the "as-built" white prints at the site for periodic inspection by the Consultant throughout the duration of the work.

.3 Upon substantial completion of the work, obtain a set of reproducible white prints of the drawings and neatly amend the print in accordance with the marked-up white prints to produce a true "as-built" set of drawings.

.4 As-built drawings are to indicate all circuiting as installed and all distribution junction box locations as well as conduit routes.

.5 As-Built Revit drawings

.1 Request BIM release form from the Consultant, and submit completed form back to the Consultant.

.2 Transfer the information from the "as-built" white prints to the files, and submit to the Consultant for review.

.3 Employ a competent computer draftsperson to indicate changes on the electronic set of as-built drawings. Provide drawings in PDF and AutoCAD formats.

.4 Submit three (3) USB flash drives including as-built drawings in AutoCAD format, one with each O&M manual.

.5 Provide three (3) sets of full size as-built drawings in hard copy format, one with each O&M manual.

.6 As-built Single Line Diagram

.1 Provide in Main Electrical Room one wall mounted copy of as-built Single Line Diagram on 6 mm (1/4 in) foam board.

.2 As-built Single Line Diagram to indicate manufacturer name and catalogue numbers of as-installed products.

.3 Operations and Maintenance (O&M) Data

.1 Submit two complete sets of Operation and Maintenance instruction manuals in hard copy, and one in electronic format. Include in each copy of the manual:

.1 Verification certificates for installation of life safety systems by the manufacturer's representative.

.2 A copy of "reviewed" shop drawings.

.3 Complete explanation of operating principles and sequences.

.4 Recommended maintenance practices and precautions.

.5 Complete wiring and connection diagrams.

.6 Certificates of guarantees.

.2 Ensure that operating and maintenance instructions are specific and apply to the model and types of equipment provided.

.3 Include attendance records for each training session in the O&M manual.

.4 Warranties

.1 Submit a written guarantee to the Owner for one year from the date of acceptance. This guarantee shall bind the contractor to correct, replace or repair promptly any defective equipment workmanship without cost to the Owner.

.2 All equipment, materials and workmanship shall be unconditionally guaranteed for a minimum period of one year from the date of acceptance.

.3 Provide warranty certificates, wherever given or required, in excess of the normal warranty period showing the name of the firm giving the warranty, dated and acknowledged, on specific equipment and systems.

.4 Warranties for temperature controls and building automation systems will start on the date of verification of acceptance by the Consultant.

.5 Include these certificates with the maintenance and operating manuals in the appropriate sections.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 CONCRETE WORK

.1 Refer to Division 03 – Concrete and Section 26 05 29.

.2 Provide all concrete work required for the electrical work. Reinstall surfacing as per architectural requirements.

.3 Provide a 100 mm (4 in) high concrete housekeeping pad for floor mounted electrical distribution equipment, such as the following:

.1 Transformers.

.2 Switchgear and switchboards.

.3 Distribution panelboards.

.4 Engine Generators.

.5 Uninterruptible Power Supplies and batteries.

.6 Transfer Switches.

3.2 LINTELS

.1 Refer to Division 04 – Masonry.

.2 Lintels for openings in masonry shall conform with requirements of by-laws, and as approved by the Structural Engineer.

.3 Pay all costs for lintels over openings, required solely by the electrical trades, not shown on architectural or structural drawings.

3.3 METALS

.1 Refer to Division 05 – Metals.

.2 Steel construction required solely for the work of this trade, and not shown on architectural or structural drawings shall be provided by this Division to the requirements of Division 05.

3.4 FLASHING AND SHEET METAL

.1 Refer to Section 07 60 00.

.2 Flash all conduits and systems passing through roof or built into an outside wall, or a waterproof floor.

.3 Provide copper flashing for sleeves passing through exterior walls or waterproof floors.

3.5 FIRESTOPPING

.1 Provide firestopping in accordance with Section 07 84 00 and Section 26 05 44.13.

.2 Ensure that fire ratings of floors and walls are maintained.

.3 Provide ULC classified firestopping products by 3M, Hilti, STI, or approved equal which have been tested in accordance with CAN/ULC-S115.

.4 Pack clearance spaces, fill all spaces between openings, pipes and ducts passing through fire separations and install firestopping systems in accordance with the appropriate ULC system number for the products and type of penetration.

.5 Install firestopping systems using personnel trained or instructed by the product manufacturer.

3.6 ACCESS DOORS

.1 Provide access doors in accordance with Section 08 31 00.

.2 Before commencing installation of work, coordinate with other trades and prepare on a set of reflected ceiling plans and wall elevations, complete layouts of access doors. Submit these layouts for Consultant's review and show exact sizes and locations of such access doors. Locate and arrange the work to suit.

.3 Group conduit work to ensure the minimum number of access doors is required.

.4 Access doors are to be installed by the trade responsible for the particular type of construction in which the doors are required.

3.7 PAINTING AND FINISHES

.1 Refer to Section 09 91 00.

.2 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.

.3 Repair and finish factory finished equipment, damaged, or scratched during installation, in an approved manner.

.4 All structural steel including hangers, brackets, supports and other ferrous metals shall be shop or factory prime painted wherever practicable. Wherever structural steel including hangers, brackets, supports, and other ferrous metals cannot be shop or factory prime painted, wire brush to remove all traces of rust, clean of all traces of dirt, oil, and grease, and apply one coat of an approved rust inhibiting primer in accordance with CGSB-GB-40d, and leave ready to receive finish paint.

.5 Primary and final painting for Work, other than items specified as factory primed or finished, will be performed as described in Division 09 – Finishes.

.6 All electrical fittings, supports, hanger rods, pull boxes, channel frames, conduit racks, outlet boxes, brackets, clamps etc., to have galvanized finish or paint finish over corrosion-resistant primer.

.7 All panelboards, motor starters etc., to be factory finished with baked on enamel. All enamel to be baked on gloss over corrosion resistant primer.

.8 Touch up minor damage to finish on factory finished equipment. Items suffering major damage to finish shall be replaced at the direction of the Consultant.

.9 Protect work so that finishes will not be damaged or marred during construction. Maintain the necessary protection until completion of the work.

.10 Provide all exposed ferrous metal work on equipment with at least one factory prime coat, or paint one prime coat on job. Clean up or wire brush all equipment, etc., before painting.

.11 For factory applied finishes, repaint or refinish surfaces damaged during shipment, erection or construction work.

3.8 LOCATION OF OUTLETS

.1 Refer to Architectural drawings for dimensions denoting exact locations.

.2 The Consultant reserves the right to change the location of outlets to within 3 m from the point indicated on the plans without extra charge providing the Contractor is advised before installation is made.

.3 Location of lighting, convenience, telephone, power, and communication outlets shall be subject to change, without extra cost to Owners, provided information is given prior to installation. No extra amount will be paid for extra labour and materials for relocating outlets up to 3000 mm from their original location nor will credits be anticipated where relocation up to 3000 mm reduces materials and labour. Other cases will be considered on their individual merits.

.4 Coordinate location of boxes with latest architectural drawings and instructions to suit door swings, millwork etc. prior to rough-in.

3.9 MOUNTING HEIGHTS AND DEVICE LOCATIONS

.1 Refer to architectural drawings for exact location of electrical equipment and devices.

.2 Architectural elevations take precedence over electrical elevations. If there are conflicts between architectural and electrical, adjust locations of electrical equipment at no additional cost to the owner.

.3 Prior to roughing-in, the contractor is to mark locations of electrical equipment and devices for conflicts with architectural, studs, etc. If conflicts are noted, inform the Consultant for a decision prior to commencing the rough-in.

.4 Mounting heights of equipment and devices listed below is from finished floor to centreline of equipment, unless specified or indicated otherwise.

.5 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

.6 Install electrical equipment at following heights above finished floor (AFF). Dimensions are to centre of device unless indicated otherwise.

.1 Power door operator push buttons: 1000 mm.

.2 HVAC thermostats and manual HVAC controls: 1200 mm.

.3 Local switches, and manual lighting control devices:

.1 1100 mm.

.2 Locate on lock side of door.

.4 System furniture service fittings: to suit furniture layout.

.5 Wall receptacles:

.1 General: min. 400 mm AFF.

.1 Above top of counters: 175 mm.

.2 Above top of continuous baseboard heater, or mechanical heating/radiation units: 75 mm to bottom of device.

.3 In fan rooms, mechanical rooms, and electrical rooms: 1100 mm.

.4 For electric ranges: 130 mm.

.6 Outlets in raceways or millwork to be located as per Architectural details.

.7 Door bell pushbuttons: 1100 mm.

.8 Panelboards: as indicated in Section 26 24 16.

.9 Emergency lighting remote heads: 300 mm below finished ceiling, or 2400 mm AFF for exposed areas or areas with ceiling height above 2750 mm (9 ft).

.10 Communications:

.1 Typical communication outlets (voice and data): 400 mm.

.2 Communications outlets for wall mounted telephones, intercom, or similar: 1100 mm.

.3 Television outlets: 200 mm below finished ceiling.

.4 Wall mounted public address speakers: 2100 mm.

.5 Clocks: 2100 mm.

.11 Access control card readers and keypads: 900 mm.

.12 Fire alarm manual pull stations: 1200 mm.

.13 Wall mounted fire alarm audible devices, including bells or horns:

.1 2300 mm to the top of the device in areas of ceiling height 2450 mm or greater.

.2 150 mm below the finished ceiling for ceiling heights less than 2450 mm, measured to the top of the device.

.14 Wall mounted fire alarm visible signal devices, including strobes: 2300 mm.

3.10 MANUFACTURER'S INSTRUCTIONS

.1 Where the specifications call for an installation to be made in accordance with Manufacturer's recommendations, a copy of such recommendations shall be at all times be kept on the job site and be available to the Owner's Representative.

.2 Follow manufacturer's instructions where they cover points now specifically indicated on the drawings and specifications. If they are in conflict with the drawings and specifications obtain clarification from the Consultant before starting work.

3.11 TESTS AND ACCEPTANCE

.1 The operation of the equipment and electrical system does not constitute an acceptance of the work by the Owner. The final acceptance is to be made after the Contractor has adjusted his equipment and demonstrated that it fulfills the requirements of the drawings and the specifications.

.2 Testing of all systems shall be performed in the presence of the Owner's designated representative. The contractor shall give 72 hours advance notice to the Owner before beginning the tests.

.3 Upon completion of the installation, the Contractor shall furnish certificates of approval from all authorities having jurisdiction, as applicable. Contractor shall demonstrate that work is complete and in perfect operating condition, with raceway and conduit systems properly grounded, wiring free from grounds, shorts, and that the entire installation is free from any physical defects.

.4 Provide labour and material to conduct the integrated systems testing of interconnected life safety systems in accordance with CAN/ULC-S1001-11.

3.12 CLOSEOUT ACTIVITIES

.1 Refer to Section 01 79 00.

.2 In the presence of the Owner, demonstrate the proper operation of all systems.

.3 Instruct the Owner's designated representatives in all aspects of the operation and maintenance of systems and equipment listed in the trade sections governed by this Section. Obtain in writing from the Consultant a list of the Owner's representatives qualified to receive instructions.

.4 Arrange for and pay for the services of qualified service technicians and other manufacturer's representatives required for instruction of specialized portions of the installation.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Building wire and cable.

.1 Armoured cable.

.2 Metal clad cable.

.3 Fire resistive cables.

.4 Wiring connectors and connections.

.2 Permitted voltage drop for feeder and branch circuits.

.3 Conductor sizes are based on copper unless indicated as aluminum or "AL".

1.2 REFERENCES

.1 CSA Group:

.1 CSA C22.1:21, Canadian Electrical Code, Part 1 (25th Edition), Safety Standard for Electrical Installations.

.2 Ontario Electrical Safety Code (28th edition/2021).

.3 CSA C22.2 No. 0.3-09 (R2019), Test methods for electrical wires and cables.

.4 CSA C22.2 No. 48-15, Nonmetallic sheathed cable.

.5 CSA C22.2 No. 51-14, Armoured cables.

.6 CSA C22.2 No. 52-15, Underground secondary and service-entrance cables.

.7 CSA C22.2 No. 65-13, Wire connectors.

.8 CSA C22.2 No. 75-17, Thermoplastic insulated wires and cables.

.9 CSA C22.2 No. 123-16, Aluminum sheathed cables.

.10 CSA C22.2 No. 131-14, Type TECK 90 cable.

.2 NECA (National Electrical Contractors Association) - Standard of Installation.

.3 NETA (International Electrical Testing Association) - ATS-2021 - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

.4 CAN/ULC-S139:2017 – Standard Method of Fire Test for Evaluation of Integrity of Electrical Power, Data and Optical Fibre Cables.

1.3 ALTERNATES

.1 Submit bid based on copper conductors only, unless aluminum conductors are explicitly indicated on the drawings. Submit with bid an alternative price indicating the credit to substitute 208 V and 600 V copper feeders rated above 100 A with equivalent feeders of aluminum. Contractor bears responsibility for increased wire size, and corresponding changes in the size of conduits, supports, penetrations, etc. associated with the related change in conductor material. Provide appropriate lugs that are rated for aluminum conductors and provide appropriate oxidation inhibitor (i.e. Noalox or equal).

1.4 COORDINATION

.1 Where wire and cable destination is indicated, and routing is not shown, determine exact routing and lengths required.

1.5 CLOSEOUT SUBMITTALS

.1 Record Documents: Indicate as-constructed feeder sizes on single line diagram.

.2 Megger test results.

.3 Fire resistive cables: manufacturer's certification that the cables have been installed in accordance with the manufacturer's instructions.

1.6 QUALIFICATIONS

.1 Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' experience.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 American Wire Group.

.2 BICC Phillips.

.3 General Cable.

.4 Nexans.

.5 Prysmian.

.6 Southwire.

2.2 REGULATORY REQUIREMENTS

.1 Provide products listed and classified by CSA Group as suitable for the purpose specified and indicated.

2.3 CONDUCTOR MATERIAL

.1 Submit bid based on copper conductors only

2.4 BUILDING WIRE

.1 RW90:

.1 Single copper conductor.

.2 Minimum 12 AWG for branch circuit wiring.

.3 Minimum 14 AWG for 120 V control wiring.

.4 Chemically cross-linked polyethylene insulation.

.5 Rated for 90°C, 600 V.

.6 Suitable for handling to -40°C.

.7 For interior installations in conduit.

.2 RWU90:

.1 Single copper conductor.

.2 Minimum 12 AWG for branch circuit wiring.

.3 Minimum 14 AWG for 120 V control wiring.

.4 Chemically cross-linked polyethylene insulation.

.5 Rated for 90°C, 1000 V.

.6 Suitable for handling to -40°C.

.7 For exterior installations, direct buried, or in conduit.

.3 T90 Nylon:

.1 Single copper conductor.

.2 Thin wall PVC insulation with nylon covering.

.3 Rated for 90°C, 600 V.

.4 May be used up to size 10 AWG for interior installations.

.5 Base conduit fill on RW90 cable diameters.

2.5 ARMOURED CABLE

.1 General

.1 Connectors: standard as required, complete with anti-short rings.

.2 Runs to be limited to fixture drops, and runs to devices in walls and partitions, maximum horizontal runs in exposed areas and ceiling spaces to be 1.8 m (6 ft).

.2 Type AC:

.1 Two, three or four copper conductors rated RW90, 1000 V.

.2 Bare copper ground wire.

.3 Insulation Voltage Rating: 600 V.

.4 Insulation Temperature Rating: 90°C (194°F).

.5 Insulation Material: Thermoplastic.

.6 Overall interlocked aluminum tape armour.

.3 Type SPC90:

.1 Use for LED lighting, fluorescent dimming controls, and other SMART building applications.

.2 Colour coded cable with power, control, and signal under one cable.

.3 12-2C Power with a 16-2C Control.

.4 Bare copper ground wire.

.5 Insulation Voltage Rating: 600 V.

.6 Insulation Temperature Rating: 90°C (194°F).

.7 Insulation Material: Thermoplastic.

2.6 FIRE RESISTIVE CABLES

.1 General:

.1 2 hour fire rating to CAN/ULC-S139 and to meet 2012 Ontario Building Code rule 3.2.7.10.

.2 Alternative means of compliance:

.1 Conduits encased in a minimum of 50 mm (2 in) of concrete.

.2 Be protected by a fire rated assembly listed to achieve the minimum fire rating as indicated.

.2 Manufacturers:

.1 nVent Pyrotenax 1850 series Mineral Insulated (MI) cable.

.2 VITALink MC Brand Type MC-RC90, manufactured by Marmon Wire & Cable Inc. (listed by ULC under ULC category code ‘FHIT7’ or ‘FHJR7’, dated 19 May 2015). This cable is not to be installed in conduit.

.1 Request quotation from manufacturer or manufacturer’s representative for field certification of installed Vitalink cables prior to requesting Consultant’s construction field review.

.2 Power cable must be installed according to UL protocol FHIT7.120 – Electrical circuit integrity systems certified in Canada.

.3 Prysmian Lifeline RC90 cable.

.1 Installation in accordance with UL protocol FHIT7-51, and FHIT7-51A.

.2 System makes use of Remke connectors and Resolve boxes, with no substitutions.

.3 Substitution Limitations:

.1 Substitutions may only be considered by the Consultant if the product is listed by ULC under ULC Category Codes ‘FHIT7’ or ‘FHJR7’.

2.7 TECK90 CABLE

.1 Single, three, or four conductors as indicated on drawings.

.2 Cable to CSA C22.2 No. 131.

.3 Conductors:

.1 Grounding conductor: copper.

.2 Circuit conductors: copper, size as indicated.

.4 Insulation: Cross-linked polyethylene (XLPE), type RW90, rating: 600 V.

.5 Inner jacket: polyvinyl chloride.

.6 Armour: interlocking aluminum.

.7 Overall covering: thermoplastic.

.8 Fastenings:

.1 One-hole steel straps to secure surface cables 50 mm diameter and smaller. Two-hole steel straps for cables larger than 50 mm diameter.

.2 Channel type supports for two or more cables at 1500 mm centres.

.3 Threaded rods: 6 mm diameter to support suspended channels.

.9 Connectors: Watertight, approved for TECK cable.

2.8 CONDUCTOR PULLING LUBRICANT

.1 Where pulling lubricant is required, use non-wax based cable lubricants compatible with cable manufacturer recommendations, such as American Polywater.

2.9 CONNECTORS

.1 Armoured cable connectors must be proper squeeze type connectors and plastic anti-short bushings at terminations.

.2 Connectors for conductors connecting to devices as per local governing electrical requirements to be equal to IDI Electric (Canada) Ltd., "Ideal" No. 451, No. 452, and No. 453, "Wing-Nut", CSA certified, 600 V, rated pressure type connectors.

.3 For conductors sized 3/0 AWG and greater, provide long barrel double crimp, two (2) hole compression type lug connectors, unless otherwise noted.

2.10 WIRING TERMINATION

.1 Lugs, terminals, or screws used for termination of wiring to be suitable for copper conductors. Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring. Maintain phase sequence and colour coding throughout.

.2 Splice wire, up to and including 6 AWG, with nylon insulated expandable spring type connectors.

.1 Thomas & Betts – Marr Max series.

.3 Splice large conductors using compression type connections insulated with heat shrink sleeves.

.1 Thomas & Betts – 5400 Series lugs & heat shrink type #s series.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verify that field measurements are as indicated.

.2 Wire and cable routing indicated is approximate unless dimensioned.

.3 Where wire and cable destination is indicated and routing is not shown, determine exact routing and lengths required.

.4 Voltage Drop

.1 Ensure voltage drop in power and control conductors is in accordance with the requirements of the OESC.

.2 Size conductors accordingly when sizes are not identified.

.1 Feeder conductors: maximum voltage drop of 2%.

.2 Branch circuit conductors: maximum voltage drop of 3%.

.5 Verify that mechanical work likely to damage wire and cable has been completed.

.6 Verify that raceway installation is complete and supported.

3.2 PREPARATION

.1 Completely and thoroughly swab raceway before installing wire.

3.3 INSTALLATION

.1 Route wire and cable as required to meet project conditions.

.2 Install cable to CSA C22.1 and per manufacturer's installation guidelines.

.3 Conduit and cable supports:

.1 All wiring to be installed in EMT at all exposed areas unless otherwise specified.

.2 All mechanical equipment to be connected with liquid tight flexible conduit.

.3 Support cables above accessible ceiling, using spring metal clips to support cables from structure. Do not rest cable on ceiling panels.

.4 Conductors

.1 Provide separate neutral for each circuit. Common neutrals not permitted.

.2 Use solid conductor for feeders and branch circuits 10 AWG and smaller.

.3 Use stranded conductors for control circuits.

.4 Use conductor not smaller than 12 AWG for power and lighting circuits.

.5 Use conductor not smaller than 16 AWG for control circuits.

.6 Use 10 AWG conductors for 20 A, 120 V branch circuits longer than 25 m.

.5 Pulling conductors

.1 Pull all conductors into raceway at same time.

.2 Use suitable wire pulling lubricant for building wire 4 AWG and larger.

.3 Neatly train and lace wiring inside boxes, equipment, and panelboards.

.4 Protect exposed cable from damage.

.6 Connectors

.1 Use suitable cable fittings and connectors.

.2 Clean conductor surfaces before installing lugs and connectors.

.3 Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.

.4 Use split bolt connectors for copper conductor splices and taps 6 AWG and larger. Tape uninsulated conductors and connector with electrical tape to 150 per cent of insulation rating of conductor.

.5 Use solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.

.6 Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.

.7 Identification

.1 Identify and colour code wire and cable to Section 26 05 53. Identify each conductor with its circuit number or other designation indicated.

.2 Where colour-coded tape is utilized, apply a minimum of 50 mm (2 in) at terminations, junction and pull boxes and conduit fittings. Do not paint conductors under any condition.

.3 Utilize colour coding on bussing in panels and, switchgear, disconnects, and metering cabinets to match conductor colour coding.

3.4 CONDUCTORS, WIRES, AND CABLES

.1 Provide fire rated conductors or provide a fire rated assembly around conductors used for life safety applications as described in 2012 OBC 3.2.7.10.

.2 Indoor wiring installed in conduit, unless otherwise noted: 600 V "RW90 XLPE".

.3 Wiring in channel back of fluorescent and LED lighting fixtures: 600 V type GTF or TEW.

.4 Lighting and power branch circuit wiring:

.1 Copper, minimum 12 AWG.

.2 Home runs to lighting and receptacle panels, which exceed 22 m (75 ft) in length: minimum 10 AWG.

.5 Size wires for 2 per cent maximum voltage drop to farthest outlet on a maximum 80% loaded circuit.

.6 Outdoor wiring: “RWU90 XLPE”.

.7 Conductors shall be colour coded. Conductors 10 AWG and smaller shall have colour impregnated into insulation at time of manufacture. Conductors size 8 AWG and larger may be colour coded with adhesive colour coding tape, but only black insulated conductors shall be employed in this case, except for neutrals which shall be white wherever possible.

.8 Colour coding as follows:

.1 Phase "A" – Red.

.2 Phase "B" – Black.

.3 Phase "C" – Blue.

.4 Control – Orange.

.5 Ground – Green.

.6 Neutral – White.

.9 Neatly train circuit wiring in cabinets, panels, pull boxes and junction boxes and hold with nylon cable ties.

3.5 SITE TESTS AND INSPECTIONS

.1 Perform continuity tests of all feeders, motor circuits, and branch circuits.

.2 Perform insulation-resistance test (megger test) on each feeder. Submit report to the Consultant.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Low-voltage control cabling.

.2 Control-circuit conductors.

1.2 REFERENCES

.1 CSA Group:

.1 CSA C22.1:21, Canadian Electrical Code, Part 1 (25th Edition), Safety Standard for Electrical Installations.

.2 Ontario Electrical Safety Code (28th edition/2021).

.3 CSA C22.2 No. 0.3-09 (R2019), Test methods for electrical wires and cables.

.4 CSA C22.2 No. 48-15, Nonmetallic sheathed cable.

.5 CSA C22.2 No. 51-14, Armoured cables.

.6 CSA C22.2 No. 65-13, Wire connectors.

.7 CSA C22.2 No. 75-17, Thermoplastic insulated wires and cables.

.8 CSA C22.2 No. 208-14, Fire alarm and signal cable.

.2 NECA (National Electrical Contractors Association) - Standard of Installation.

1.3 QUALIFICATIONS

.1 Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' experience.

1.4 COORDINATION

.1 Where wire and cable destination is indicated and routing is not shown, determine exact routing and lengths required.

PART 2 - PRODUCTS

2.1 REGULATORY REQUIREMENTS

.1 Conform to CSA C22.1.

.2 Provide products listed and classified by CSA Group as suitable for the purpose specified and indicated.

2.2 LOW VOLTAGE WIRING

.1 LVT:

.1 Multi conductor PVC insulated.

.2 Bare copper ground conductor.

.3 Overall PVC jacket.

.4 Rated 30 V.

.5 CMP (FT6) rated if cable is exposed.

.6 CMR (FT4) rated if cable is installed in conduit.

.2 Category 5e Network Cabling.

.1 CMP (FT6) rated if cable is exposed.

.2 CMR (FT4) rated if cable is installed in conduit.

2.3 TERMINATIONS AND SPLICES

.1 All terminations and splices shall be of an approved type for the conductors being used.

.2 Where conductors are terminated or spliced, it shall be done in the following manner:

.1 Where a single solid conductor is terminated in a device under one screw or clamping mechanism, no additional terminating hardware is required.

.2 Where multiple or stranded conductors are terminated in a device under one screw or clamping mechanism, self insulated crimp-on cable ends or approved equal shall be used up to and including 10 AWG sized conductors. Approved compression lugs shall be used for larger conductor sizes.

.3 Where multiple conductors are spliced, properly sized Wing Nut connectors, or approved equal, shall be used for up to two 8 AWG or three 10 AWG conductors. Pressure type sleeve cable connectors, splices, tee's, etc., shall be used for all larger size connections and terminations.

.4 Insulate all bare surfaces of splices with heat shrink sleeving or equivalent.

.5 Conductors connected to ground rods for service or equipment grounding or to building structural or architectural elements shall be terminated, connected, and spliced using a thermoweld process or approved non-mechanical compression type connectors.

.3 Install all service and feeder conductors as continuous lengths without breaks, measured and cut based on site dimensions.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verify that mechanical work likely to damage wire and cable has been completed.

.2 Verify that raceway installation is complete and supported.

.3 Verify that field measurements are as indicated.

.4 Wire and cable routing indicated is approximate unless dimensioned.

3.2 PREPARATION

.1 Completely and thoroughly swab raceway before installing wire.

3.3 INSTALLATION

.1 Route control cabling as required to meet project conditions.

.2 Install cable to the CSA C22.1.

.3 Conduit and supports

.1 All wiring to be installed in EMT at all exposed areas and in partitions unless otherwise specified.

.2 All mechanical equipment to be connected with liquid tight flexible conduit.

.3 Support cables above accessible ceiling, using spring metal clips to support cables from structure. Do not rest cable on ceiling panels.

.4 Conductors

.1 Use stranded conductors for control circuits.

.2 Use conductor not smaller than 16 AWG for control circuits.

.5 Pulling conductors

.1 Pull all conductors into raceway at same time.

.2 Neatly train and lace wiring inside boxes, equipment, and panelboards.

.3 Neatly train circuit wiring in cabinets, panels, pull boxes and junction boxes and hold with nylon cable ties.

.4 Protect exposed cable from damage.

.6 Connectors

.1 Use suitable cable fittings and connectors.

.2 Clean conductor surfaces before installing lugs and connectors.

.3 Use solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.

.4 Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.

.7 Identification

.1 Identify and colour code wire and cable to Section 26 05 53. Identify each conductor with its circuit number or other designation indicated.

.2 Where colour coded tape is utilized, apply a minimum of 50 mm (2 in) at terminations, junction and pull boxes and conduit fittings. Do not paint conductors under any condition.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Grounding electrodes and conductors.

.2 Equipment grounding conductors.

.3 Bonding.

.4 The terms “connect” and “bond” are used interchangeably in this Specification and have the same meaning.

1.2 RELATED REQUIREMENTS

.1 Section 27 05 26 – Grounding and Bonding for Communications Systems.

1.3 REFERENCES

.1 CSA Group:

.1 CSA C22.1:21, Canadian Electrical Code, Part 1 (25th Edition), Safety Standard for Electrical Installations.

.2 Ontario Electrical Safety Code (28th edition/2021).

.3 CSA C22.2 No. 0.4-17, Bonding of electrical equipment.

.4 CSA C22.2 No. 41-13, Grounding and bonding equipment.

.5 CSA C22.2 No. 75-17, Thermoplastic insulated wires and cables.

.2 ANSI/TIA/EIA J-STD-607-A - Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.

.3 Institute of Electrical and Electronics Engineers, Inc.

.1 IEEE 81-1983 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System.

1.4 ACTION SUBMITTALS

.1 Product Data: Provide for grounding electrodes and connections.

1.5 INFORMATIONAL SUBMITTALS

.1 Test Reports: Indicate overall resistance to ground and resistance of each electrode.

.2 Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.6 CLOSEOUT SUBMITTALS

.1 Project Record Documents: Record actual locations of components and grounding electrodes.

.2 Certificate of Compliance: Indicate approval of installation by authority having jurisdiction.

1.7 QUALIFICATIONS

.1 Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years' experience.

1.8 REGULATORY REQUIREMENTS

.1 Products: Listed and classified testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 B-Line by Eaton.

.2 Hubbell (Burndy).

.3 Panduit.

.4 Thomas & Betts.

2.2 PERFORMANCE CRITERIA

.1 Grounding System Resistance: 5 ohms.

.2 Provide all equipment grounding as required regardless of whether it has been shown on drawings or called for in this specification. Arrange grounds so that under normal operating conditions no injurious amount of current will flow in any grounding conductor.

2.3 GROUNDING AND BONDING CONDUCTORS

.1 Electrical grounding conductors shall be CSA C22.2 No. 75 insulated stranded copper, except that sizes 10 AWG and smaller shall be solid copper. Insulation colour shall be continuous green for all equipment grounding conductors.

.2 Bonding conductors shall be ASTM B8 bare stranded copper, except that sizes 10 AWG and smaller shall be ASTM B1 solid bare copper wire.

2.4 ROD ELECTRODES

.1 Material: Copper-clad steel.

.2 Diameter: 19 mm.

.3 Length: 3000 mm.

2.5 GROUND RODS

.1 Copper clad steel, 19 mm (3/4 in) diameter by 3000 mm (10 ft) long, conforming to CSA C22.2 No. 41.

.2 Quantity of rods shall be as required to obtain the specified ground resistance.

2.6 SPLICES AND TERMINATION COMPONENTS

.1 Components shall meet or exceed CSA C22.2 No. 41, and be clearly marked with the manufacturer, catalog number, and permitted conductor size(s).

2.7 GROUND CONNECTIONS

.1 Below Grade: Exothermic-welded type connectors.

.2 Above Grade:

.1 Bonding Jumpers: compression type connectors, using zinc-plated fasteners and external tooth lockwashers.

.2 Ground Busbars: Two-hole compression type lugs using tin-plated copper or copper alloy bolts and nuts.

2.8 GROUND TERMINAL BLOCKS

.1 At any equipment mounting location (e.g. backboards and hinged cover enclosures) where rack-type ground bars cannot be mounted, provide screw lug-type terminal blocks.

2.9 SPLICE CASE GROUND ACCESSORIES

.1 Splice case grounding and bonding accessories shall be supplied by the splice case manufacturer when available. Otherwise, use 6 AWG insulated ground wire with shield bonding connectors.

2.10 MECHANICAL CONNECTORS

.1 Material: Bronze.

2.11 WIRE

.1 Material: Stranded copper.

.2 Foundation Electrodes: 2/0 AWG.

.3 Grounding Electrode Conductor: Size to meet Ontario Electrical Safety Code requirements.

2.12 GROUNDING WELL COMPONENTS

.1 Well Pipe: 200 mm by 600 mm long concrete pipe with belled end.

.2 Well Cover: Cast iron with legend "GROUND" embossed on cover.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verify that final backfill and compaction has been completed before driving rod electrodes.

3.2 INSTALLATION

.1 General

.1 Ground in accordance with the Ontario Electrical Safety Code, as shown on drawings, and as hereinafter specified.

.2 System Grounding:

.1 Secondary service neutrals: Ground at the supply side of the secondary disconnecting means and at the related transformers.

.2 Separately derived systems (transformers downstream from the service entrance): Ground the secondary neutral.

.3 Equipment Grounding: Metallic structures (including ductwork and building steel), enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames, and other conductive items in close proximity with electrical circuits shall be bonded and grounded.

.4 Ground electrical equipment and wiring in accordance with Ontario Electrical Safety Code and Local Inspection Authority's Rules and Regulations.

.5 Install grounding conductors, outside Electric Rooms and Electrical Closets in conduit and conceal where possible. Make connections to water mains, all metallic piping systems, neutral and equipment with brass, copper or bronze bolts and connectors or weld using Cadweld or Thermoweld processes.

.6 Provide grounding conductors, sized as per Code, and connect to grounding bus or water main wherever non-raceways are installed.

.2 Provide grounding electrode conductor and connect to reinforcing steel in foundation footing. Bond steel together.

.3 Provide bonding to meet Regulatory Requirements.

.4 Bond together metal siding not attached to grounded structure; bond to ground.

.5 Install ground grid under access floors indicated.

.6 Bond together each metallic raceway, pipe, duct, and other metal object entering space under access floors. Bond to underfloor ground grid. Use 6 AWG bare copper conductor.

.7 Equipment Grounding Conductor: Provide separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.

.8 Ground Resistance

.1 Grounding system resistance to ground not to exceed 5 ohms. Make necessary modifications or additions to the grounding electrode system for compliance without additional cost to the Owner. Final tests shall assure that this requirement is met.

.2 Resistance of the grounding electrode system shall be measured using a four-terminal fall-of-potential method as defined in IEEE 81. Ground resistance measurements shall be made before the electrical distribution system is energized and shall be made in normally dry conditions not less than 48 hours after the last rainfall. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together below grade. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.

.3 Services at power company interface points shall comply with the power company ground resistance requirements.

.9 Ground Rod Installation

.1 Drive each rod vertically in the earth, not less than 3000 mm (10 ft) in depth.

.2 Where permanently concealed ground connections are required, make the connections by the exothermic process to form solid metal joints. Make accessible ground connections with mechanical pressure type ground connectors.

.3 Where rock prevents the driving of vertical ground rods, install angled ground rods or grounding electrodes in horizontal trenches to achieve the specified resistance.

.10 Inaccessible Grounding Connections

.1 Make grounding connections, which are buried or otherwise normally inaccessible (except connections for which periodic testing access is required) by exothermic weld.

.11 Secondary Equipment and Circuits

.1 Main Bonding Jumper: Bond the secondary service neutral to the ground bus in the service equipment.

.2 Metallic Piping, Building Steel, and Supplemental Electrode(s):

.1 Provide a grounding electrode conductor sized per code between the service equipment ground bus and all metallic water and gas pipe systems, building steel, and supplemental or made electrodes. Jumper insulating joints in the metallic piping. All connections to electrodes shall be made with fittings that conform to CSA C22.2 No. 41.

.2 Provide a supplemental ground electrode and bond to the grounding electrode system.

.3 Conduit Systems:

.1 Ground all metallic conduit systems. All metallic conduit systems shall contain an equipment grounding conductor.

.2 Non-metallic conduit systems shall contain an equipment grounding conductor, except that non-metallic feeder conduits which carry a grounded conductor from exterior transformers to interior or building-mounted service entrance equipment need not contain an equipment grounding conductor.

.3 Conduit containing only a grounding conductor, and which is provided for mechanical protection of the conductor, shall be bonded to that conductor at the entrance and exit from the conduit.

.4 Feeders and Branch Circuits: Install equipment grounding conductors with all feeders and power and lighting branch circuits.

.5 Boxes, Cabinets, Enclosures, and Panelboards:

.1 Bond the equipment grounding conductor to each pull box, junction box, outlet box, device box, cabinets, and other enclosures through which the conductor passes (except for special grounding systems for intensive care units and other critical units shown).

.2 Provide lugs in each box and enclosure for equipment grounding conductor termination.

.3 Provide ground bars in panelboards, bolted to the housing, with sufficient lugs to terminate the equipment grounding conductors.

.6 Receptacles shall not be grounded through their mounting screws. Ground with a jumper from the receptacle green ground terminal to the device box ground screw and the branch circuit equipment grounding conductor.

.7 Raised Floors: Provide bonding of all raised floor components.

.12 Corrosion Inhibitors

.1 When making ground and ground bonding connections, apply a corrosion inhibitor to all contact surfaces. Use corrosion inhibitor appropriate for protecting a connection between the metals used.

.13 Conductive Piping

.1 Bond all conductive piping systems, interior and exterior, to the building to the grounding electrode system. Bonding connections shall be made as close as practical to the equipment ground bus.

3.3 FIELD QUALITY CONTROL

.1 Perform inspections and tests listed in NETA ATS, Section 7.13.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Conduit and equipment supports.

.2 Anchors and fasteners.

1.2 REFERENCES

.1 CSA C22.1:21, Canadian Electrical Code, Part 1 (25th Edition), Safety Standard for Electrical Installations.

.2 Ontario Electrical Safety Code (28th edition/2021).

.3 CECA - Canadian Electrical Contractors Association.

1.3 CLOSEOUT SUBMITTALS

.1 Submit the following in the Operation and Maintenance Manual for products used over the course of the project:

.1 Product Data: Provide manufacturer's catalogue data for fastening systems.

.2 Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

1.4 REGULATORY REQUIREMENTS

.1 Provide products listed and classified by Canadian Standards as suitable for purpose specified and shown.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 B-line by Eaton.

.2 Burndy Canada Ltd. (Hubbell).

.3 Erico Caddy.

.4 E. Myatt & Co. Inc.

.5 Hilti Canada.

.6 Thomas & Betts.

.7 Unistrut.

2.2 GENERAL

.1 All supporting devices, strut channel, threaded rod, anchors, etc. to be used shall be of the “hot dipped” galvanized type. Electrogalvanized components will not be accepted.

.2 Materials and Finishes: Provide adequate corrosion resistance.

.3 Provide materials, sizes, and types of anchors, fasteners and supports to carry the loads of equipment and conduit. Consider weight of wire in conduit when selecting products.

.4 Anchors and Fasteners:

.1 Concrete Structural Elements: Use expansion anchor sand preset inserts.

.2 Steel Structural Elements: Use beam clamps and welded fasteners.

.3 Concrete Surfaces: Use self-drilling anchors and expansion anchors.

.4 Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts and hollow wall fasteners.

.5 Solid Masonry Walls: Use expansion anchors and preset inserts.

.6 Sheet Metal: Use sheet metal screws.

.7 Wood Elements: Use wood screws.

2.3 ANCHORS AND HANGERS

.1 Hangers for electrical conduit shall be galvanized after fabrication.

.2 Perforated strapping: not permitted.

2.4 INSERTS

.1 Use only factory-made threaded or toggle type.

.2 Where inserts cannot be placed, use factory-made expansion shields for light weights, where approved by the Consultant.

.3 Do not use powder-activated tools except with the written permission of the Consultant.

2.5 SLEEVES

.1 Through interior walls, use standard weight steel pipes, conduit, or 18 gauge galvanized steel. Cut flush with finished surfaces. Check room finish schedules.

.2 Through exterior walls above grade, floors, and roof use standard weight steel pipes, machine cut, flush with finished surface inside and to suit flashing outside.

.3 Through exterior walls below grade, water-proofed floors, and other water-proof walls, use heavy weight cast iron pipes, machine cut. Extend sleeves 100 mm (4 in) above finished floors, and cut flush with underside of floor.

2.6 STEEL CHANNEL

.1 Description: Painted steel.

2.7 SUPPORTS

.1 Steel supports in wet or dry locations to be galvanized after fabrication.

.2 Where galvanized members are bolted together use cadmium plated bolts.

.3 For hanger rods use minimum 10 mm (3/8 in) diameter steel threaded rod. Use clevis type attachment.

.4 Provide minimum 100 mm (4 in) high concrete bases for all floor mounted equipment.

2.8 SUPPORTS AND BASES

.1 Submit proposed method of attachment of hangers and beam clamps, to cellular steel deck for approval before proceeding with Work.

.2 Supply and erect special structural Work required for the installation of electrical equipment. Provide anchor bolts and other fastenings unless noted otherwise. Mount equipment required to be suspended above floor level, where details are not shown, on a frame or platform bracketed from the wall or suspended from the ceiling. Carry supports to either the ceiling or the floor, or both as required, at locations where, because wall thickness is inadequate, it is not permitted to use such brackets.

.3 Electrical panels, switches or other electrical equipment shall be complete with suitable bases or mounting brackets.

.4 Provide channel or other metal supports where necessary, to adequately support lighting fixtures. Do not use wood unless wood forms part of the building structure.

.5 Support hangers, in general, from inserts in concrete construction or from building structural steel beams, using beam clamps. Provide additional angle or channel steel members, required between beams for supporting conduits and cables.

.6 Provide any additional supports required from existing concrete construction for any piping or equipment, by drilling same and installing expansion bolt cinch anchors.

.7 Do not use explosive drive pins in any section of Work without obtaining prior approval.

2.9 THREADED ROD COVERS

.1 Protect cable from abrasion caused by contact with threaded rod.

.2 To meet UL 94V-0 specifications.

.3 Colour: Black.

.4 Manufacturers:

.1 Panduit TRC18FR-X20Y.

.2 Approved equal.

2.10 STACKED TRANSFORMER SUPPORTS

.1 Stacking of transformers is only allowed if all other options have been exhausted due to lack of space. Stacking is only applicable to floor mount applications and is not allowed for ceiling or wall mount configurations. Stacking shall comply with the following requirements:

.1 The transformer stacked on top is the same size or smaller than the transformer below.

.2 The OESC clearance requirements for each individual transformer is satisfied.

.3 The ambient temperature must not exceed 30°C.

.2 Strut channel structure to support transformers shown on Drawings to be stacked above another transformer.

.3 Provide sheet metal heat diversion shield between stacked transformers. Install shield at an angle as not to trap heat.

2.11 CONCRETE BASES AND HOUSEKEEPING PADS

.1 Provide concrete bases of dimensions where indicated, but not less than 100 mm (4 in) larger in both directions than supported unit, and 100 mm (4 in) high, and so anchors will be a minimum of 10 bolt diameters from edge of the base. Chamfer edges.

.2 Use 20 MPa (3000 psi) 28 day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03 – Concrete.

.3 Install dowel rods to connect concrete bases to concrete floor. Unless otherwise indicated, install dowel rods on 450 mm (18 in) centres around full perimeter of base.

.4 Anchor equipment to concrete base.

.5 Provide a housekeeping pad for floor mounted equipment, including but not limited to the following:

.1 Transformers.

.2 Switchgear and switchboards.

.3 Distribution panelboards.

.4 Engine Generators.

.5 Uninterruptible Power Supplies and batteries.

.6 Transfer Switches.

2.12 CONCRETE ANCHORS

.1 Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

.2 Drilled expansion anchors for anchors set in concrete block or poured concrete after the concrete has set. Size the insert and number of anchors so that the maximum load per anchor does not exceed the manufacturer's recommendation.

.3 U-channel concrete inserts shall be 12 gauge steel 1-5/8 in square with insert anchors 1 3/8 in long and 100 mm (4 in) on centre.

.4 Install anchor bolts to elevations required for proper attachment to supported equipment.

2.13 PLYWOOD EQUIPMENT BOARDS

.1 Plywood Equipment Boards: preservative treated, and kiln dried; thickness as indicated, or if not indicated, not less than 19 mm (3/4 in) deep. Provide marine grade plywood where subject to moisture conditions.

.2 Paint plywood board white, or to match adjacent finishes. Leave the fire-retardant label unpainted for verification by the Consultant and by Authority Having Jurisdiction (AHJ).

.3 Unless otherwise noted, boards shall be painted with two coats of good grade weatherproof flat gray non-conductive fire-retardant paint on all sides and edges (prior to mounting) and plumbed in a true vertical position. Provide nominal 13 mm (1/2 in) rustproof spacers between back of plywood and wall. Cut, fit, and place plywood equipment boards accurately in location, alignment, and elevation to support and anchor electrical materials and equipment. Select fastener sizes that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood members. Attach to substrates as required to support applied loads. Maintain at least 100 mm (4 in) from bottom of plywood equipment boards and the finished floor surface.

.4 Unless directed otherwise in field, plywood equipment boards shall be 2440 mm (8 ft) high by 19 mm (3/4 in) deep by length shown on drawings (as dimensioned or as scaled) or length as

required to accommodate equipment if not indicated on drawings. Unless directed otherwise in field, provide plywood equipment boards for all indoor surface mounted panelboards and systems "head-end" equipment for all applications where located in mechanical or electrical rooms/areas and only where specifically shown on drawings for all other applications.

2.14 ROOF SUPPORTS

.1 High-density polyethylene platform and base, height adjustable with rounded corners and edges to reduce likelihood of roof penetration.

.2 Large surface area to spread the weight of supported objects including conduits, and cable trays over a large surface footprint.

.3 No penetration of the waterproof membrane.

.4 Self drains water, rot proof, and sunlight resistant.

.5 Manufacturers:

.1 Thomas & Betts Superstrut Adjustable Universal Support.

.2 Eaton Dura-Blok series.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Obtain permission from the Consultant before drilling or cutting structural members.

.2 Fabricate supports from structural steel or steel channel. Rigidly weld members or use hexagon head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.

.3 Install surface-mounted cabinets and panelboards with minimum of four anchors.

.4 In wet and damp locations use steel channel supports to stand cabinets and panelboards 25 mm (1 in) off wall.

.5 Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.

.6 Provide inserts, sleeves, equipment supports and hangers, sealing of sleeves and openings, as required for all electrical work. Ensure that the load onto structures does not exceed the maximum loading per square metre as shown on Structural Drawings or as directed by the Consultant.

.7 Provide insets, holes, anchor bolts and sleeves in time when walls, floors, and roof are erected.

.8 Place insets only in structural members and not in the finishing material.

.9 Secure all supports and hangers to the structure unless noted otherwise.

.10 Suspend hanger rods from approved concrete inserts and from beam clamps. Obtain Consultant's approval before welding to steel structural members.

.11 Secure supports to precast concrete members to inserts originally cast into the members or by rods passing between the members and connected to a steel plate bearing.

.12 Sealing of Sleeves and Openings to Maintain Fire Rating

.1 Use Dow-Corning #3-6548 'Silicone RTV' foam, Thomas & Betts "Flamesafe' firestopsystem, Electrovert 'Flameseal" firestop putty, or approved equal materials installed in accordance with the manufacturer's specifications and recommendations.

.2 Submit data sheets for review prior to installation.

.13 Supports

.1 All conduits, panels, etc. to be securely and adequately supported.

.2 Where more than three conduits run together, conduit racks to be used.

.3 Single runs of conduit to be supported by galvanized conduit straps or ring bolt type hangers. Tie wire or perforated metal strap hangers will NOT be accepted.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Rigid metal conduit.

.2 Flexible metal conduit.

.3 Liquid tight flexible metal conduit.

.4 Electrical metallic tubing (EMT).

.5 Electrical non-metallic tubing (ENT).

.6 Rigid PVC conduit.

.7 Fittings and conduit bodies.

1.2 REFERENCES

.1 CSA Group:

.1 CSA C22.1:21, Canadian Electrical Code, Part 1 (25th Edition), Safety Standard for Electrical Installations.

.2 Ontario Electrical Safety Code (28th edition/2021).

.3 CSA C22.2 No. 45.1:22 – Electrical rigid metal conduit – steel.

.4 CSA C22.2 No. 56-17 (R2022), Flexible metal conduit and liquid-tight flexible metal conduit.

.5 CSA C22.2 No. 83.1:07 (R2022), Electrical Metallic Tubing – Steel.

.6 CSA C22.2 No. 211.1-06 (R2021), Rigid types EB1 and DB2/ES2 PVC conduit.

.7 CSA C22.2 No. 211.2-06 (R2021), Rigid PVC (unplasticized) conduit.

.8 CSA C22.2 No. 227.1:19 (R2023), Electrical nonmetallic tubing.

.9 CSA C22.2 No. 227.2.1:19 (R2023), Liquid-tight flexible nonmetallic conduit.

.10 CSA C22.2 No. 2420-09 (R2019), Belowground reinforced thermosetting resin conduit (RTRC) and fittings.

1.3 RECORD DOCUMENTATION

.1 Accurately record actual routing of conduits larger than 51 mm (2 in).

.2 Accurately record actual routing of all conduits installed below grade, regardless of size, including whether direct buried or installed in concrete duct bank.

1.4 REGULATORY REQUIREMENTS

.1 Provide products listed and classified by CSA (Canadian Standards Association) as suitable for purpose specified and shown.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Accept conduit on site. Inspect for damage.

.2 Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

1.6 PROJECT CONDITIONS

.1 Verify that field measurements are as shown on drawings.

.2 Verify routing and termination locations of conduit prior to rough-in.

.3 Conduit routing, if shown on drawings, is approximate unless dimensioned. Route as required to provide a complete wiring system.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Where products are listed in this section based on a single manufacturer, the equivalent product from the following manufacturers is acceptable:

.1 Appleton.

.2 Columbia-MBF.

.3 Crouse-Hinds by Eaton.

.4 Hubbell.

.5 Thomas & Betts Ltd.

2.2 RIGID METAL CONDUIT

.1 Rigid metal conduit: to CSA C22.2 No. 45, hot dipped galvanized steel, threaded.

.2 Epoxy coated conduit: to CSA C22.2 No. 45, with zinc coating and corrosion resistant epoxy finish inside and outside.

.3 Fittings and conduit bodies: Material to match conduit.

2.3 FLEXIBLE METAL CONDUIT

.1 Flexible metal conduit: to CSA C22.2 No. 56, interlocked steel construction.

.2 Fittings: CSA C22.2 No. 56.

2.4 LIQUID TIGHT FLEXIBLE METAL CONDUIT

.1 Description: Interlocked steel construction with PVC jacket.

.2 Fittings: CSA C22.2 No. 56.

2.5 ELECTRICAL METALLIC TUBING (EMT)

.1 Description: CSA C22.2 No. 83.1; galvanized tubing.

.2 Fittings and Conduit Bodies: CSA C22.2 No. 83.1; steel type.

2.6 ELECTRICAL NON-METALLIC TUBING (ENT)

.1 To CSA C22.2 No. 227.1.

2.7 NON-METALLIC CONDUIT

.1 Rigid Type EB1 PVC Conduit: to CSA C22.2 No. 211.1.

.2 Rigid Type DB2/ES2 PVC Conduit: to CSA C22.2 No. 211.1.

2.8 CONDUIT, FITTINGS, AND ACCESSORIES

.1 Conduit accessories, conduits and fittings conforming to CSA Standard C22.2 No. 18-1972.

.2 Provide rain tight connectors, couplings, fittings, junction boxes, pull boxes and surface outlet boxes shall be used for surface conduit installations exposed to moisture or in sprinklered buildings.

.3 Rigid conduit bushings:

.1 Thomas & Betts Ltd. - Series 5031.

.4 EMT Connectors:

.1 Thomas & Betts Ltd. - Steel City TC121A series.

.5 Ground Bushings:

.1 Thomas & Betts – Blackjack or 1220 series.

.6 Flexible conduit connectors:

.1 Thomas & Betts Ltd. - Series 3110.

.2 EMT couplings: steel concrete tight to match connectors.

.7 Terminate rigid conduit entering boxes or enclosures with nylon insulated steel threaded bushings.

.1 Thomas & Betts – 8125 series.

.8 Terminate EMT entering boxes or enclosures with nylon insulated steel concrete tight connectors.

.9 Terminate flexible conduit entering boxes or enclosures with nylon insulated steel connectors.

.1 Thomas & Betts – 5332 series.

PART 3 - EXECUTION

3.1 PREPARATION

.1 Produce layout sketches of conduit runs through mechanical and electrical service areas, through corridors, and other congested areas in order to resolve any interferences with other work, and to determine the most efficient route to run the conduit.

3.2 INSTALLATION

.1 Minimum size: 21 mm (3/4 in) unless otherwise specified.

.2 Conceal all conduit except in mechanical rooms and electrical rooms, or unless otherwise indicated in this specification, or noted on the drawings. Surface conduit work is not permitted unless specifically noted.

.3 Install wiring in conduit unless otherwise specified. Where conduit sizes are not shown on drawings, provide conduits sized in accordance with Ontario Electrical Safety Code, CSA C22.1. When conduits are indicated, they are the minimum size required, and must be increased to suit the length of run or voltage drop requirements.

.4 Conduit use:

.1 Unless otherwise specified below or shown on the drawings, all systems shall be installed in electrical metallic tubing (EMT).

.2 Equipment subject to vibration:

.1 Use liquid tight flexible metal conduit for connections to transformers, motors, and equipment, subject to vibration and movement.

.3 Outdoor locations, above grade: use rigid steel.

.4 Underground: Use rigid PVC conduit for wiring in slabs on grade, and wiring below grade.

.5 Wet and damp locations:

.1 Use rigid steel.

.2 Use liquid tight flexible metal conduit for connections to transformers, motors, and equipment, subject to vibration and movement.

.6 Dry locations:

.1 Concealed in metal stud partitions:

.1 Use electrical metallic tubing.

.2 Use of AC90 (Bx) as described in Section 26 05 19.

.2 Concealed in concrete: Use electrical non-metallic tubing or rigid PVC.

.3 Exposed areas: Use electrical metallic tubing.

.4 Use liquid tight flexible metal conduit below raised floors for connections to all devices.

.5 Aluminium conduit may be used, in lieu of steel conduit, in clean and dry locations, but shall not be used in poured concrete, or for signal and intercommunication systems wiring.

.6 Use epoxy coated conduit in corrosive areas.

.7 Equipment in sprinklered spaces:

.1 Provide CSA certified sealing rings for rigid steel galvanized conduit and CSA certified raintight connectors for steel galvanized electrical metallic tubing (EMT) where conduits enter the top or the sides of enclosures.

.5 Arrangement and supports:

.1 Arrange supports to prevent misalignment during wiring installation.

.2 Arrange conduit to maintain headroom and present neat appearance.

.3 Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.

.4 Group related conduits; support using conduit rack.

.5 Construct rack using steel channel; provide space on each for 25 per cent additional conduits.

.6 Fasten conduit supports to building structure and surfaces to Section 26 05 29.

.7 Do not support conduit with wire or perforated pipe straps.

.8 Remove wire used for temporary supports.

.9 Do not attach conduit to ceiling support wires.

.10 Route exposed conduit parallel and perpendicular to walls.

.11 Route conduit installed above accessible ceilings parallel and perpendicular to walls.

.12 Route conduit in and under slab from point-to-point.

.13 In damp and unheated areas, avoid moisture traps; provide junction box with drain fitting at low points in conduit system.

.14 Provide suitable fittings to accommodate expansion and deflection where conduit crosses expansion joints.

.6 Clearances:

.1 Maintain adequate clearance between conduit and piping.

.2 Maintain 300 mm (12 in) clearance between conduit and surfaces with temperatures exceeding 40°C.

.7 Conduit bends:

.1 Install no more than equivalent of three 90 degree bends between boxes.

.1 Use conduit bodies to make sharp changes in direction, as around beams.

.2 Use hydraulic one-shot bender to fabricate bends in metal conduit larger than 50 mm size or provide prefabricated conduit bends.

.8 Install wall entrance seals where conduits pass through exterior walls below grade.

.9 Provide expansion coupling in conduit runs at building expansion joints and in long runs subject to thermal expansion, all in accordance with manufacturer recommendations.

.10 Cut conduit square using saw or pipe cutter; de-burr cut ends.

.11 Bring conduit to shoulder of fittings; fasten securely.

.12 Use suitable caps to protect installed conduit against entrance of dirt and moisture.

.13 Use conduit hubs or sealing locknuts to fasten conduit and to cast boxes.

.14 Provide suitable pull string in each empty conduit except sleeves and nipples.

.15 Ground and bond conduit to Section 26 05 26.

.16 Identify conduit to Section 26 05 53.

.17 Flexible conduit and armoured cable will be accepted for a maximum length of 1500 mm for final connection to lighting fixtures. Do not connect from fixture to fixture.

3.3 CLEANING

.1 Conduit manufacturer's touch-up enamel shall be used to repair all scratches and gouges on epoxy-coated conduit.

END OF SECTION

No Floor Boxes
SEE ADD#4,Q#97

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Wall and ceiling outlet boxes.

.2 Pull and junction boxes.

1.2 RELATED REQUIREMENTS

.1 Section 26 09 23 – Lighting Control Devices.

.2 Section 26 27 16 – Electrical Cabinets and Enclosures.

.3 Section 26 27 26 – Wiring Devices: Wall plates in finished areas, floor box service fittings, fire-rated poke-through fittings, and access floor boxes.

1.3 REFERENCES

.1 CSA Group:

.1 CSA C22.1:21, Canadian Electrical Code, Part 1 (25th Edition), Safety Standard for Electrical Installations.

.2 Ontario Electrical Safety Code (28th edition/2021).

.1 CSA C22.2 No. 18.1:13 (R2022), Metallic outlet boxes.

.3 CSA C22.2 No. 18.1-13 (R2022) – Metallic Outlet Boxes (Tri-national standard, with UL 514A and ANCE NMX-J-023/1).

.4 CSA C22.2 No. 40-17 - Junction and Pull Boxes.

.5 CSA C22.2 No. 85-14 (R2018) – Rigid PVC Boxes and Fittings.

1.4 CLOSEOUT SUBMITTALS

.1 Record actual locations and mounting heights of outlet, pull, and junction boxes on project record documents.

1.5 REGULATORY REQUIREMENTS

.1 Provide products listed and classified by CSA (Canadian Standards Association) as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.1 OUTLET BOXES

.1 Sheet Metal Outlet Boxes: CSA C22.2 No. 18.1, galvanized steel.

.1 Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 13 mm male fixture studs where required.

.2 Concrete Ceiling Boxes: Concrete type.

.2 Non-metallic Outlet Boxes: CSA C22.2 No. 18.1.

.3 Cast Boxes: CSA C22.2 No. 18.1, Type FD, aluminum. Provide gasketed cover by box manufacturer. Provide threaded hubs.

.4 Wall Plates for Finished Areas: As specified in Section 26 27 26.

2.2 PULL BOXES AND JUNCTION BOXES

.1 Sheet Metal Boxes: CSA C22.2 No. 18.1, galvanized steel.

.2 Hinged Enclosures: As specified in Section 26 27 16.

.3 Surface Mounted Cast Metal Box: CSA C22.2 No. 18.1, Type 4; flat-flanged, surface mounted junction box:

.1 Material: Cast aluminum.

.2 Cover: Provide with ground flange, neoprene gasket, and stainless steel cover screws.

2.3 OUTLET BOXES

.1 Conform to CSA C22.2 No. 18.1.

.2 Where 103 mm (4 in) square outlet boxes are installed in exposed concrete or cinder block finished areas, blocks will be cut as described in Division 04 as instructed under this Section. Cut openings to provide a close fit to boxes and covers so that edges of openings are not visible after installation of plates. Use of mortar to patch up openings that are cut too large or to patch ragged edges is not permitted.

.3 Ceiling boxes: 103 mm (4 in) octagon or square, complete with fittings, where required to support fixtures.

.4 Switch and receptacle boxes:

.1 103 mm (4 in) square with plaster ring, where flush mounted in plaster walls.

.2 Iberville 1104 series box, or equal, where flush mounted in wood or drywall, with stud fasteners as required.

.3 Masonry boxes in masonry walls.

.5 Where boxes are surface mounted in unfinished areas they shall be FS conduits.

.6 Standard outlet boxes manufactured from code gauge galvanized steel.

.7 Provide a suitable outlet box for each light, switch, receptacle, or other outlet, approved for the area it is to be installed.

.8 Support outlet boxes independently of conduit and cable.

.9 Locate outlet boxes, mounted in hung ceiling space, so they do not obstruct or interfere with the removal of lay-in ceiling tiles.

.10 Offset outlet boxes, shown back to back in partitions, horizontally a minimum 150 mm (6 in) to minimize noise transmission between adjacent rooms.

.11 Use gang boxes at locations where more than one device, of the same system only, is to be mounted. Utilize separate boxes for each system.

.12 Use tile wall covers where 103 mm (4 in) square outlet boxes are installed in exposed concrete or cinder block in finished areas.

.13 Provide flush mount boxes, panels, cabinets, and electrical devices, which are installed in finished areas, with suitable flush trims and doors or covers, unless specifically noted otherwise.

.14 Provide pre-formed polyethylene vapour barriers for all boxes located in walls with internal vapour barriers.

No Floor Boxes
SEE ADD#4,Q#97

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verify locations of floor boxes prior to rough-in.

3.2 INSTALLATION

.1 Install boxes to CSA C22.1.

.2 Install in locations as shown on drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.

.3 Set wall mounted boxes at elevations to accommodate mounting heights indicated.

.4 Electrical boxes are shown on drawings in approximate locations unless dimensioned. Adjust box location up to 3 m (10 ft) if required to accommodate intended purpose.

.5 Orient boxes to accommodate wiring devices oriented as specified in Section 26 27 26.

.6 Maintain headroom and present neat mechanical appearance.

.7 Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

.8 Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 150 mm (6 in) from ceiling access panel or from removable recessed luminaire.

.9 Install boxes to preserve fire resistance rating of partitions and other elements, using materials and methods.

.10 Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.

.11 Locate outlet boxes to allow luminaires positioned as shown on reflected ceiling plan.

.12 Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.

.13 Use flush mounting outlet box in finished areas.

.14 Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.

.15 Do not install flush mounting box back-to-back in walls; provide minimum 150 mm (6 in) separation. Provide minimum 600 mm (24 in) separation in acoustic rated walls.

.16 Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.

.17 Use stamped steel bridges to fasten flush mounting outlet box between studs.

.18 Install flush mounting box without damaging wall insulation or reducing its effectiveness.

.19 Use adjustable steel channel fasteners for hung ceiling outlet box.

.20 Do not fasten boxes to ceiling support wires.

.21 Support boxes independently of conduit.

.22 Use gang box where more than one device is mounted together. Do not use sectional box.

.23 Use gang box with plaster ring for single device outlets.

.24 Use cast outlet box in exterior locations exposed to the weather.

.25 Use cast outlet box in wet locations.

.26 Set floor boxes level.

.27 Large pull boxes: Use hinged enclosure in interior dry locations, surface-mounted cast metal box in other locations.

3.3 ADJUSTING

.1 Adjust floor box flush with finish flooring material.

.2 Adjust flush-mounting outlets to make front flush with finished wall material.

.3 Install knockout closures in unused box openings.

3.4 CLEANING

.1 Clean interior of boxes to remove dust, debris, and other material.

.2 Clean exposed surfaces and restore finish.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Cables installed in ducts.

.2 Direct buried cables.

.3 Handholes.

1.2 RELATED REQUIREMENTS

.1 Section 31 23 00 – Excavation and Fill.

1.3 REFERENCES

.1 CSA Group:

.1 CSA C22.3 No. 7-15, Underground systems.

.2 Institute of Electrical and Electronics Engineers:

.1 IEEE 835-1994, Standard Power Cable Ampacity Tables.

.3 Insulated Cable Engineers Association, Inc. (ICEA).

1.4 SUBMITTALS

.1 Submit records of underground utility locates, indicating location plan of existing utilities as found in field and clearance record from utility authority and location plan of relocated and abandoned services, as required.

.2 Feeder ampacity calculations from cable manufacturer for any duct banks or direct buried feeders not constructed in accordance with OESC to demonstrate compliance with IEEE 835.

1.5 CLOSEOUT SUBMITTALS

.1 Record documentation:

.1 Records of underground utility locates.

.2 Record as-constructed location of all underground conduits and feeders on as-built drawings regardless of conduit size.

PART 2 - PRODUCTS

2.1 FILL MATERIALS

.1 Sand fill: clean, natural sand and gravel material, free from silt, clay, loam, friable or soluble materials and vegetable matter.

.2 Backfill material: Selected material from excavation or other sources, reviewed by the Consultant, unfrozen and free from rocks larger than 75 mm (3 inch), rock with sharp angular surfaces, cinders, ashes, sods, refuse, or other deleterious materials.

2.2 DIRECT BURIED AND CONCRETE ENCASED CONDUITS

.1 Rigid Type DB2/ES2 PVC conduit to Section 26 05 33.13.

2.3 CONDUCTORS

.1 RWU90, in accordance with Section 26 05 19 for use in direct buried applications, and in below grade conduits and duct banks.

2.4 TRACER WIRE

.1 Direct burial rated tracer wire: single, solid copper, 12 AWG minimum size with 30 mm PVC jacket.

.1 Provide red jacket for circuits 120 V and higher.

.2 Provide orange jacket for communications conduits and services lower than 120 V.

2.5 HANDHOLES

.1 460 mm (18”) round handhole.

.2 Precast concrete, to OPSD 2112.02 standard, suitable for use in vehicular traffic areas.

.3 Manufacturers:

.1 Armtec-Brooklin Concrete.

.2 Hy-Grade Precast Concrete.

.3 Utilicon.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Perform locates prior to start of work.

3.2 EXCAVATION AND FILL

.1 In accordance with Section 31 23 00.

.2 Trenching:

.1 Excavate to dimensions indicated. Ensure trench width is sufficient to accommodate mechanical vibratory compactor.

.2 Do not leave open trench at end of day’s operation.

.3 Backfilling:

.1 Do not proceed with backfilling operations until Electrical Inspection Authority has inspected and approved installation.

.4 Restoration:

.1 Restore surface of work area to conditions existing prior to execution of work.

.2 After backfilling trench, provide new topsoil as required to follow minimum depths after settlement of 100 mm (4 in) for grass seeded areas.

.3 Restore surface of paved areas to match existing.

3.3 CABLE INSTALLATION IN DUCTS

.1 Install cables as indicated in ducts.

.2 Do not pull spliced cables inside ducts.

.3 Install multiple cables in duct simultaneously.

.4 Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension.

.5 To facilitate matching of colour coded multiconductor control cables reel off in same direction during installation.

.6 Before pulling cable into ducts and until cables are properly terminated, seal ends of lead covered cables with wiping solder; seal ends of non-leaded cables with moisture seal tape.

.7 After installation of cables, seal duct ends with duct sealing compound.

3.4 DIRECT BURIAL OF CABLE

.1 Provide sand bed as indicated.

.2 Lay cables maintaining 75 mm (3 in) clearance from each side of trench to nearest cable. Do not pull cable into trench.

.3 Provide offsets for thermal action and minor earth movements. Offset cable 150 mm for each 60 m run, maintaining minimum cable separation and bending radius requirements.

.4 Install treated planks on cables for mechanical protection. Install above cables and below markers.

.5 Cable separation:

.1 Maintain 75 mm (3 in) minimum separation between cables of different circuits.

.2 Maintain 300 mm (12 in) horizontal separation between low and high voltage cables.

.3 When low voltage cables cross high voltage cables maintain 300 mm (12 in) vertical separation with low voltage cables in upper position.

.4 At crossover, maintain 75 mm (3 in) minimum vertical separation between low voltage cables and 150 mm between high voltage cables.

.5 Maintain minimum 300 mm (12 in) horizontal separation between cables or conduits and gas service where installed in the same trench.

3.5 MARKERS

.1 Mark cable every 150 m along duct runs and changes in direction.

.2 Mark underground splices.

.3 Where markers are removed to permit installation of additional cables, reinstall existing markers.

.4 Install cedar post type markers.

.5 Lay concrete markers flat and centred over cable with top flush with finish grade.

.6 Where warning tape is used to comply with 2021 OESC Rule 12-012(11) or latest edition, bury the tape approximately halfway between the installation and grade level, covering the width of the raceways or cables installed, in accordance with OESC Bulletin 12-2-(latest version).

.7 Tracer wires:

.3 Provide direct burial rated tracer wire above all underground raceways and duct banks for power, control/monitoring, lighting and branch circuits, and communications raceways.

.4 Install tracer wire above the warning tape.

3.6 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00.

.2 Perform tests using qualified personnel. Provide necessary instruments and equipment.

.3 Check phase rotation and identify each phase conductor of each feeder.

.4 Check each feeder for continuity, short circuits and grounds. Ensure resistance to ground of circuits is not less than 50 megohms.

.5 Pre-acceptance tests:

.1 After installing cable but before splicing and terminating, perform insulation resistance test with 1000 V megger on each phase conductor.

.2 Check insulation resistance after each splice and/or termination to ensure that cable system is ready for acceptance testing.

.6 Acceptance Tests:

.1 Ensure that terminations and accessory equipment are disconnected.

.2 Ground shields, ground wires, metallic armour, and conductors not under test.

.3 High Potential (Hipot) Testing.

.1 Conduct hipot testing in accordance with manufacturer's recommendations.

.7 Provide Owner with list of test results showing location at which each test was made, circuit tested and result of each test.

.8 Non-Conforming Work: Remove and replace entire length of cable if cable fails to meet any of test criteria.

3.7 WASTE MANAGEMENT

.1 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.2 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.3 Do not dispose of unused material into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.

.4 Divert unused metal and wiring materials from landfill to metal recycling facility as approved by Departmental Representative.

.5 Do not dispose of preservative treated wood through incineration.

.6 Do not dispose of preservative treated wood with other materials destined for recycling or reuse.

.7 Dispose of treated wood, end pieces, wood scraps and sawdust at sanitary landfill approved by Departmental Representative.

.8 Fold up metal banding, flatten and place in designated area for recycling.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Sleeves, sealing of sleeves and openings, as required for all electrical work.

1.2 SUBMITTALS

.1 Submit data sheets for firestopping in accordance with Section 01 33 00.

.2 Submit copies of firestopping drawings with ULC certificate and system number for each specific installation.

.3 Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance ratings.

.4 Submit dimensioned location drawings indicating required sleeves and formed openings in structural poured concrete or precast concrete construction or in roofing, and locations of cutting or drilling required for Electrical work.

PART 2 - PRODUCTS

2.1 SLEEVES

.1 Galvanized steel sleeves:

.1 24 gauge with an integral flange at one (1) end to secure sleeve to formwork construction.

.2 Schedule 40 pipe.

.2 Schedule 40 PVC sleeves.

2.2 SLEEVE SEALS

.1 Manufacturers

.1 Hilti Canada.

.2 Specified Technologies Inc.

.3 3M Canada Inc.

.4 Tremco.

.5 A/D Fire Protection Systems.

.6 Nelson.

.2 Asbestos-free, elastomeric materials and intumescent materials, tested, listed, and labelled by ULC in accordance with CAN/ULC-S115, and CAN/ULC-S101 for installation in ULC designated firestopping, and smoke seal systems to provide a positive fire, water and smoke seal and a fire resistance rating (flame, hose stream and temperature) no less than fire rating for surrounding construction.

.3 Materials are to be compatible with abutting dissimilar materials and finishes and complete with primers, damming and back-up materials, supports, and anchoring devices in accordance with firestopping manufacturer's recommendations and ULC tested assembly. Coordinate material requirements with trades supplying abutting areas of materials.

.4 Maintain fire rating of separation in accordance with architectural drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Where conduits and conductors pass through structural poured concrete, provide sleeves of type suitable for application, and approved by local governing codes.

.2 Sleeves in concrete slabs, except as noted below, are to be 24 gauge or equivalent, with an integral flange to secure sleeves for formwork construction.

.3 Sleeves in waterproof concrete slabs and in other slabs where waterproof sleeves are required are to be lengths of Schedule 40 pipe sized to extend 100 mm (4 in) above floor.

.4 Sleeves in poured concrete walls and foundation are to be Schedule 40 pipe.

.5 Through interior walls, use standard weight steel pipes, conduit, or galvanized steel. Cut flush with finished surfaces. Check room finish schedules.

.6 Through exterior walls above grade, floors, and roof use standard weight steel pipes, machine cut, flush with finished surface inside and to suit flashing outside.

.7 Through exterior walls below grade, water-proofed floors, and other water-proof walls, use heavy weight cast iron pipes, machine cut. Extend sleeves 100 mm (4 in) above finished floors, and cut flush with underside of floor.

.8 Size sleeves, unless otherwise noted, to leave 13 mm (1/2 in) clearance around conduit, duct, conductor, etc. Void between sleeves and conduit, duct, conductors, etc., to be packed and sealed for length of sleeves as in accordance with article entitled “Sleeve Seals” specified in this Section. Pack and seal sleeves set in exterior walls with governing authority approved materials suitable for application and pack both ends of sleeves watertight with approved permanently flexible and water tight materials. Coordinate exact responsibility of work with General Trades Contractor.

.9 Submit to concrete reinforcement detailer at proper time, drawings indicating required sleeves, recesses and formed openings in poured concrete work. Completely and accurately dimension such drawings and relate sleeves, recesses and formed openings to suitable grid lines and elevation datum.

.10 Supply sleeves of a water protecting type in accordance with detail found on drawings for installation in following locations:

.1 in Mechanical and Fan Room floor slabs, except where on grade.

.2 in slabs over Mechanical, Fan, Electrical and Telephone Equipment Rooms or closets.

.3 in floors equipped with waterproof membranes.

.11 "Gang" type sleeving to be permitted only with approval of Owner and reviewed with the Consultant.

.12 Terminate sleeves for work which is exposed, so that sleeve is flush at both ends with wall, partition, or slab surface such that sleeve may be covered completely by escutcheon plates.

.13 Sleeves are not required in interior walls and dry area floors where conduit is installed ahead of floor construction.

.14 Seal all openings and sleeves after installation of equipment:

.1 With an approved material to maintain fire rating where sleeves and openings pass through fire separations and floors.

.2 With an approved material to maintain fire rating for sleeves and openings provided for future equipment.

.3 Flash all conduits and systems passing through roof or built into an outside wall, or a waterproof floor.

.4 Provide copper flashing for sleeves passing through exterior walls or waterproof floors.

.15 Provide all flashing and waterproofing for sleeves through roof and exterior walls to the requirements of Division 07.

.16 Firestop sleeves in accordance with the manufacturer's specifications and recommendations.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Tested firestop systems used in penetrations for the passage of cables, conduit, and other electrical equipment through fire-rated vertical barriers (walls and partitions), horizontal barriers (floor/ceiling assemblies), and vertical service shaft walls and partitions.

1.2 RELATED REQUIREMENTS

.1 Coordinate work of this section with work of other sections as required to properly execute the work and as necessary to maintain satisfactory progress of the work of other sections, including:

.1 Section 07 84 00 – Firestopping.

.2 Section 27 05 44 – Sleeves and Sleeve Seals for Communications Pathways and Cabling.

1.3 REFERENCES

.1 Underwriter's Laboratories (UL) and Underwriters Laboratories of Canada (ULC):

.1 Test Requirements: CAN/ULC-S115:2018, Standard Method of Fire Tests of Firestop Systems.

.2 Underwriters Laboratories of Canada (ULC) runs CAN/ULC-S115:2018 under their designation of ULC-S115:2018 and publishes the results in their "FIRE RESISTANCE RATINGS DIRECTORY" that is updated annually.

.3 Underwriters Laboratories (UL) of Northbrook, IL runs ASTM E-814 under their designation of UL 1479 and publishes the results in their "FIRE RESISTANCE DIRECTORY" that is updated annually. UL tests that meet the requirements of ULC-S115-M are given a cUL listing and are published by UL in their "Products Certified for Canada (cUL) Directory.

.4 CAN/ULC-S102:2018, Standard Test Method for Surface Burning Characteristics of Building Materials and CAN/ULC-S101 Fire Endurance Tests of Building Construction and Materials.

.2 ASTM:

.1 Omega Point Laboratories runs ASTM E-814 and publishes the results annually in their "Omega Point Laboratories Directory".

.2 Inspection Requirements: ASTM E 2174, "Standard Practice for On-site Inspection of Installed Fire Stops.", and ASTM E2393 Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers.

.3 Test Requirements: ASTM E 2307, "Standard Test Method for Determining Fire Resistance of Perimeter Fire Barrier Systems Using Intermediate-Scale, Multi-story Test Apparatus".

.4 ASTM D6904, "Standard Practice for Resistance to Wind Driven Rain for Exterior Coatings Applied on Masonry".

.5 ASTM C 679, "Standard Test Method for Tack-Free Time of Elastomeric Sealants".

.3 International Firestop Council Guidelines for Evaluating Firestop Systems Engineering Judgments.

.4 Ontario Building Code.

.5 Ontario Electrical Safety Code.

1.4 DEFINITIONS

.1 Firestopping: Material or combination of materials used to retain integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke, and hot gases through penetrations in fire rated wall and floor assemblies.

1.5 SUBMITTALS

.1 Submit Product Data: Manufacturer's specifications and technical data for each material including the composition and limitations, documentation of ULC or cUL firestop systems to be used and manufacturer's installation instructions to comply with Section 01 33 00.

.2 Manufacturer's engineering judgment identification number and drawing details when no ULC or cUL system is available for an application. Engineered judgment must include both project name and contractor’s name who will install firestop system as described in drawing.

.3 Submit material safety data sheets provided with product delivered to project site.

.4 Submit shop drawings in accordance with Section 01 33 00:

.1 Submit complete cUL, ULC, or equivalent approved systems for all applications. Ensure the listing is clearly noted on the submittal.

1.6 CLOSEOUT SUBMITTALS

.1 On completion of firestopping and smoke sealing installation, submit a Letter of Assurance to the Consultant certifying the firestopping and smoke sealing installation has been carried out throughout the building to electrical service penetrations and that installation has been done in strict accordance with requirements of the Ontario Building Code, any applicable municipal bylaws, ULC requirements, and manufacturer’s instructions.

1.7 QUALITY ASSURANCE

.1 Fire-Test-Response Characteristics: Provide through-penetration fire stop systems and fire-resistive joint systems that comply with specified requirements of tested systems.

.2 Firestop System installation must meet requirements of CAN/ULC-S115 tested assemblies that provide a fire rating as shown in Section 2.1 Clauses 4, 5, 6, and 7 below.

.3 Proposed firestop materials and methods shall conform to applicable governing codes having local jurisdiction.

.4 Firestop Systems do not re-establish the structural integrity of load bearing partitions/assemblies, or support live loads and traffic. Installer shall consult the structural engineer prior to penetrating any load bearing assembly.

.5 For those firestop applications that exist for which no ULC or cUL tested system is available through a manufacturer, a manufacturer's engineering judgment derived from similar ULC or cUL system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineering judgment drawings must follow requirements set forth by the International Firestop Council.

1.8 INSTALLER QUALIFICATIONS

.1 Engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having the necessary training to install manufacture’s products per specified requirements. A supplier’s willingness to sell its firestopping products to the Contractor or to an Installer engaged by the Contractor does not in itself confer qualification on the buyer.

.2 Installation Responsibility: assign installation of through-penetration fire stop systems and fire-resistive joint systems in Project to a single sole source firestop specialty contractor.

.3 The work is to be installed by a contractor with at least one of the following qualifications:

.1 FM 4991 approved contractor.

.2 UL approved contractor.

.3 Manufacturer’s accredited fire stop specialty contractor.

.4 Installer: Minimum 3 years experience with fire stop installation.

1.9 DELIVERY, STORAGE, AND HANDLING

.1 Deliver materials undamaged in manufacturer's clearly labeled, unopened containers, identified with brand, type, and ULC or cUL label where applicable.

.2 Coordinate delivery of materials with scheduled installation date to allow minimum storage time at project site.

.3 Store materials under cover and protect from weather and damage in compliance with manufacturer's requirements.

.4 Comply with recommended procedures, precautions or remedies described in material safety data sheets as applicable.

.5 Do not use damaged or expired materials.

1.10 PROJECT CONDITIONS

.1 Do not use materials that contain flammable solvents.

.2 Scheduling

.1 Schedule installation of CAST IN PLACE firestop devices after completion of floor formwork, metal form deck, or composite deck but before placement of concrete.

.2 Schedule installation of Drop-In firestop devices after placement of concrete but before installation of the pipe penetration. Diameter of sleeved or cored hole to match the listed system for the device.

.3 Schedule installation of other firestopping materials after completion of penetrating item installation but prior to covering or concealing of openings.

.3 Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.

.4 Weather conditions: Do not proceed with installation of firestop materials when temperatures exceed the manufacturer's recommended limitations for installation printed on product label and product data sheet.

.5 During installation, provide masking and drop cloths to prevent firestopping materials from contaminating any adjacent surfaces.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

.1 Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and

application, as demonstrated by the firestopping manufacturer based on testing and field experience.

.2 Provide components for each firestopping system that are needed to install fill material. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.

.3 Provide a round fire-rated cable management device whenever cables penetrate fire rated walls, where frequent cable changes and additions may occur. The fire-rated cable management device shall consist of a corrugated steel tube with zinc coating, contain an inner plastic housing, intumescent material rings, and inner fabric smoke seal membrane. The length of the sleeve shall be 315 mm (12.4 inches). The fire-rated cable management device shall contain integrated intumescent firestop wrap strip materials sufficient to maintain the hourly rating of the barrier being penetrated. The fire-rated cable management device shall contain a smoke seal fabric membrane or intumescent firestop plugs sufficient to achieve the L-Rating requirements of the barrier type. Install device per the manufacturer's published installation instructions.

.4 Penetrations in Horizontal Assemblies: Provide firestopping with ratings determined in accordance with CAN/ULC-S115. For penetrations through a Fire Wall or horizontal Fire Separation provide a firestop system with a "FT" Rating as determined by ULC or cUL which is equal to the fire resistance rating of the construction being penetrated.

.5 W-ratings: in accordance with Section 07 84 00.

.6 Provide a firestop system with an Assembly Rating as determined by CAN/ULC-S115 which is equal to the time rating of construction joint assembly.

.7 Penetrations in Smoke Barriers: Provide firestopping with ratings determined in accordance with CAN/ULC-S115.

.1 L-Rating: Not exceeding 5.0 CFM/sqft of penetration opening at both ambient and elevated temperatures.

.8 Mold Resistance: Provide penetration firestopping with mold and mildew resistance rating of 0 as determined by ASTM G21.

.9 Rain and water resistance: provide perimeter joint sealant tested in accordance with ASTM D 6904 with less than 1 hour tack free time as tested in accordance with ASTM C 679.

2.2 MANUFACTURERS

.1 Manufacturer List:

.1 AD Fire Protection Systems.

.2 Hilti (Canada) Corporation

.3 3M.

.4 Specified Technologies, Inc. (STI).

.5 Tremco, Inc.

.2 Substitutions: Where a specific manufacturer is noted in this Section, equivalent products from the manufacturers listed above may be used, subject to compliance with through penetration firestop systems and joint systems listed in the ULC Fire Resistance Directory – Volume III, or UL Products Certified for Canada (cUL) Directory.

2.3 MATERIALS

.1 Use only firestop products that have been ULC or cUL tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.

.2 Accessories: provide components for each firestopping and smoke seal systems that are needed to install fill materials. Use only components specified by firestopping material manufacturer, and approved by the qualified testing agency. Accessories include, but are not limited to, the following items:

.1 Permanent forming, damming, and backing material.

.2 Temporary forming material.

.3 Pre-formed firestop devices for use with non-combustible and combustible pipes (closed and open systems), conduit and/or cable bundles penetrating concrete floors and/or gypsum walls:

.1 Hilti Tub Box Kit (CP 681) for use with tub installations.

.2 Hilti Cast-In Place Firestop Device (CP 680-PX) for use with XFR pipe.

.3 Hilti Cast-In Place Firestop Device (CP 680-M) for use with non-combustible penetrants.

.4 Hilti Speed Sleeve (CP 653) for use with cable penetrations.

.5 Hilti Firestop Drop-In Device (CFS-DID) for use with non-combustible and combustible penetrants.

.6 Hilti Cast-in Firestop sleeve (CFS-CID MD P) and (CFS-CID MD M) for use with combustible and non-combustible pipes through metal deck.

.7 Hilti Firestop Block (CFS-BL).

.8 STI SpecSeal series SSC Firestop Collars.

.9 STI SpecSeal series LCC Firestop Collars.

.4 Sealants or caulking materials for use with non-combustible items including steel pipe, copper pipe, rigid steel conduit and electrical metallic tubing (EMT).

.1 Hilti Intumescent Firestop Sealant (FS-ONE MAX).

.2 Hilti Fire Foam (CP 620)/CP 660.

.3 Hilti Flexible Firestop Sealant (CP 606).

.4 Hilti Firestop Silicone Sealant Gun Grade (CFS-S SIL GG).

.5 Hilti Firestop Silicone Sealant Self Leveling (CFS-S SIL SL).

.5 Intumescent sealants or caulking materials for use with combustible items (penetrants consumed by high heat and flame) including insulated metal pipe, PVC jacketed, flexible cable or cable bundles and plastic pipe.

.1 Hilti Intumescent Firestop Sealant (FS-ONE MAX).

.6 Foams, intumescent sealants, or caulking materials for use with flexible cable or cable bundles.

.1 Hilti Intumescent Firestop Sealant (FS-ONE MAX).

.2 Hilti Fire Foam (CP 620)/660.

.3 Hilti Flexible Firestop Sealant (CP 606).

.4 Hilti Firestop Silicone Sealant Gun Grade (CFS-S SIL GG).

.5 Hilti Firestop Silicone Sealant Self Leveling (CFS-S SIL SL).

.7 Firestop Putty Pads: Intumescent, non-hardening putty pads to be installed on metallic and non-metallic electrical switch and receptacle boxes to reduce horizontal separation between boxes to less than 610 mm (24 in):

.1 STI SpecSeal Series SSP Firestop Putty Pads.

.2 Hilti Firestop Putty Pad (CP 617).

.8 Materials used for large size/complex penetrations made to accommodate cable trays, multiple steel and copper pipes, electrical busways in raceways.

.1 Hilti Firestop Block (CFS-BL).

.2 Hilti Composite Sheet (CFS-COS).

.3 Hilti Firestop Mortar (CP 637).

.4 Hilti Fire Foam (CP 620)/660.

.5 Hilti Firestop Board (CP 675T).

.9 Non-curing, re-penetrable materials used for large size/complex penetrations made to accommodate cable trays, multiple steel and copper pipes, electrical busways in raceways.

.1 Hilti Firestop Block (CFS-BL).

.2 Hilti Firestop Board (CP 675T).

.10 Re-penetrable, round cable management devices for use with new or existing cable bundles penetrating gypsum or masonry walls.

.1 Hilti Speed Sleeve (CP 653) with integrated smoke seal fabric membrane.

.2 Hilti Firestop Cable Collar (CFS-CC).

.3 Hilti Firestop Sleeve (CFS-SL SK).

.4 Hilti Retrofit Sleeve (CFS-SL RK) for use with existing cable bundles.

.5 Hilti Gangplate (CFS-SL GP) for use with multiple cable management devices.

.6 Hilti Gangplate Cap (CFS-SL GP CAP) for use at blank openings in gangplate for future penetrations.

.11 For blank openings made in fire-rated wall or floor assemblies, where future penetration of pipes, conduits, or cables is expected.

.1 Hilti CFS-BL Firestop Block (for walls and floors).

.2 Hilti CFS-PL Firestop Plug (for walls and floors).

.12 Cast-In-Place Firestop Device: Single component molded firestop device installed on forms prior to concrete placement with totally encapsulated, tamper-proof integral firestop system and smoke sealing gasket. Device shall allow for a concrete floor thickness of minimum 63 mm (2-1/2 in) up to 914 mm (36 in) without the use of field applied extension tubing:

.1 STI SpecSeal CID Cast-In Firestop Device.

.2 Hilti CP 680 Cast-In Place Firestop Device (for floors only).

.13 For single or cable bundles up to 25 mm (1 in) diameter penetrating gypsum, masonry, concrete walls or wood floor assemblies.

.1 Hilti CFS-D Firestop Cable Disc.

PART 3 - EXECUTION

3.1 INSTALLERS

.1 Labour Use to Install Firestop Systems

.1 To ensure complete harmony on the project site, the installation of each scope of work is to be performed jurisdictionally correct per existing trade agreements.

3.2 PREPARATION

.1 Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.

.1 Verify penetrations are properly sized and in suitable condition for application of materials.

.2 Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, rust, laitance, release agents, water repellents, and any other substances that may affect proper adhesion.

.3 Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.

.4 Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of firestopping.

.5 Do not proceed until unsatisfactory conditions have been corrected.

3.3 COORDINATION

.1 Coordinate construction of openings, penetrations to ensure that the fire stop systems are installed according to specified requirements.

.2 Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration fire stop systems.

.3 Coordinate fire stopping with other trades so that obstructions are not placed in the way prior to the installation of the fire stop systems.

.4 Do not cover up through-penetration fire stop and joint system installations that will become concealed behind other construction until each installation has been examined by the building inspector.

3.4 INSTALLATION

.1 Regulatory Requirements: Install firestop materials in accordance with ULC Fire Resistance Directory or UL Products Certified for Canada (cUL) Directory or Omega Point Laboratories Directory.

.2 Manufacturer's Instructions: Comply with manufacturer's instructions for installation of through-penetration and construction joint materials.

.1 Seal all holes or voids made by penetrations to ensure an air and water-resistant seal.

.2 Consult with mechanical engineer, project manager, and damper manufacturer prior to installation of ULC or cUL firestop systems that might hamper the performance of fire dampers as it pertains to duct work.

.3 Protect materials from damage on surfaces subjected to traffic.

3.5 FIELD QUALITY CONTROL

.1 Examine sealed penetration areas to ensure proper installation before concealing or enclosing areas.

.2 Keep areas of work accessible until inspection by applicable code authorities.

.3 Inspection of through-penetration firestopping shall be performed in accordance with ASTM E 2174, “Standard Practice for On-Site Inspection of Installed Fire Stops”, or other recognized standard.

.4 Perform under this section patching and repairing of firestopping caused by cutting or penetrating of existing firestop systems already installed by other trades.

.5 Manufacturer’s Field Services: During Installation, provide periodic destructive testing inspections to assure proper installation/application. After installation is complete, submit findings in writing indicating whether or not the installation of the tested system identified was installed correctly.

3.6 IDENTIFICATION AND DOCUMENTATION

.1 The firestop contractor is to supply documentation for each single application addressed. This documentation is to identify each penetration location on the entire project.

.2 The Documentation Form for through penetrations is to include:

.1 A Sequential Location Number.

.2 The Project Name.

.3 Date of Installation.

.4 Detailed description of the penetration location.

.5 Tested System or Engineered Judgment Number.

.6 Type of assembly penetrated.

.7 A detailed description of the size and type of penetrating item.

.8 Size of opening.

.9 Number of sides of assemblies addressed.

.10 Hourly rating to be achieved.

.11 Installer’s Name.

.3 Copies of these documents are to be provided to the general contractor at the completion of the project.

.4 Identify through-penetration firestop systems with pressure-sensitive, self-adhesive, preprinted vinyl labels. Attach labels permanently to surfaces of penetrated construction on both sides of each firestop system installation where labels will be visible to anyone seeking to remove penetrating items or firestop systems. Include the following information on labels:

.1 The words: "Warning-Through Penetration Firestop System-Do Not Disturb. Notify Building Management of Any Damage."

.2 Contractor's Name, address, and phone number.

.3 Through-Penetration firestop system designation of applicable testing and inspecting agency.

.4 Date of Installation.

.5 Through-Penetration firestop system manufacturer's name.

.6 Installer's Name.

3.7 ADJUSTING AND CLEANING

.1 Remove equipment, materials, and debris, leaving area in undamaged, clean condition.

.2 Clean all surfaces adjacent to sealed holes and joints to be free of excess firestop materials and soiling as work progresses.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 This section provides minimum acceptance requirements for vibration isolation for all electrical equipment, conduit, and piping.

1.2 RELATED REQUIREMENTS

.1 Concrete work is described in Division 03 and Section 26 05 29.

.2 Section 26 12 16 – Dry-Type, Medium-Voltage Transformers.

.3 Section 26 22 13 – Low-Voltage Distribution Transformers.

.4 Section 26 32 13.16 – Gas-Engine-Driven Generator Sets.

1.3 SUBMITTALS

.1 All outdoor mounted equipment shall be restrained for the highest wind speed as specified by the project's structural engineer, the governing building code(s) or the authority having jurisdiction.

.2 Submit shop drawings for all devices specified herein and as indicated and scheduled on the drawings. Submittals shall indicate full compliance with the device specification in Part 2. Any deviation shall be specifically noted and subject to engineer approval. Submittals shall include device dimensions, placement, attachment, and anchorage requirements.

1.4 CLOSEOUT SUBMITTALS

.1 Submit a letter from vibration isolation manufacturer to certify correct installation of products, as specified in Part 3 of this Section.

1.5 QUALITY ASSURANCE

.1 All vibration isolation systems shall be by one manufacturer.

.2 Unless otherwise directed by the local authority having jurisdiction, the following codes and standards will apply:

.1 International Building Code 2009.

.2 American Society of Civil Engineers 7-05.

.3 Ontario Building Code, Latest Edition.

.3 Manufacturer's Qualifications: Firms regularly engaged in manufacture of vibration control products of type, size, and capacity required, whose products have been in satisfactory use in similar service for not less than 5 years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Vibro-Acoustics.

.2 Kinetics Noise Control.

.3 BVA Systems.

.4 Vibron Limited.

.5 Mason Industries.

2.2 VIBRATION ISOLATION

.1 Springs: All springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. All springs except internal nested springs shall have an outside diameter not less than 0.8 of the compressed height of the spring. Ends of springs shall be square and ground for stability. Laterally stable springs shall have kx/ky ratios of at least 0.9. All springs shall be fully colour-coded to indicate capacity – colour striping is not considered adequate.

.2 Corrosion Protection: All springs shall be powder-coated enamel. Housings shall be hot dipped galvanized, powder-coated enamel, or painted with rust-resistant paint.

.3 Isolators:

.1 Vibration Isolation Pads: Type N – Neoprene pad type isolators, 10 mm (3/8”) minimum thick, ribbed on both sides.

.1 Type NSN – Sandwich neoprene pad type isolators, with 10 mm (3/8”) minimum thick ribbed neoprene pads bonded to each side of a 3.5 mm (10 ga) minimum galvanized metal plate. Isolator pads shall be selected to ensure that deflection does not exceed 20% of isolator free height.

.2 Rubber-in-Shear Floor Mounts: Type RD – “Double-deflection” neoprene isolators, with neoprene-coated metal surfaces, and top and bottom surfaces ribbed. Isolators shall have bolt holes in the base.

.3 Restrained Spring Floor Mounted Isolators: Type CSR – Laterally stable, vertically restrained spring isolators with welded steel housings and heavy top plates for supporting equipment. Springs shall be supported either with a neoprene cup or a metal base plate complete with a ribbed neoprene pad, minimum 6 mm (1/4”) thick, bonded to the base plate. Housings shall include vertically restraining limit stops. Minimum clearance around the restraining bolts and between the housing and the spring shall be 13 mm (1/2”). Top plate and restraining bolts shall be out of contact with the housing during normal operation and neoprene grommets shall be incorporated to minimize short-circuiting of restraining bolts. For outdoor applications, housing must be hot-dip galvanized. For indoor applications, powder-coated finish for the housing is acceptable.

PART 3 - EXECUTION

3.1 GENERAL

.1 Coordinate size, doweling, and reinforcing of concrete equipment housekeeping pads and piers with vibration isolation manufacturer to ensure adequate space and prevent edge breakout failures. Pads and piers must be adequately doweled into structural slab.

.2 Coordinate locations and sizes of structural supports with locations of vibration isolators (e.g., roof curbs, cooling towers, air-cooled chillers, etc.).

.3 Isolated equipment, duct and piping located on roofs must be attached to the structure. Intermediate supports between the restraint and structure that are not attached to the structure must be approved by the restraint manufacturer.

3.2 VIBRATION ISOLATION

.1 Ensure housekeeping pads have adequate space to mount equipment and isolator housings and shall also be large enough to ensure adequate edge distance for isolator anchors.

.2 Select and locate vibration isolation equipment to give uniform loading and deflection, according to weight distribution of equipment.

.3 Engine-generator set silencers and associated exhaust piping shall be supported with Type SHR isolators with a minimum 40 mm (1-1/2 in) static deflection.

.4 Equipment Isolation:

						Floor Span								
			Slab on Grade			Up to 6 m (20 ft)			6 m to 9 m (20 ft to 30 ft)			9 m to 12 m (30 ft to 40 ft)		
Eqpm Type	**HP and Other**	**RPM**	**Base Type**	**Isolator Type**	**Min. Defl.**	**Base Type**	**Isolator Type**	**Min. Defl., in.**	**Base Type**	**Isolator Type**	**Min. Defl., in.**	**Base Type**	**Isolator Type**	**Min. Defl., in.**
Transformers and UPS's														
All	All	All	N/A	NSN	3 mm (0.12")	N/A	NSN	3 mm (0.12")	N/A	NSN	3 mm (0.12")	NM	RD/NSN	6 mm (0.25")
Engine-Driven Generators														
All	All	All	N/A	CSR	19 mm (0.75")	N/A	CSR	38 mm (1.50")	N/A	CSR	64 mm (2.50")	N/A	CSR	89 mm (3.50")
Notes:	(1) Units that are suspended overhead shall use isolation hangers in place of floor mounted isolators with equal or greater deflection.													
	(2) Floor spans are defined as the distance between structural support columns or walls.													

.5 There shall be no rigid contact of isolated equipment with shaft walls, floor slabs, partitions, or non-flexible conduits connections.

.6 Where recommended by the manufacturer, isolator base plates shall be bolted to the structure or foundation. Bolting shall incorporate neoprene bushings and washers.

3.3 SITE TESTS AND INSPECTIONS

.1 After installation, arrange and pay for the vibration isolation product manufacturer, or representative, to visit the site to verify that the vibration isolation systems are installed and operating properly, and shall submit a certificate so stating. Verify that isolators are adjusted, with springs perpendicular to bases or housing, adjustment bolts are tightened up on equipment mountings, and hangers are not cocked.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Nameplates and labels.

.2 Wire and cable markers.

.3 Conduit markers.

.4 Receptacle labels.

.5 Signage.

1.2 RELATED REQUIREMENTS

.1 Section 09 91 00 – Painting.

1.3 SUBMITTALS

.1 Product Data: Provide catalogue data for nameplates, labels, and markers.

.2 Provide shop drawings of nameplates for Consultant’s review prior to fabrication (scale 1:1).

.3 Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under regulatory requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

1.4 REGULATORY REQUIREMENTS

.1 Provide products listed and classified by CSA Group as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.1 NAMEPLATES AND LABELS

.1 Nameplates:

.1 Engraved three-layer laminated plastic, letters on contrasting background.

.2 Colours to match existing building system, where applicable. If no building system exists, use the following:

.1 347/600 volt system: White text on Blue background.

.2 120/208 volt system: Black text on White background.

.3 Fire Detection system: White text on Red background.

.4 Emergency Lighting system: Red text on White background.

.5 LV systems: White text on Green background.

.3 Confirm colours with the Consultant prior to ordering nameplates.

.2 Equipment Nameplates to indicate:

.1 Equipment/Panelboard ID.

.2 Ampacity.

.3 Voltage.

.4 Number of Phases.

.5 Number of wires in system.

.6 Interrupting Capacity.

.7 Size, number of poles, Panelboard ID, and circuit number of upstream overcurrent protection device.

.1 Location of upstream device if not in the same room.

.3 Coordination Study Labels to Section 26 05 73.16.

.4 Arc Flash Study Labels to Section 26 05 73.19.

.5 Locations:

.1 Distribution panelboards, and individual distribution panelboard branch breakers.

.2 Receptacle panelboards.

.3 Each electrical distribution and control equipment enclosure.

.4 Uninterruptible Power Supply.

.5 Mechanical Equipment.

.6 UPS receptacles.

.7 Disconnects, starters and contactors: indicate equipment being controlled and voltage.

.8 Terminal cabinets, junction boxes, and pull boxes: indicate system and voltage.

.9 Transformers: indicate capacity, primary and secondary voltages.

.6 Letter Size:

.1 Use 3 mm letters for identifying individual equipment and loads.

.2 Use 6 mm letters for identifying grouped equipment and loads.

.7 Labels:

.1 Mechanically fastened with sheet metal screws, with 5 mm white letters on black background.

.2 White letters on red background for UPS and equipment, and devices downstream of UPS.

.3 Labels: embossed plastic labels with 6 mm high letters unless specified otherwise.

.4 Wording on nameplates and labels to be reviewed by the Consultant prior to manufacturing.

.5 Allow for minimum of twenty-five (25) letters per nameplate and label.

.6 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.

.7 Terminal cabinets and pull boxes: indicate system and voltage.

2.2 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings, numbered, on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour coding: to CSA C22.1.

.4 Use colour coded wires in communication cables, matched throughout system.

2.3 WIRE MARKERS

.1 Description: tape, split sleeve, or tubing type wire markers.

.2 Locations: Each conductor at panelboard gutters, pull boxes, outlet and junction boxes and each load connection.

.3 Legend:

.1 Power and Lighting Circuits: Branch circuit or feeder number indicated on drawings.

.2 Control Circuits: Control wire number indicated on shop drawings.

2.4 CONDUIT AND BOX MARKERS

.1 Colour code conduits, boxes, and metallic sheathed cables.

.2 Location: Provide markers for each conduit longer than 2 m.

.3 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.

.4 Colours to match equipment nameplate background colour:

.1 347/600 volt system: Blue.

.2 120/208 volt system: Black.

.3 Fire Alarm system: Red.

.4 Emergency Lighting system: Red/White.

.5 LV Systems (EPO, Remote Monitoring, Generator Control, Communications): Green.

.6 120/208 volt Uninterruptable Power Supply (UPS): Orange.

.5 Confirm colours with the Consultant prior to commencing rough-in.

2.5 JUNCTION AND PULL BOXES

.1 Clearly identify main pull or junction boxes (excluding obvious outlet boxes) by painting outside of covers.

.2 Spray painting: not permitted.

.3 Paint colours to be in accordance with following schedule:

.1 Lighting: yellow.

.2 Normal power: blue.

.3 Emergency power: orange.

.4 Fire alarm: red.

.5 Communications systems including telephone and data: green.

.6 Miscellaneous signals: brown.

.4 In addition to painting miscellaneous signal boxes, clearly identify specific system in which box is installed. Identify source panelboard for power circuits.

2.6 BRANCH BREAKER LABELS

.1 General:

.1 Legibly identify every circuit and circuit modification as to its clear, evident, and specific purpose or use. Include sufficient detail to allow each circuit to be distinguished from all others.

.2 Label spare positions that contain unused overcurrent devices or switches.

.3 Do not describe any circuit in a manner that depends on transient conditions of occupancy.

.2 Switchboards, distribution panelboards, enclosed breakers, and disconnect switches:

.1 Locate identification at each switch.

.2 Branch breaker nameplates on switchboards, distribution panelboards and switchboards, and generator load breakers to indicate:

.1 Locate identification at each switch on a switchboard.

.2 Identification of downstream equipment fed from the breaker.

.1 Location of downstream device if not in the same room.

.3 Breaker size and number of poles.

.4 Interrupting Capacity.

.5 Circuit number (where applicable).

.6 Do not describe any circuit in a manner that depends on transient conditions of occupancy.

.3 Lighting and Receptacle Panelboards:

.1 Provide a circuit directory that is located on the face or inside of the panel door.

.2 Do not describe any circuit in a manner that depends on transient conditions of occupancy.

2.7 RECEPTACLE LABELS

.1 Label all receptacles with the panelboard ID and circuit number.

.2 Use receptacle labels by electronic labeller Brother P-Touch, model PT-20/25, Dymo-Tape or approved equal.

.3 Location: On receptacle wall plate.

PART 3 - EXECUTION

3.1 EQUIPMENT NAMEPLATES FROM MANUFACTURERS

.1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

.2 Manufacturers' nameplates and CSA labels are to be visible and legible after equipment is installed. Provide warning signs, as specified, or to meet requirements of Inspection Department, Health and Safety, and the Consultant.

.3 Label power outlets with circuit identification on visible portion of faceplate or surface mounted outlet box.

3.2 CONDUIT AND BOX IDENTIFICATION

.1 Locate labels as follows:

.1 At every end of every conduit, duct, or cable run, adjacent to item of equipment serviced.

.2 On each exposed conduit, duct or cable passing through a wall, partition, or floor (one on each side of such wall partition or floor).

.3 At intervals of 15 m (50 ft) along every exposed conduit, duct or cable run exceeding 15 m (50 ft) in length.

.4 At every access point on concealed conduit duct or cable.

.5 At each junction box.

.2 Place labels so as to be visible from 1500 mm (5 ft) above adjacent floor platform.

3.3 PREPARATION

.1 Degrease and clean surfaces to receive nameplates and labels.

3.4 APPLICATION

.1 Confirm colours prior to start of work.

.2 Install nameplate and label parallel to equipment lines.

.3 Secure nameplate to equipment front using adhesive.

.4 Secure nameplate to inside surface of door on panelboard that is recessed in finished locations.

.5 Identify conduit using field painting.

.6 Paint coloured band on each conduit longer than 2 m.

.7 Paint bands 6 m on centre.

3.5 LABELLING

.1 Colour code wiring consistently throughout the installation and generally match colour coding of internal wiring of pre-wired components.

.2 Label wiring with point name using Thomas & Betts 12 character polestar metalized labels with 3 rows of characters per label, or equal by Brady. Label to occur as a minimum at both ends and at pull boxes of the wiring run.

.3 Identify all pull boxes, junction boxes, etc. (installed as part of this project or used by this project) with the exact use of the box. Indelible felt pen marker is acceptable.

.4 Label light control items with point name using Thomas & Betts 12 character label, or equal by Brady. Label to be black lettering on clear backing.

.5 Label relays and controllers inside panels using Thomas & Betts 12 character label, or equal by Brady.

.6 Provide red, 13 mm (1/2 in) diameter, sticker on emergency light fixture frame. Include circuit number on sticker with thin permanent black mark pen.

3.6 LABELS AND SIGNS

.1 Manufacturers' nameplates and CSA labels are to be visible and legible after equipment is installed. Provide warning signs, as specified, or to meet requirements of Inspection Department, Health and Safety, and the Consultant.

.2 Label power outlets with circuit identification on visible portion of faceplate or surface mounted outlet box.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Provide a short circuit and coordination study for the electrical distribution system. The basic analysis shall include a protective device evaluation, and a protective device coordination study.

.2 The project shall begin at the point of utility service for the facility and continue down through the system to all downstream distribution and branch panelboards, motor control centres and significant motor locations.

.3 The project shall include any new generators and any associated emergency power distribution equipment, including automatic transfer switches and generator ground fault protection.

1.2 RELATED REQUIREMENTS

.1 Section 26 05 73.19 – Arc-Flash Hazard Analysis.

.2 Single Line Diagram.

1.3 REFERENCE STANDARDS

.1 Perform all studies in accordance with the latest applicable IEEE and ANSI standards.

.1 ANSI C38.010-1999.

.2 ANSI C37.5-1979.

.3 ANSI C37.13-1990.

1.4 SUBMITTALS

.1 In accordance with Section 01 33 00:

.2 Submit the following:

.1 Submit for review three copies of the protection coordination study.

.2 Shop drawings for equipment affected by the coordination study will not be reviewed until the coordination study has been submitted and reviewed.

.3 Include a one-line diagram of the system.

.4 Bind the final report in a three-ring binder, as well as a soft copy.

.3 Projection System Coordination:

.1 Prepare a graph or coordination curves, prior to manufacture of service entrance and distribution equipment on K & E No. 336E Time-Current characteristic graph paper. Time-current characteristics shall be plotted of the following:

.1 Supply Authorities relays or fuses protecting incoming service (Contractor under this section shall obtain this information).

.2 Main and feeder protective devices at every voltage level used in distribution system.

.3 Protective devices associated with largest motor and/or refrigeration compressor.

.2 Preliminary submission of graph for comment will be accepted. Submit graph to Supply Authority for approval by them as providing satisfactory co-ordination. When curves have been approved by Supply Authority, they shall be submitted for approval. After approval has been obtained, order protective devices, and calibrate to conform with these curves.

.3 Each time-current characteristic curve sheet shall include:

.1 A single line diagram for the portion of the system involved.

.2 Transformer damage curves (where applicable).

.3 Cable damage curves (where applicable).

.4 Available fault levels for the portion of the system involved.

.4 Consult manufacturer of the refrigeration compressors and obtain recommendations for settings on starters. Incorporate information in co-ordination curves and submit the associated curves to Compressor Manufacturer and obtain approval from the manufacturer.

.5 Compressor manufacturer and mechanical trade contractor will determine and calibrate proper protection on motor starters and will ensure that it coordinates with protective devices on switchboard.

.6 Co-ordination curves, mentioned above, shall be prepared by distribution equipment manufacturers as soon as possible after award of contract.

.7 At the option of this contractor under this section, these co-ordination curves may also be prepared by an independent testing organization. In this case, the independent testing organization shall determine the proper settings of all protective relays and devices and pass them on to the switchboard manufacturer for incorporation into the switchboards. Include all associated costs in the tender.

.8 Distribution Equipment manufacturers shall examine drawings and specifications prior to award of contract to ensure that relays and devices being supplied by them will co-ordinate satisfactorily to Supply Authority requirements. Payment will not be allowed, after award of contract, for extra charges due to device changes to comply with recommended practices, due to oversight or negligence by distribution equipment manufacturers.

.4 Upon review by the Consultant, submit the coordination study to the local electrical utility for their review and approval.

1.5 CLOSEOUT SUBMITTALS

.1 The Engineer who prepared the report shall visit the site and confirm that the feeder sizes as installed are consistent with the report as submitted.

.2 Submit final version of the report with as-constructed feeder lengths and feeder sizes.

1.6 QUALITY ASSURANCE

.1 Preparer Qualifications: Firm experienced in the analysis, evaluation, and coordination of electrical distribution systems and similar to the system for this project.

.2 The study shall be prepared in accordance with the latest edition of NETA ATS, the Canadian Electrical Code, as well as manufacturer’s recommendations.

.3 Short-Circuit Analysis and Coordination Study shall be performed by a registered Professional Engineer. Study shall be signed and sealed by the Engineer. The Engineer shall have a minimum of eight years experience in the analysis, evaluation, and coordination of electrical distribution systems.

.4 The firm conducting the study shall have one million worth of Professional Liability Insurance in addition to standard general insurance.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Independent Testing Organizations

.1 AC Tesla.

.2 Brosz and Associates.

.3 C-INTECH.

.4 Eastenghouse.

.5 Enkompass.

.6 G.T. Wood.

.7 Haronitis and Associates Ltd.

.2 Electrical distribution manufacturers:

.1 Eaton.

.2 Schneider Electric.

2.2 PROTECTIVE DEVICE COORDINATION STUDY

.1 Prepare coordination time-current characteristic curves to determine the required settings/sizes of the protective devices to maximize selectivity. The utility upstream protective device feeding the facility shall be maintained as the upper limit for coordination. These settings shall be obtained by the preparer, along with any other protective device setting requirements. The coordination curves shall be prepared on log-log paper and illustrate adequate clearing times between series devices. The curves shall be created through the use of the study software package, but must reflect actual protective devices to be installed. Adequate time-current curves shall be generated to depict coordination. In addition, protective device characteristics shall be suitably determined to reflect calculated short-circuit levels at the location.

.2 A narrative analysis shall accompany each coordination curve sheet and describe the coordination and protection in explicit detail. All curve sheets shall be multi-colour for improved clarity. Areas lacking complete coordination shall be highlighted and reasons provided for allowing condition to remain or provide solution to resolve situation. System coordination, recommended ratings, and setting of protective devices shall be accomplished by a registered professional electrical engineer with a minimum of eight years of current experience in the coordination of electrical power systems.

.3 The following information shall be provided on all curve sheets:

.1 Device identification and associated settings/size.

.2 Voltage at which curves are plotted.

.3 Current multiplier.

.4 ANSI frequent fault damage curve.

.5 Cable insulation damage curves.

.6 Transformer inrush point.

.7 Single-line for the portion of the system.

.8 Motor starting profiles (where applicable).

2.3 SINGLE LINE DIAGRAM

.1 The final report shall include a multi-colour single line diagram of the electrical distribution system within the scope of the project. The single line diagram shall include:

.1 Transformer rating, voltage ratio, impedance, and winding connection.

.2 Feeder cable phase, neutral and ground sizes, length of cable, conductor material, and conduit size and type.

.3 Switchgear, switchboards, panelboards, MCC's, fuses, circuit breakers, ATS's and switches continuous current ratings.

.4 Protective relays with appropriate device numbers and CT's and PT's with associated ratios.

.5 Detailed legend indicating device type identification and other significant details.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Obtain fault level and X/R ratio information from the utility.

3.2 SUMMARY

.1 The results of the system studies shall be summarized in a final report.

.2 Where required, copies of the final report shall be submitted to the Supply Authority for their review and approval. Submit approved copies of the report to the Consultant.

3.3 ADJUSTING

.1 The contractor shall engage the manufacturer's service group or alternately a qualified independent testing firm to perform field adjustments of the protective devices as required for placing the equipment in final operating condition. The settings shall be in accordance with the approved short circuit study and protective device evaluation / coordination study.

.2 Necessary field settings of devices and adjustments and minor modifications to equipment to accomplish conformance with the approved protective device coordination study, shall be carried out by manufacturer's service group.

.3 Submit a final service report confirming that settings have been completed.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Provide an Arc Flash Hazard Analysis Study per the requirements described in CSA Z462 Standard for Electrical Safety in the Workplace.

.2 The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are obtained in CSA Z462-08, Annex D, or more recent version of the standard as cited by this Section.

.3 The scope of the studies shall include all existing distribution equipment and all new distribution equipment supplied by the equipment manufacturer under this contract.

1.2 RELATED REQUIREMENTS

.1 Section 26 05 73.16 – Coordination Studies.

.2 Single Line Diagram.

1.3 REFERENCES

.1 Institute of Electrical and Electronics Engineers, Inc. (IEEE):

.1 IEEE 141 – Recommended Practice for Electric Power Distribution and Coordination of Industrial and Commercial Power Systems.

.2 IEEE 242 – Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems.

.3 IEEE 399 – Recommended Practice for Industrial and Commercial Power System Analysis.

.4 IEEE 241 – Recommended Practice for Electric Power Systems in Commercial Buildings.

.5 IEEE 1015 – Recommended Practice for Applying Low-Voltage Circuit Breakers Used in Industrial and Commercial Power Systems.

.6 IEEE 1584-2018 - Guide for Performing Arc-Flash Hazard Calculations.

.2 American National Standards Institute (ANSI):

.1 ANSI C57.12.00 – Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers.

.2 ANSI C37.13 – Standard for Low Voltage AC Power Circuit Breakers Used in Enclosures.

.3 ANSI C37.010-2016 – Standard Application Guide for AC High Voltage Circuit Breakers Rated on a Symmetrical Current Basis.

.4 ANSI C 37.41 – Standard Design Tests for High Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches and Accessories.

.3 CSA Group:

.1 CSA C22.1:21, Canadian Electrical Code, Part 1 (25th Edition), Safety Standard for Electrical Installations.

.2 Ontario Electrical Safety Code (28th edition/2021).

.3 CSA Z462:21, Workplace electrical safety.

1.4 SUBMITTALS

.1 Submit the protective device coordination study to the Consultant prior to receiving final review of the distribution equipment shop drawings and/or prior to release of equipment drawings for manufacturing. If formal completion of the studies may cause delay in equipment manufacturing, approval from the engineer may be obtained for preliminary submittal of sufficient study data to ensure that the selection of device and characteristics will be satisfactory.

.2 Upon review by the Consultant, submit the arc-flash study to the local electrical utility for their review and approval.

1.5 CLOSEOUT SUBMITTALS

.1 The results of the protective device coordination and arc flash hazard analysis studies shall be summarized in a final report. Three (3) bound copies of the complete final report shall be submitted. Additional copies of the complete report with input and output data shall be provided on CD in PDF format.

.2 The report shall include the following sections:

.1 Executive Summary.

.2 Descriptions, purpose, basis, and scope of the study.

.3 Tabulations of circuit breaker, fuse, and other protective device ratings versus calculated short circuit duties.

.4 Protective device time versus current coordination curves, tabulations of relay and circuit breaker trip unit settings, fuse selection.

.5 Fault current calculations including a definition of terms and guide for interpretation of the computer printout.

.6 Details of the incident energy and flash protection boundary calculations.

.7 Recommendations for system improvements, where needed.

.8 Single Line Diagram.

.3 Arc flash labels (refer to CSA Z462 Annex Q) shall be provided in hard copy only.

1.6 QUALIFICATIONS

.1 Arc flash hazard analysis studies shall be conducted under the supervision and approval of a licensed Professional Electrical Engineer skilled in performing and interpreting the power system studies.

.2 The licensed Professional Electrical Engineer shall be a full-time employee of the equipment manufacturer or an approved engineering firm.

.3 The licensed Professional Electrical Engineer shall have a minimum of eight (8) years of experience in performing power system studies.

.4 The equipment manufacturer or approved engineering firm shall demonstrate experience with Arc Flash Hazard Analysis by submitting names of at least ten actual arc flash hazard analysis it has performed in the past year.

1.7 COMPUTER ANALYSIS SOFTWARE

.1 The studies shall be performed using the latest revision of the SKM or equivalent.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Independent Testing Organizations:

.1 AC Tesla.

.2 Brosz and Associates.

.3 C-INTECH.

.4 Eastenghouse.

.5 Enkompass.

.6 G.T. Wood.

.7 Haronitis and Associates Ltd.

.2 Electrical distribution manufacturers:

.1 Eaton.

.2 Schneider Electric.

2.2 STUDIES

.1 The contractor shall furnish an Arc Flash Hazard Analysis Study per CSA Z462, reference Section 4.1.8.2.2, 4.3.3.

2.3 DATA COLLECTION

.1 Contractor shall furnish all data as required by the power system studies. The Engineer performing arc flash hazard analysis studies shall furnish the Contractor with a listing of required data immediately after award of the contract. The Contractor shall expedite collection of the data to assure completion of the studies as required for final approval of the distribution equipment shop drawings and/or prior to the release of the equipment for manufacturing.

.2 Source combination may include present and future motors and generators.

2.4 ARC FLASH HAZARD ANALYSIS

.1 The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in CSA Z462 Annex D.

.2 The flash protection boundary and the incident energy shall be calculated at all significant locations in the electrical distribution system (switchboards, switchgear, panelboards, and splitters) where work could be performed on energized parts.

.3 The Arc-Flash Hazard Analysis shall include all significant locations in 240 volt and 208 volt systems fed from transformers equal to or greater than 112.5 kVA where work could be performed on energized parts.

.4 Safe working distances shall be based upon the calculated arc flash boundary considering an incident energy of 1.2 calories per square centimetre.

.5 When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short-circuit and coordination study model. Ground overcurrent relays should not be taken into consideration when determining the clearing time when performing incident energy calculations.

.6 The short-circuit calculations and the corresponding incident energy calculations for multiple system scenarios must be compared and the greatest incident energy must be uniquely reported for each equipment location. Calculations must be performed to represent the maximum and minimum contributions of fault current magnitude for all normal and emergency operating conditions. The minimum calculation will assume that the utility contribution is at a minimum and will assume a minimum motor contribution (all motors off). Conversely, the maximum calculation will assume a maximum contribution from the utility and will assume the maximum amount of motors to be operating. Calculations shall take into consideration the parallel operation of synchronous generators with the electric utility, where applicable.

.7 The incident energy calculations must consider the accumulation of energy over time when performing arc flash calculations on buses with multiple sources. Iterative calculations must take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors and generators should be decremented as follows:

.1 Fault contribution from induction motors should not be considered beyond 3-5 cycles.

.8 Fault contribution from synchronous motors and generators should be decayed to match the actual decrement of each as closely as possible (e.g. contributions from permanent magnet generators will typically decay from 10 per unit to 3 per unit after 10 cycles).

.9 For each equipment location with a separately enclosed main device (where there is adequate separation between the line side terminals of the main protective device and the work location), calculations for incident energy and flash protection boundary shall include both the line and load side of the main breaker.

.10 When performing incident energy calculations on the line side of a main breaker (as required per above), the line side and load side contributions must be included in the fault calculation.

.11 Mis-coordination should be checked amongst all devices within the branch containing the immediate protective device upstream of the calculation location and the calculation should utilize the fastest device to compute the incident energy for the corresponding location.

.12 Arc Flash calculations shall be based on actual overcurrent protective device clearing time.

.13 Maximum clearing time will be capped at 2 seconds based on IEEE 1584.

.14 Where it is not physically possible to move outside of the flash protection boundary in less than 2 seconds during an arc flash event, a maximum clearing time based on the specific location shall be utilized.

2.5 REPORT SECTIONS

.1 Incident energy and flash protection boundary calculations:

.1 Arcing fault magnitude.

.2 Protective device clearing time.

.3 Duration of arc.

.4 Arc flash boundary.

.5 Working distance.

.6 Incident energy.

.7 Hazard Risk Category.

.8 Recommendations for arc flash energy reduction.

PART 3 - EXECUTION

3.1 FIELD ADJUSTMENT

.1 Adjust relay and protective device settings according to the recommended settings table provided by the coordination study. Field adjustments to be completed by the engineering service division of the equipment manufacturer under the Startup and Acceptance Testing contract portion.

.2 Make minor modifications to equipment as required to accomplish conformance with short circuit and protective device coordination studies.

.3 Notify Owner in writing of any required major equipment modifications.

3.2 ARC FLASH WARNING LABELS

.1 The contractor of the Arc Flash Hazard Analysis shall provide a 90 mm (3.5 in) by 125 mm (5 in) thermal transfer type label of high adhesion polyester for each work location analyzed.

.2 All labels will be based on recommended overcurrent device settings and will be provided after the results of the analysis have been presented to the owner and after any system changes, upgrades or modifications have been incorporated in the system.

.3 The label shall include the following information, at a minimum:

.1 Location designation.

.2 Nominal voltage.

.3 Flash protection boundary.

.4 Hazard risk category.

.5 Incident energy.

.6 Working distance.

.7 Engineering firm and issue date.

.8 Labels shall be machine printed, with no field markings.

.4 Arc flash labels shall be provided in the following manner and all labels shall be based on recommended overcurrent device settings.

.1 For each 600 volt, and applicable 208 volt panelboard, one arc flash label shall be provided.

.2 For each motor control centre, one arc flash label shall be provided.

.3 For each low voltage switchboard, one arc flash label shall be provided.

.4 For each switchgear, one flash label shall be provided.

.5 For medium voltage switches one arc flash label shall be provided.

.5 Arc Flash Warning Label General Instructions:

.1 Only qualified electricians who recognize and avoid the electrical and Arc Flash hazards are allowed to place the arc flash warning labels.

.2 Electricians should wear suitable PPE, such as electrical safety boots, Safety Glasses, etc. while performing labeling.

.3 Generally, arc flash label shall be put on a prominent pre-cleaned place on the front of the electrical equipment (such as switchgear, panel, disconnect switch, generator output breaker). Label should be visible and readable, displayed horizontally, attached flatly and securely, and not allowed to cover other signs or labels on the equipment.

.4 Under the special request of the client, labels could be put on the back of the panel door when the panel is located in clean and finished spaces such as an office area.

.5 When putting a label on small equipment with no space labeling on the wall just beside the equipment is allowed.

.6 Special request may be attached to this General Instruction. For examples, more than one identical label is applied for large equipment; different labels could be applied for different sections of one equipment; for a splitter with several disconnect switches only one label is placed on the splitter for this group.

.7 Take the pictures for each label to indicate both names of the label and equipment and labeling area of the equipment. Email these pictures to the Consultant for quality control and record.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Electrical connections to equipment specified in other sections.

.2 Conduit rough-ins for future equipment.

1.2 RELATED REQUIREMENTS

.1 Division 08 – Openings.

.2 Division 11 – Equipment.

.3 Division 14 – Conveying Equipment.

.4 Division 20 – Common Mechanical Requirements.

.5 Section 20 05 13 – Common Motor Requirements for Mechanical Equipment.

.6 Division 21 – Fire Suppression.

.7 Division 22 – Plumbing.

.8 Division 23 – Heating, Ventilating, and Air Conditioning.

.9 Division 25 – Integrated Automation.

1.3 REFERENCES

.1 NEMA WD 1 - General Colour Requirements for Wiring Devices.

.2 NEMA WD 6 - Wiring Devices - Dimensional Requirements.

1.4 COORDINATION

.1 Coordinate work to Section 01 31 00.

.2 Obtain and review shop drawings, product data, and manufacturer's instructions for equipment provided under other sections.

.3 Determine connection locations and requirements.

.4 Sequence rough-in of electrical connections to coordinate with installation schedule for equipment.

.5 Sequence electrical connections to coordinate with start-up schedule for equipment.

1.5 SUBMITTALS

.1 Submit to Section 01 33 00.

.2 Product Data: Provide wiring device manufacturer's catalogue information showing dimensions, configurations, and construction.

.3 Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.6 REGULATORY REQUIREMENTS

.1 Provide products listed and classified by testing firm acceptable to authority having jurisdiction as suitable for purpose specified and shown.

PART 2 - PRODUCTS

2.1 COMMON MOTOR REQUIREMENTS

.1 Motors up to and including 1/3 hp, shall be 1 phase, 60 Hz, 120 V.

.2 Motors 1/2 hp and above shall be 3 phase, 60 Hz, 575 V or 208 V.

2.2 CORDS AND CAPS

.1 Attachment Plug Construction: Conform to NEMA WD 1.

.2 Configuration: NEMA WD 6; match receptacle configuration at outlet provided for equipment.

.3 Cord Construction: NFPA 70, Type SJO multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.

.4 Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.

PART 3 - EXECUTION

3.1 CONDUIT PATHWAYS AND ROUGH-INS

.1 Where drawings indicate to rough-in conduits for future equipment, or equipment to be provided by the Owner, or other systems as noted on the plans, provide pull string in the conduit, and tag the conduit for the reserved future use/purpose.

.2 Where circuits breakers, disconnect switches, or other electrical distribution is provided for future equipment, tag the devices with the reserved future use/purpose.

3.2 WIRING OF EQUIPMENT PROVIDED UNDER OTHER DIVISIONS

.1 Use the following procedures for wiring of motors and equipment provided under other Divisions.

.2 The following equipment shall be responsibility of the trade supplying the equipment unless otherwise noted, in accordance with the requirements laid out in the individual section, or this division:

.1 Motors.

.2 Starters.

.3 Variable Frequency Drives.

.4 Motor Control Centres.

.5 Control wiring.

.3 In every instance, install starter, motor control centre, variable frequency drivers (VFD), etc. and wire to line side of the starter, the Motor Control Centre (MCC), or VFD. Extend wiring from starter, MCC, or VFD to motor as indicated.

.4 Provide all wiring for starters and VFD’s from supply to starter to VFD and to motor. Coordinate requirements with the appropriate trade.

.5 Provide 500 mm of liquid tight flexible metal conduit for final connection to motor. Provide disconnect switches where required by code, and as indicated on the drawings.

.6 Where individual starters and controls are grouped together provide a panel for mounting this equipment. Provide a feeder, main fused disconnect and a splitter of adequate size and capacity and wire to line side of the starters on this panel and from starters to motors.

.7 Equipment, General

.1 Ascertain exact locations of starters, motor control centres, motors, etc. from drawings and coordinate exact locations with the supplying trade.

.2 Control wiring shall be the responsibility of the supplying trade.

.1 Control wiring shall be in accordance with Section 26 05 19, and Section 26 05 23.

.2 Control wiring shall be installed in conduit in accordance with Section 26 05 33.13.

.8 Doors

.1 Ascertain exact locations of door operators, push buttons, automatic sensors, and other door hardware.

.2 Provide branch circuit wiring for door operators.

.3 Provide control and control wiring for all low voltage door interconnections.

.9 Overhead Doors and Folding Vehicle Doors

.1 Ascertain exact locations of control panels, remote controls, safety equipment such as safety eyes, overhead door contacts, etc. from shop drawings and architectural drawings, and coordinate exact locations with overhead door trade.

.2 Provide branch circuit wiring for door controls.

.3 Provide control and control wiring for all low voltage door interconnections.

.10 Conveying Equipment (e.g. Elevators): in accordance with Section 26 05 83.14.

.11 Plumbing Equipment

.1 Ascertain exact locations of starters, motor control centres, motors, infra-red plumbing fixture controls from Mechanical Drawings and coordinate exact locations with plumbing trade.

.2 Provide branch circuit wiring and an outlet for each infra-red plumbing fixture control.

.3 Control wiring shall be the responsibility of the plumbing trade, as described above.

.12 HVAC Equipment

.1 Ascertain exact locations of starters, motor control centres, motors, motorized dampers, VAV boxes, and heating control valves from HVAC drawings and coordinate exact locations with HVAC Division.

.2 In the case of unit heaters, reheat coils and cabinet unit heaters, terminate wiring on terminals provided. Control wiring, thermostats, or other control devices shall be the responsibility of the HVAC trade, as described above.

.3 Provide branch circuit wiring and an outlet for each motorized damper, variable air volume (VAV) box, or heating control valve. Control wiring shall be the responsibility of the HVAC trade, as described above.

.4 Provide 120 V power connections to small exhaust fans, and ceiling fans for all line voltage control devices, including but not limited to wiring through toggle switches, line voltage thermostats, countdown timer switches, or line voltage speed controllers. Refer to mechanical drawings and schedules for control devices and coordinate requirements with HVAC Division.

.5 Provide 120 V wiring connections to duplex receptacles integral with air handling unit control panels.

.6 Provide 120 V wiring connections to HVAC maintenance receptacles integral with roof mounted HVAC equipment.

.7 Provide 120 V wiring connections to lighting fixture/switch combinations integral with air handling units.

.13 Integrated Automation (Building Automation System)

.1 Provide 120 V wiring connections to BAS system controllers/panels and other control system or component requiring 120 V power including, but not limited to, VAV boxes, dampers, low voltage transformers, etc.

.2 From equipment as noted on drawings, extend suitable wiring in conduit from equipment contacts to designated BMS panel serving area, terminating wiring and conduit in a junction box. Leave wiring un-terminated with slack coiled length of minimum 2 m (6 ft) long. Clearly label junction box and wiring end for termination onto BMS panel by respective Mechanical Trade.

3.3 EXAMINATION

.1 Verify that equipment is ready for electrical connection, wiring, and energization.

3.4 ELECTRICAL CONNECTIONS

.1 Provide a local disconnect switch for all equipment, regardless of if a disconnect switch is shown or not shown on the plans.

.2 Make electrical connections to equipment manufacturer's instructions.

.3 Make conduit connections to equipment using flexible conduit. Use liquid-tight flexible conduit with watertight connectors in damp or wet locations.

.4 Make wiring connections using wire and cable with insulation suitable for temperatures encountered in heat producing equipment.

.5 Provide receptacle outlet where connection with attachment plug is indicated. Provide cord and cap where field-supplied attachment plug is indicated.

.6 Provide suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

.7 Install disconnect switches, controllers, control stations, and control devices as indicated.

.8 Modify equipment control wiring with terminal block jumpers as indicated.

.9 Provide interconnecting conduit and wiring between devices and equipment where indicated.

END OF SECTION

Updated through ADD#14

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Commissioning of all building electrical systems and component including:

.1 Testing and adjustment.

.2 Demonstration and training.

.3 Instructions of all procedures for Owner's personnel.

.4 Updating as-built data.

.5 Co-ordination of Operation and Maintenance material.

.2 Provide labour and material to conduct the commissioning process as outlined in this specification section, including the hiring of an Independent Testing Contractor (ITC) as detailed below.

.3 Provisions of this section shall apply to all sections of Division 26, Division 27, Division 28, and sections related to electrical utilities in Division 33.

1.2 RELATED REQUIREMENTS

.1 Testing and commissioning are called for throughout the individual specifications. This does not relieve this trade from providing all testing and commissioning necessary to ensure that systems and equipment operate as required and that they interface with other systems and equipment as required.

.2 Section 26 08 50 – Commissioning of Lighting: additional commissioning requirements for commissioning of lighting and lighting controls.

1.3 COMMISSIONING PROCESS ALLOCATION

.1 The commissioning process shall be allocated a value equal to 5 per cent of the contract. The Electrical Contractor may draw from this allocation as the commissioning process is completed.

.2 The Electrical Contractor shall submit all test and verification forms. The Consultant will use these forms to calculate percentage complete.

.3 The Electrical Contractor may claim up to 3 per cent of the contract from this allocation leading up to performance testing. The remaining 2 per cent shall not be paid out until the performance testing, O&M manuals, and training have been completed satisfactorily.

1.4 DEFINITIONS

.1 Cx – Commissioning.

.2 Commissioning Provider (CxP)

.1 The Commissioning Provider (CxP), also referred to as the Commissioning Consultant, shall be hired by The Owner.

.2 The CxP responsibilities shall include:

.1 preparing the commissioning plan.

.2 co-ordinating with the contractor to schedule tests.

.3 preparing a test form manual.

.4 witnessing selected tests.

.5 receiving all test forms.

.6 co-ordinating the contractors training.

.7 chair the commissioning meetings.

.3 The Electrical Contractor shall co-operate with the CxP.

.4 The Electrical Contractor shall provide assistance to the CxP and have personnel available during the performance testing procedure. Each electrical system shall be tested in the operational mode.

1.5 SUBMITTALS

.1 Conform to Section 01 33 00 for requirements for shop drawings and record drawings.

.2 A commissioning document shall be prepared by the CxP prior to conducting these activities for use by the Commissioning Team.

.3 The electrical sub-contractor shall be responsible for ensuring all activities are properly documented in this manual and co-ordinated through the General Contractor.

.4 As-built drawings and data books must be available two weeks prior to commissioning for review and use by the consultant and Commissioning Team prior to the start of the commissioning activities.

1.6 CLOSEOUT SUBMITTALS

.1 Attendance records for all training sessions.

.2 Testing reports for system load balance measurements, infra-red test and harmonics tests.

1.7 QUALITY ASSURANCE

.1 Provide qualified trades persons, certified testing agencies, factory trained and approved by the Commissioning Team Leader.

.2 Submit the names of all personnel to be used during the Commissioning activities.

1.8 WARRANTY

.1 Equipment and system warranties shall not begin until the system demonstration and turnover has been conducted successfully and accepted by the Owner.

.2 The Electrical Contractor shall fill out the warranty form listing the equipment and systems and the start and finishing dates for warranty.

.3 Refer to Division 01 and Section 26 05 00 for the requirements during the warranty period.

PART 2 - PRODUCTS

2.1 EQUIPMENT

.1 The Contractor and manufacturers shall provide all instrumentation and equipment necessary to conduct the tests specified. The Contractor shall advise the Consultant of instrumentation to be used and the dates the instruments were calibrated.

PART 3 - EXECUTION

3.1 THE COMMISSIONING PROCESS

.1 The purpose of the commissioning process is to fully test all building systems including architectural, mechanical, and electrical components and operating procedures by challenging these systems to realistic operation conditions.

.2 The commissioning process consists of:

.1 Shop Drawings and Record Drawings.

.2 Installation inspection and equipment verification.

.3 Independent testing contractor.

.4 Testing of equipment and systems.

.5 Commissioning meetings.

.6 Operating and maintenance manuals.

.7 Operating training.

.8 Commissioning Agent testing.

.9 Systems Demonstration and turnover.

.10 Testing forms.

.11 Warranties.

3.2 PREPARATION

.1 Provide test instruments required for all activities as defined in the commissioning documents.

.2 Verify all systems are in compliance with the requirements of the commissioning documents prior to the pre-commissioning check out operation.

.3 Confirm all scheduled activities have identified personnel available.

.4 Where systems or equipment do not operate as required, make the necessary corrections or modifications, re-test and re-commission.

3.3 SYSTEM DESCRIPTION

.1 Perform all start-up operations, control adjustment, trouble shooting, servicing and maintenance of each item of equipment as defined in the commissioning documentation.

.2 Owner will provide list of personnel to receive instructions and will co-ordinate their attendance at agreed upon times.

.3 Prepare and insert additional data in the operations and maintenance manuals and update as-built drawings when need for additional data becomes apparent during the commissioning exercise.

.4 Where instruction is specified in the commissioning manual, instruct personnel in all phases of operation and maintenance using operation and maintenance manuals as the basis of instruction.

.5 Conduct presentation on Owner's premises. Owner will provide space.

3.4 COMMISSIONING

.1 Commission the components of the electrical system using the NETA Acceptance Testing Specifications.

.2 Refer to the project commissioning plan prepared by the CxP.

.3 Commissioning activities for the electrical systems must have available up to date as-built drawing information and accurate Operations and Maintenance Manuals. These documents shall be a major part of this activity.

.4 Contractor shall be responsible to update all documentation with information and any changes duly noted during the Commissioning exercise.

.5 Contractor shall arrange for all outside suppliers, equipment manufacturers, test agencies and others as identified in the commissioning sections of this specification. The cost associated with this requirement shall be included as part of the tender price.

3.5 FINAL REPORT

.1 This trade shall assemble all testing data and commissioning reports and submit them to the General Contractor for submission to the Owner.

.2 Each form shall bear signature of recorder, and that of supervisor of reporting organizer.

3.6 SCHEDULE OF ACTIVITIES

.1 Commissioning activities shall be conducted based on pre-established schedule with all members of the commissioning team.

.2 In addition, there will be two meetings held through the contract duration to introduce the parties of the commissioning team, establish the schedules and deadlines for the various activities and review the Commissioning Manual.

.3 Adhering to the established schedule is very important as the co-ordination and scheduling of the participants will be difficult to alter once this is established. Close co-ordination of this schedule is important.

.4 In the event project cannot be commissioned in the allotted time slot, the contractor shall pay for all costs associated with assembling the Commissioning Team at a later date. If the contractor has not performed his duties to reach commissioning stage as outlined earlier, he will incur all expenses of other trades and the Commissioning Team due to his non-compliance.

3.7 INSTALLATION INSPECTION AND EQUIPMENT VERIFICATION

.1 The Electrical Contractor shall co-ordinate with the Electrical Consultant who will inspect the electrical installation.

.2 The Electrical Contractor shall complete the equipment verification forms for each piece of equipment. The forms shall be included in the operating and maintenance manual. The equipment data shall include:

.1 Manufacturers name, address, and telephone number.

.2 Distributors name, address, and telephone number.

.3 Make, model number and serial number.

.4 Voltage and current ratings.

3.8 INDEPENDENT TESTING CONTRACTOR

.1 The Independent Testing Contractor (ITC) shall be hired by the contractor and shall issue reports to the Electrical Consultant.

.2 The ITC shall conduct load balancing measurements to verify load balancing performed in accordance with Section 26 05 00.

3.9 TESTING OF EQUIPMENT AND SYSTEMS

.1 The Electrical Contractor shall be responsible for all tests detailed in this Section, and those tests required by a manufacturer as part of their installation requirements.

.2 The Electrical Contractor shall schedule all tests which shall be witnessed by the Electrical Consultant or the Commissioning Consultant. The contractor shall complete and sign the testing forms.

.3 The Electrical Contractor shall conduct tests on the following equipment as a minimum. Refer to the individual specification sections for test procedures.

.1 Section 26 05 19 – Low-Voltage Electrical Power Conductors and Cables.

.2 Section 26 05 73.16 – Coordination Studies.

.3 Section 26 24 13 – Switchboards.

.4 Section 26 24 16 – Panelboards.

.5 Section 26 24 19 – Motor Control Centres.

.6 Section 27 51 16 – Public Address Systems.

.7 Section 28 10 00 – Access Control.

.8 Section 28 46 13 – Fire-Alarm Systems.

.4 When all testing has been completed and all mechanical and electrical systems are operational the contractor shall conduct system load balance measurements, infra-red test and harmonics tests.

3.10 COMMISSIONING MEETINGS AND REPORTING

.1 The Electrical Contractor shall include the schedule for all tests in the construction schedule.

.2 The Commissioning meetings shall occur during the regular construction meetings. The testing schedules and the results of all tests shall be reviewed.

.3 All testing forms and reports associated with the electrical systems shall be directed to the Electrical Consultant, with copies to the Consultant, Commissioning Consultant, and the Owner.

.4 The forms and reports to be issued shall include:

.1 Shop drawings, issued and accepted.

.2 Equipment verification forms.

.3 Testing forms.

.4 Reports resulting from tests.

.5 Testing schedule.

.6 Minutes of commissioning meetings.

.7 Manufacturers' Certificates.

3.11 OPERATING AND MAINTENANCE MANUAL

.1 Conform to the specification section for the requirements of the O&M manuals.

3.12 CLOSEOUT ACTIVITIES

.1 Conform to section for requirements for instructions to the Building Owner for each system and equipment.

.2 The training shall be provided by qualified technicians or electricians and shall be conducted in a classroom and at the equipment or system.

.3 The training sessions shall be scheduled, co-ordinated and video recorded by the Commissioning Consultant.

.4 Each training session shall be structured to cover:

.1 The operating and maintenance manual.

.2 Operating procedures.

.3 Maintenance procedures.

.4 Troubleshooting procedures.

.5 Spare parts.

.5 Submit a course outline to the Electrical Consultant before training commences. Provide course documentation for up to eight people.

.6 The training session shall be scheduled and co-ordinated by the Commissioning Consultant. Contractor shall video tape the sessions.

.7 Training shall be provided for the following systems:

.1 Electrical Systems including distribution and lighting: 8 hour minimum

.2 Section 27 51 16 – Public Address Systems: 1 hour minimum

.3 Section 28 10 00 – Access Control: 1 hour minimum

.4 Section 28 46 13 – Fire-Alarm Systems: 2 hours minimum

.8 The Electrical Contractor shall conduct a walkthrough of the installation. During the walkthrough the Electrical Contractor shall:

.1 Identify equipment.

.2 Identify electrical panels.

.3 Identify starters and disconnects.

.4 Review the electrical power distribution.

.5 Review the light power distribution.

.6 Review the switchgear.

.7 Review the general maintenance procedures.

3.13 THE ELECTRICAL SYSTEM DEMONSTRATION AND TURNOVER

.1 The system demonstration and turnover to The Owner shall occur when:

.1 The installation is complete.

.2 The acceptance test conducted by the Electrical Consultant has been completed successfully.

.3 Training has been completed.

.4 Equipment Operating and Maintenance Manuals have been accepted.

.5 System operating manuals have been accepted.

.6 Shop-drawings have been updated.

.7 As-built drawings have been completed.

.8 The commissioning process has been completed successfully and system operation accepted by the Electrical Consultant and Commissioning Consultant.

.2 The systems demonstration shall be conducted by the Electrical Contractor and manufacturers. The demonstration shall cover a physical demonstration of equipment installation and operation.

3.14 TESTING FORMS

.1 The Electrical Contractor and manufacturers shall fill out the forms listed in this section or provide other forms. The forms must be approved by the Electrical Consultant and the Owner before they are used.

END OF SECTION

Task	Contractor	Consultant	Commissioning
Manufacturer's Start-Up Checklist Completed			
Cooling System			
Inspect heat exchanger/radiator for leaks, damages and debris			
Check filter cap gasket and sealing surfaces			
Check ventilation louver operation			
Check coolant level, PH level, oil and rust contaminate			
Check hoses and connections for deterioration and tightness			
Check jacket water heater hoses for proper operation			
Check jacket water pump for leaks and unusual noises			
Check coolant conditioner concentration and temperature protection			
Check fan drive pulleys, belts and fan for proper lubrication, tension and wear, and clearance.			
Fuel System			
Verify natural gas isolation valve annunciates at control panel and/or fire alarm annunciator as specified on drawings			
Check fuel lines for leaks and tightness			
Check fuel line brackets for wear points			
Inspect governor oil level			
Check all governor control linkages for free movement			
Inspect primary and secondary fuel filters for leaks			
Air Induction and Exhaust System			
Inspect air filter restriction indicator for reading			
Inspect and clean air filter			
Inspect air filter housing and piping for leaks			
Inspect turbo chargers for oil/exhaust leaks			
Inspect exhaust manifolds for leaks, loose hardware and oil carry over.			
Inspect muffler and piping for leaks, loose hardware, rain cap and supports, drain muffler			
Inspect crankcase vent for restrictions or excessive blow by			
Lubrication System			
Check lube oil level and top up			
Check proper operation of oil pressure gauge			
Check hoses and piping for leaks			
Inspect unit for leaks			
Starting System			
Check starting batteries for electrolyte level and specific gravity.			
Clean and check batteries for loose/corroded connections			

Task	Contractor	Consultant	Commissioning
Load test batteries, measure voltage drop			
Inspect starter for loose connection and unusual noises			
Check battery charger output/float rate and equalize timer			
Inspect battery charger output'/float rate and equalize timer			
Inspect charging alternator belts, pulleys and voltage output.			
Engine Monitors and Safety Controls			
Check operation of LOP, HWT and over speed shutdown circuits			
Inspect and test all alarms for proper operation			
Inspect and perform functional test of natural gas valve alarms.			
Inspect wiring harness for weak and loose connections			
Check operation of engine mounted control panel and do an ATS Transfer Test if Allowed.			
Check oil pressure, water temperature, and alternator gauges for readings			
Control Panel			
Check for proper manual operation			
Operational check for correct voltmeter reading (adjust if necessary)			
Operational check for correction ammeter reading			
Operational check for correct frequency reading			
Inspect electrical connections			
Training and Demonstration			
Manufacturer's Performance Verification Checklist submitted to Cx Manager for final PV.			

END OF SECTION

Task	Contractor	Consultant	Commissioning
Manufacturer's Start-Up Checklist Completed			
ATS Visual Inspections			
ATS is correct voltage, ampacity			
Check terminations.			
Check for no voltage on Normal terminals with Normal source locked out and engine start disabled			
Check for no voltage on Emergency terminals with Emergency source locked out and engine start disabled			
Check ATS free from debris			
Check buswork and supporting hardware for carbon tracking, cracks, corrosion, or any other types of deterioration.			
Check stationary and movable contacts.			
Check system hardware for loose connections.			
Check all control wiring and power cables (especially wiring between or near hinged door) for signs of wear or deterioration.			
Check all control wiring and power cables for loose connections.			
Check cabinet interior for loose hardware.			
Check phase rotation.			
Tighten buswork, control wiring, power cables, and system hardware, as necessary.			

Task	Contractor	Consultant	Commissioning
ATS Operation			
Connect the set starting batteries. Connect the normal Bypass Operation			
Verify proper operation of the battery charger.			
Test system operation by enabling test function on transfer switch and verify transfer sequence and timers.			
Test system bypass isolation operation.			
Verify Bypass/Isolation interlocks			
Verify Bypass/Isolation indicator lights.			
Close and lock the cabinet door.			
Verify engine startup and transfer to generator on loss of normal source.			
Verify engine cooldown and shutdown after transfer back to normal power.			
Verify alarm contacts.			
Training and Demonstration			
Manufacturer's Performance Verification Checklist submitted to Cx Manager for final PV.			

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Common requirements for commissioning of all electric lighting, including interior, exterior, and emergency lighting.

.2 The party responsible for the functional testing shall not be directly involved in either the design or construction of the project.

1.2 RELATED REQUIREMENTS

.1 Section 26 09 23 – Lighting Control Devices.

.2 Section 26 51 19 – LED Interior Lighting.

.3 Section 26 52 13.13 – Emergency Lighting.

.4 Section 26 56 19 – LED Exterior Lighting.

1.3 REFERENCES

.1 ASHRAE

.1 ASHRAE Guideline 0-2005 – The Commissioning Process.

.2 ANSI/ASHRAE/IES 90.1-2013 – Energy Standard for Building Except Low-Rise Residential Buildings.

.2 Illumination Engineering Society (IES)

.1 IES DG-29-11 – Design Guide for the Commissioning Process Applied to Lighting and Control Systems.

.3 Ontario Building Code

.1 Supplementary Standard SB-10: Energy Efficiency Requirements, December 22, 2016 update.

1.4 ACTION SUBMITTALS

.1 Refer to Section 01 33 00.

.2 Submit sample commissioning forms.

1.5 CLOSEOUT SUBMITTALS

.1 Section 01 78 00: Submittals for project closeout.

.2 Submit commissioning reports.

.1 Submit a floor plan or spreadsheet table checklist that indicates each local lighting control device, occupancy sensors, daylighting controls, system component.

.2 Submit the system sequence of operation fully describing the equipment components and functionality, including set points and alarm functions.

.3 The detailed sequence of operation shall be provided regardless of the completeness and clarity of the sequences in the controls specification and/or drawings.

.3 The functional testing party shall provide documentation certifying that the installed lighting controls meet or exceed all documented performance criteria.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 SITE TESTS AND INSPECTIONS

.1 Sensor placement and orientation for all sensor types.

.2 Occupancy sensor function, sensitivity, and time delays.

.3 Daylight harvesting sensor calibration.

.4 Automated shade operation.

.5 Manual control placement and operation.

.6 Automated control operation, including scheduled on/off functions and dimming trims and presets.

.7 Override operation, access, and functionality.

.8 Centralized control interfaces and operation.

.9 Client education of operations.

.10 Documentation archived to client.

3.2 FUNCTIONAL TESTING

.1 Lighting control devices and control systems shall be tested to ensure that control hardware and software are calibrated, adjusted, programmed, and in proper working condition in accordance with the construction documents and manufacturer's installation instructions.

.2 When occupant sensors, time switches, programmable schedule controls, or photosensors are installed, at a minimum, the following procedures shall be performed:

.1 Confirm that the placement, sensitivity, and time-out adjustments for occupant sensors yield acceptable performance, lights turn off only after space is vacated and do not turn on unless space is occupied.

.2 Confirm that time switches and programmable schedule controls are programmed to turn the lights off.

.3 Confirm that photosensor controls reduce electric lights levels based on the amount of usable daylight in the space as specified.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Materials and installation for contactors for system voltages up to 600 V.

1.2 REFERENCES

.1 CSA Group:

.1 CSA C22.2 No. 14-18, Industrial Control Equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Allen Bradley "500L" series

.2 Eaton.

.3 Schneider Electric.

.4 Siemens.

2.2 CONTACTORS

.1 Contactors: to CSA C22.2 No. 14.

.2 Electrically held controlled by pilot devices as indicated and rated for type of load controlled. Half size contactors not accepted.

.3 Contactors shall be electrically held 60 Hz, 120 V coil; NEMA Type 1 general purpose enclosure.

.4 Fused switch combination contactor as indicated.

.5 Complete with 2 normally open and 2 normally closed auxiliary contacts unless indicated otherwise.

.6 Mount in CSA Enclosure 1 unless otherwise indicated.

.7 Include following options in cover:

.1 Red indicating lamp.

.2 Hand-Off-Auto selector switch.

.8 Provided complete with control transformer, in contactor enclosure.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install contactors and connect auxiliary control devices.

3.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 53.

.2 Size 4 nameplate indicating name of load controlled as indicated.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Occupancy and Vacancy sensors.

.2 Power packs, and auxiliary relays, momentary switches.

.3 Manual controls devices, including dimming switches and low voltage momentary switches.

.4 Timer switches.

.5 Daylight harvesting photo sensors.

.6 Emergency lighting control units.

1.2 PRODUCTS INSTALLED BUT NOT SUPPLIED UNDER THIS SECTION

.1 Line voltage manual control devices, as described in Section 26 27 26 – Wiring Devices.

.2 Multi-zone scene controllers, as described in Section 26 09 36 – Modular Dimming Controls.

1.3 RELATED REQUIREMENTS

.1 Section 26 08 50 – Commissioning of Lighting.

.2 Section 26 27 26 – Wiring Devices.

.3 Section 26 51 19 – LED Interior Lighting.

.4 Section 26 56 19 – LED Exterior Lighting.

1.4 REFERENCES

.1 CSA Group:

.1 CSA C22.1:21, Canadian Electrical Code, Part 1 (25th Edition), Safety Standard for Electrical Installations.

.2 Ontario Electrical Safety Code (28th edition/2021).

.3 CSA C22.2 No. 14-13 – Industrial Control Equipment.

.4 CSA C22.2 No. 42 - General Use Receptacles.

.5 CSA C22.2 No. 42.1 - Cover Plates for Flush Mounted Wiring Devices.

.6 CSA C22.2 No. 184 - Solid-State Lighting Controls.

.7 CSA C22.2 No. 184.1 - Solid State Dimming Controls.

.8 CSA C22.2 No. 156 - Solid-State Speed Controls.

.2 National Electrical Manufacturers Association (NEMA):

.1 WD1 (R2005) –- General Color Requirements for Wiring Devices.

.2 WD6 – Dimensional Specifications.

.3 Ontario Building Code.

.4 UL 924 - Standard for Safety of Emergency Lighting and Power Equipment.

1.5 SUBMITTALS

.1 In accordance with Section 01 33 00.

.2 Product Data:

.1 Submit manufacturer's descriptive literature and product specifications for each product.

.2 Manufacturer's product drawings.

.3 Manufacturer's installation instructions.

.3 Where the lighting controls include the option for custom engraving, or custom touchscreen user interfaces on control devices, switches, or scene controllers, the Contractor is to submit proposed engraving/labelling/graphics as part of the shop drawing submittal, for review by the Owner.

1.6 CLOSEOUT SUBMITTALS

.1 Documentation of all lighting control system setpoints, sensor sensitivities, occupancy sensor timeouts, and as-programmed sequences of operation to aid in future troubleshooting.

.2 Lighting controls functional test report.

1.7 QUALITY ASSURANCE

.1 Manufacturer Qualifications: Products free of defects in material and workmanship.

1.8 WARRANTY

.1 Product is warranted free of defects in material and workmanship.

.2 Product is warranted to perform the intended function within design limits.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Wattstopper DLM.

.2 Acuity Brands Lighting (nLight, Sensorswitch).

.3 Cooper Lighting Solutions.

.4 Current Lighting (formerly Hubbell/GE).

.5 Lutron Vive.

2.2 GENERAL REQUIREMENTS OF ALL SENSORS AND POWER PACKS

.1 Manufactured by an ISO 9002 certified manufacturing facility and shall have a defect rate of less than 1/3 of 1 per cent.

.2 Five year warranty and CUL listed.

.3 In the event of failure, provide a bypass manual "override on" feature on each sensor.

.4 When bypass utilized, lighting to remain on constantly, or control is to be diverted to a wall switch until sensor is replaced. The override feature is to be designed for use by building maintenance personnel and not be readily achieved by building occupants.

2.3 OCCUPANCY AND VACANCY SENSORS

.1 General:

.1 Sensors using passive infrared, ultrasonic, microphonic, and multi-technology adaptive technology.

.2 Sensor timeouts configurable by system software.

.3 Electrical: Rating: 24 VDC input voltage, up to 40 mA current draw.

.4 Mechanical: Mounting: Sensors for mounting on ceilings and walls, including corners, must be available.

.5 Environmental:

.1 Operating Temperature Range: 0 degrees C to 40 degrees C

.2 Relative Humidity: 0 per cent to 95 per cent non-condensing.

.2 Dual Technology Wall Switch Sensor, 24V

.1 Wattstopper DW-100-24-W series (Basis of Design).

.2 Sensor capable of detecting presence in the control area by detecting Doppler shifts in transmitted ultrasound and passive infrared heat changes.

.3 Utilize a dual sensing verification principle for coordination between ultrasonic and Passive Infrared (PIR) Technologies to reduce likelihood of false triggering.

.4 For best results, sensor shall feature a trigger mode where the end-user can choose which technology will activate the sensor from Off mode (initial), the type of detection that will reset the time delay (maintain), and the type of detection that will cause the sensor to be turned back on immediately after the lights are turned off due to lack of motion (re-trigger). Selection of technologies for initial, maintain, and re-trigger shall be done with DIP switches.

.5 Sensor shall have its trigger mode factory preset to allow for quick installation in most applications. In this default setting, both technologies must occur in order to initially activate lighting systems. Detection by either technology shall maintain the lighting on, and detection by either technology shall turn lights back on after lights were turned off for 5 seconds or less in automatic mode, and 30 seconds or less in manual mode.

.6 Robotic test method, as referred in the NEMA WD 7 Guide, shall be utilized for minor motion coverage verification.

.7 Ultrasonic sensing shall be volumetric in coverage with a frequency of 40 kHz. It shall utilize Advanced Signal Processing which automatically adjusts the detection threshold dynamically to compensate for constantly changing levels of activity and air flow throughout controlled space.

.8 The PIR technology shall utilize a temperature compensated, dual element sensor and a multi-element Fresnel lens. The lens shall filter short wavelength IR, such as those emitted by the sun and other visible light sources. Face lens grooves in to avoid dust and residue build up which affects IR reception.

.9 Utilize zero crossing circuitry to reduce stress on relay, and therefore increase sensor life.

.10 Operate at 24 VDC and halfwave rectified and utilize a power pack or lighting control system input module to supply power.

.11 To blend in aesthetically, sensor protrusion not more than 3/8” from the wall and utilize colour-matched lens.

.12 To assure detection at desktop level uniformly across the space, sensor shall have a 28 segment, 2 level, Fresnel injection molded lens.

.13 Sensor shall feature a walk-through mode, where lights turn off 3 minutes after the area is initially occupied if no motion is detected after the first 30 seconds, set by DIP switch.

.14 To avoid false ON activations and to provide immunity to RFI and EMI, Detection Signature Analysis shall be used to examine the frequency, duration, and amplitude of a signal, to respond only to those signals caused by human motion.

.15 Coverage up to 1,000 sq. ft. for walking motion, with a field view of 180 degrees.

.16 Automatic-ON or manual-ON operation, adjustable with a DIP switch.

.17 Sensor shall have an adjustable time delay.

.18 Each sensing technology shall have an LED indicator that remains active at all times, in order to verify detection within the area to be controlled.

.19 Sensor shall have a service switch to allow end-users to operate the sensor in the unlikely event of a failure; set by a trim pot.

.20 Sensor shall have a built-in light level that features simple, one-step daylighting setup that works from 8 fc to 180 fc.

.21 The Dual Technology wall switch sensor shall be a completely self-contained control system that replaces a standard toggle switch

.3 Dual Technology Ceiling Mounted Sensor, 24V

.1 Wattstopper DT-300 series (Basis of Design).

.2 The Dual Technology sensor shall be capable of detecting presence in the control area by detecting doppler shifts in transmitted ultrasound and passive infrared heat changes.

.3 Sensor shall utilize Dual Sensing Verification Principle for coordination between ultrasonic or microphonic and Passive Infrared (PIR) Technologies. Detection verification of both technologies must occur in order to activate lighting systems. Upon verification, detection by either technology shall keep the lighting on.

.4 Sensor shall have a retrigger feature in which detection by either technology shall retrigger the lighting system on within 5 seconds of being switched off.

.5 Sensors shall be ceiling mounted with a flat, unobtrusive appearance, and provide 360 degree coverage.

.6 Ultrasonic sensing shall be volumetric in coverage, with a frequency of 40 kHz. It shall utilize Advanced Signal Processing that automatically adjusts the detection threshold dynamically to compensate for changing levels of activity and airflow throughout a controlled space.

.7 To avoid false ON activations, and to provide immunity to RFI and EMI, Detection Signature Analysis shall be used to examine the frequency, duration, and amplitude of a signal, in order to respond only to those signals caused by human motion.

.8 The PIR technology shall utilize a temperature compensated, dual element sensor and a multi-element Fresnel lens. The lens shall be Poly IR4 material to offer superior performance in the infrared wavelengths and filter short wavelength IR, such as those emitted by the sun and other visible light sources. The lens shall have grooves facing in to avoid dust and residue build up which affects IR reception.

.9 Sensors shall operate at 24 VDC, and halfwave rectified, and utilize a 24 V power pack.

.10 Sensors shall feature a walk-through mode, where lights turn off 3 minutes after the area is initially occupied if no motion is detected after the first 30 seconds.

.11 The sensor shall have a built-in light level sensor that works from 10 fc to 300 fc.

.12 The sensors shall feature terminal style wiring.

.13 Each sensing technology shall have an LED indicator that remains active at all times in order to verify detection within the area to be controlled. The LED can be disabled for applications that require less sensor visibility.

2.4 SPECIAL PURPOSE OCCUPANCY SENSORS

.1 Occupancy Sensors for High bay applications:

.1 For use in warehouses, distribution centres, and gymnasiums.

.2 Maximum 14 m (45 feet) mounting height.

.3 Surface-mount or end-mount model to suit application.

.4 180 degree and 360 degree coverage lenses available.

.5 Low-voltage, passive infrared (PIR) sensor.

.6 End-mount model to attach directly to industrial T5HO and T8 fixtures through an extended 13 mm (0.5 inch) chase nipple or junction box.

.7 Adjustable timeout for maximum energy savings.

.8 Basis of design: Lutron LUT-WSPSM24V-360-CPN6111 and similar.

2.5 POWER PACKS

.1 General:

.1 Self-contained transformer and relay module.

.2 Internal relay controlling up to 20A for 120, 230, 277VAC or 347VAC ballast loads and 120VAC incandescent loads.

.3 Provide a 24 VDC, 150 mA output.

.4 Capable of parallel wiring without regard to AC phases on primary.

.5 Power pack can be used as a standalone, low voltage switch, or can be wired to sensor for auto control.

.6 Construction: high impact, UL rated plastic case

.7 Power pack shall be UL/CUL Listed, FCC Certified, UL 2043 plenum rated and meets ASHRAE 90.1 requirements

.8 Shall at minimum meet the following environmental specifications:

.1 Operating Temperature Range: 0 degrees C to 40 degrees C

.2 Relative Humidity: 0 per cent to 95 per cent non-condensing

.2 Power Pack and Auxiliary Relay, 347 V

.1 Power Pack: Wattstopper B347D-P Series (Basis of Design)

.2 Auxiliary Relay: Wattstopper S347-E-P Series (Basis of Design)

.3 Power pack shall be a self-contained transformer and relay module measuring 45 mm by 70 mm by 38 mm (1.75 inch by 2.75 inch by 1.5 inch).

.4 For ease and speed of installation, power pack shall have 12 mm (1/2") snap-in nipple for 12 mm (1/2") knockouts and mounting on outside of enclosure.

.5 Power pack shall have dry contacts capable of switching 15 amp ballast @ 347 VAC, 60Hz.

.6 Power pack shall have primary voltage input of 347 VAC.

.7 Power pack shall provide a 24 VDC, 114 mA output, with the relay connected.

.8 Power pack shall be capable of parallel wiring without regard to AC phases on primary.

.9 Power pack can be used as a standalone, low voltage switch, or can be wired to sensor for auto control.

.10 Power pack shall have hold-ON and hold-OFF inputs for integration with lighting control panels, BMS and other building systems.

.11 Power pack shall have overcurrent protection if the low voltage current drawn exceeds 150 mA. In the event of an overcurrent, the low voltage output current shuts down and the LED will blink to indicate a fault condition.

.12 Power pack shall have an LED to indicate status of relay.

.13 Power pack shall utilize Zero Crossing Circuitry to protect from the effects of inrush current and increase product longevity.

2.6 DECORATOR LOW VOLTAGE MOMENTARY SWITCHES

.1 Wattstopper DCC2 series (Basis of Design).

.2 Switch intended for use with power packs and sensors requiring a momentary contact switch that provides on/off signals.

.3 12 VAC/VDC, 24 V Rectified, 24 VAC/VDC

.4 50 mA Max. Internal Contact rating

.5 500 mΩ resistance when closed

.6 Single pole, double throw with centre position rest.

2.7 DIMMING SWITCHES

.1 Direct control of dimming luminaires up to the luminaire manufacturer’s specified rating.

.2 Coordinate dimming signal configuration (2-wire phase cut, 3-wire, 4-wire 0-10V, or 4-wire DALI) with the fixture ballast or driver per Section 26 51 19, lighting fixture schedule, and related sections.

.3 Compatible with related lighting control devices i.e. occupancy sensors.

.4 Submit luminaire manufacturer’s dimmer compatibility documentation to demonstrate compatibility and limits of dimming level.

.5 Manufacturers:

.1 Lutron NovaT* style dimmers.

.2 Cooper

.3 Leviton.

.4 Approved Equal.

2.8 TIMER SWITCHES

.1 Digital time switch programmable to turn loads off after a preset time.

.2 Capable of operating as an ON/OFF switch.

.3 Five terminal, completely self-contained control system that replaces a standard toggle switch. Switching mechanism 30 V @ 1 A air gap relay.

.4 24 VAC when used in conjunction with power packs. For small rooms, or small localized loads, line voltage is permitted.

.5 No minimum load requirement.

.6 Time scroll feature permitting manual overriding of the preset time-out period. Selecting time scroll UP shall allow time-out period to scroll up throughout the timer possibilities to the maximum. Time scroll DN (down) shall allow time-out period to scroll down to minimum.

.7 Options available for user to enable:

.1 One second light flash warning at five minutes before the timer runs out and twice when the countdown reaches one minute (when used to control lighting loads).

.2 Beep warning sounding every five seconds once the time switch countdown reaches one minute.

.8 Manual timer reset where pressing the ON/OFF switch for more than 2 seconds resets the timer to the programmed time-out period.

.9 Liquid crystal display (LCD) that shows the timer's countdown.

.10 Incorporates two pulsed, open collector NPN transistor outputs for external latching relay coil drives or lighting control panel inputs.

.11 Fit behind a decorator style faceplate. Concealed calibration switch for setting time-out, time scroll, one second light flash, and beep warning to prevent tampering of adjustments and hardware.

.12 Time-out period adjustable in increments of 5 minutes from 5 minutes to 1 hour, and in increments of 15 minutes from 1 hour to 12 hours.

.13 Operate with power packs in order to control additional loads.

.14 Utilize terminal style wiring.

.15 For safety, in the event there is an open circuit in the low voltage line, automatically switch to OFF mode.

.16 Warranty: 5 year warranty.

.17 CUL listed.

.18 Wattstopper TS-400 and TS-400-24 series (Basis of Design).

2.9 EMERGENCY LIGHTING CONTROL UNIT FOR 120 VOLT CIRCUITS

.1 Description:

.1 Sequence of Operation: activate emergency lighting in the event of loss of normal utility power, regardless of control status of the luminaire.

.2 Provide all required functionality to allow any standard lighting control device to control emergency lighting in conjunction with normal lighting in any area within a building.

.2 Device shall be listed to UL 924 to meet the intent of Ontario Building Code for "fail-safe operation", and be approved for use in Canada.

.3 Example Manufacturers

.1 Functional Devices Inc. ESR01P series.

.2 Douglas Lighting Controls WR-RIB2401B-EL.

.3 Philips Bodine BLCD-20B.

.4 Schneider Electric SLSERC1277.

.5 Wattstopper ELCU-200 series.

.6 Approved Equal.

.4 Mounting: Able to fit in a standard junction box knockout.

.5 Features:

.1 Senses local single circuit power failure.

.2 LED indication for emergency and normal power.

.3 Provides absolute fail-to-on emergency lighting.

.4 Emergency lights are controlled with normal lighting.

.5 Sequence of Operation: automatically switch emergency lighting on and off as normal lighting is switched. When normal power is not available, force and hold emergency lighting on regardless of the state of any external control device until normal power is restored.

.6 Specifications:

.1 120 VAC; 60 Hz.

.2 Maximum Ballast Load: 10A @ 120 VAC.

.3 Housing: Fire rated V-0, 80 degrees C.

.4 Zero crossing circuitry to protect relay contacts from damaging effects of inrush current generated by switching electronic ballast loads.

.5 UL94 V-O plenum rated with compression wire terminals.

.6 UL, cUL listed Emergency Lighting and Equipment; five year warranty.

2.10 DAYLIGHT HARVESTING PHOTO SENSORS

.1 General:

.1 Class 2, low voltage.

.2 Ambient light sensor designed to interface directly with the analog input of the Lighting Control System.

.3 Supply an analog signal to the Lighting Control System proportional to the light measured.

.4 Sensor output shall provide for zero or offset based signal.

.5 Capable of a fully adjustable response in the range between 0 and 10,000 foot candles with a +/- 1 per cent accuracy at 21 degrees C.

.6 Input: 10 VDC.

.7 Output: 0 VDC to 10 VDC.

.8 Flame retardant housing and meet UL 94 HB standards.

.9 Operating temperature: -10 degrees C to 60 degrees C.

.2 Interior sensors: Fresnel lens, with a 60 degree cone of response. Range between 0 fc and 750 fc.

.3 Exterior sensors: Complete with hood over the aperture to shield the sensor from direct sunlight. Outdoor sensor circuitry completely encased in an optically clear epoxy resin. Sensor range between 0 fc and 750 fc.

.4 Atrium sensors: Translucent dome with a 180 degree field of view. Range from 2 fc to 2,500 fc.

.5 Skylight sensors: Translucent dome with a 180 degree field of view. Range between 10 fc and 7,500 fc.

2.11 SEQUENCES OF OPERATION

.1 To Section 26 06 50.19.

.2 Vacancy Sensor Operation: Manual On, Auto Off.

.3 In accordance with ASHRAE 90.1-2013.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 In accordance with manufacturer’s instructions.

.2 Minimum 14 AWG from the circuit control hardware relays.

.3 It shall be the contractor's responsibility to locate and aim sensors in the correct location required for complete and proper volumetric coverage within the range of coverage(s) of controlled areas per the manufacturer's recommendations. Rooms shall have 90 per cent to 100 per cent coverage to completely cover the controlled area to accommodate all occupancy habits of single or multiple occupants at any location within the room(s). The locations and quantities of sensors shown on the drawings are diagrammatic and indicate only the rooms which are to be provided with sensors. The contractor shall provide additional sensors if required to properly and completely cover the respective room.

.4 It is the contractor’s responsibility to arrange a pre-installation meeting with manufacturer's factory authorized representative, at Owner's facility, to verify placement of sensors and installation criteria.

.5 Proper judgement must be exercised in executing the installation so as to ensure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference of structural components.

.6 Install manual control devices and sensors in accordance with manufacturer’s instructions for Vacancy Operation.

3.2 SYSTEM STARTUP

.1 The lighting controls manufacturer’s representative shall conduct system startup and submit startup report.

3.3 SITE TESTS AND INSPECTIONS

.1 The lighting controls manufacturer’s representative and Contractor shall conduct functional testing and provide report as described in ASHRAE 90.1-2013:

.1 Lighting control devices and control systems shall be tested to ensure that control hardware and software are calibrated, adjusted, programmed, and in proper working condition in accordance with the construction documents and manufacturer’s installation instructions.

.2 When occupant sensors, time switches, programmable schedule controls, or photosensors are installed, at a minimum, the following procedures shall be performed:

.1 Occupant Sensors

.1 Certify that the sensor has been located and aimed in accordance with manufacturer recommendations.

.2 For projects with up to seven (7) occupancy sensors, all occupancy sensors shall be tested.

.3 For projects with more than seven (7) occupancy sensors, testing shall be done for each unique combination of sensor type and space geometry.

.4 For each sensor to be tested, verify the following:

.1 Status indicator (as applicable) operates correctly.

.2 Controlled lights turn off or dim down to the specified level within the required time (20 minutes, or as noted), as applicable to the space type.

.3 For auto-on occupant sensors (occupancy mode), the lights turn on to the permitted level when someone enters the space.

.4 For manual-on sensors (vacancy mode), the lights turn on only when manually activated.

.5 The lights are not incorrectly turned on by movement in nearby areas or by HVAC operation.

.2 Automatic Time Switches

.1 Confirm that the automatic time switch control is programmed with appropriate weekday, weekend, and holiday (as applicable) schedules.

.2 Document for the owner automatic time switch programming, including weekday, weekend, and holiday schedules, as well as all setup and preference program settings.

.3 Verify that correct time and date are properly set in the time switch.

.4 Verify that any battery backup (as applicable) is installed and energized.

.5 Verify that the override time limit is set to no more than two (2) hours.

.6 Simulate occupied condition. Verify and document the following:

.1 All lights can be turned on and off by their respective area control switch.

.2 The switch only operates lighting in the enclosed space in which the switch is located.

.7 Simulate unoccupied condition. Verify and document the following:

.1 All non-exempt lighting turns off.

.2 Manual override switch allows only the lights in the enclosed space where the override switch is located to turn on or remain on until the next scheduled shut off occurs.

.3 Daylight Controls

.1 All control devices (photocontrols) have been properly located, field-calibrated, and set for appropriate set points and threshold light levels.

.2 Daylight controlled lighting loads adjust to appropriate light levels in response to available daylight.

.3 The location where calibration adjustments are made is readily accessible only to authorized personnel.

.3 The individual(s) responsible for the functional testing shall not be directly involved in either the design or construction of the project and shall provide documentation certifying that the installed lighting controls meet or exceed all documented performance criteria.

.2 Test lighting controls with fire alarm system in accordance with Section 28 08 46 and Section 28 46 51.

.3 Commissioning:

.1 Upon completion of the installation, the system shall be completely commissioned to verify all adjustments and sensor placement to ensure a trouble-free lighting control system.

.2 Submit commissioning report to the Consultant and the commissioning authority for review.

.3 Provide the Consultant and Commissioning Authority with ten working days written notice of the scheduled commissioning date.

3.4 TRAINING

.1 Provide training session of minimum 4 hours duration in accordance with Section 01 79 00.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Materials and components for dry type transformers up to 600 V primary, equipment identification and transformer installation.

1.2 REFERENCES

.1 ANSI/ASHRAE/IES Standard 90.1-2013 – Energy Standard for Buildings Except Low-Rise Residential Buildings.

.2 CSA Group:

.1 CSA C22.1:21, Canadian Electrical Code, Part 1 (25th Edition), Safety Standard for Electrical Installations.

.2 Ontario Electrical Safety Code (28th edition/2021).

.3 CSA C22.2 No. 47-13 (R2018), Air-cooled transformers (dry type).

.4 CSA C9-17, Dry-type transformers.

.5 CSA C802.2-18, Minimum Efficiency Values for Dry-Type Transformers.

.3 IEEE C57.110-2018, IEEE Recommended Practice for Establishing Liquid-Immersed and Dry-Type Power and Distribution Transformer Capability When Supplying Nonsinusoidal Load Currents: this standard defines how K-factor is calculated.

.4 National Electrical Manufacturers Association (NEMA):

.1 NEMA ST-20-2014, Dry-Type Transformers for General Applications: sound levels.

.5 NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment (published by the International Electrical Testing Association).

.6 Ontario Building Code and its referenced standards.

.7 UL 1561, Standard for Dry-Type General Purpose and Power Transformers.

1.3 ACTION SUBMITTALS

.1 Product Data: Provide outline and support point dimensions of enclosures and accessories, unit weight, voltage, power, and impedance ratings and characteristics, tap configurations, insulation system type, and rated temperature rise.

1.4 INFORMATIONAL SUBMITTALS

.1 Test Reports: Indicate loss data, efficiency at 25, 50, 75, and 100 per cent rated load, and sound level.

.2 Submit manufacturer's installation instructions.

.1 Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements.

.2 Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.5 CLOSEOUT SUBMITTALS

.1 Record actual locations of transformers in project record documents.

.2 Document test results from NETA ATS.

.3 Copies of completed factory reports and testing reports.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Store and handle in strict compliance with manufacturer's instructions and recommendations. Protect from potential damage from weather and construction operations.

.2 Store so condensation will not form on or in the transformer housing and if necessary, apply temporary heat where required to obtain suitable service conditions. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

.3 Handle to manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to transformer internal components, enclosure, and finish.

.4 Handle transformer using proper equipment for lifting and handling, use when necessary lifting eye, and/or brackets provided for that purpose.

1.7 WARRANTY

.1 The transformer shall carry a 1 year warranty from the time of substantial performance.

PART 2 - PRODUCTS

2.1 GENERAL

.1 Transformers shall be standard general purpose dry type unless otherwise indicated on drawings as K-Rated or Harmonic Mitigation type.

.2 Use transformers of one manufacturer throughout project and in accordance with CSA C22.2 No. 47 and CSA C9.

2.2 MANUFACTURERS

.1 Manufacturer List:

.1 Bemag.

.2 Delta Transformer.

.3 Eaton.

.4 Hammond.

.5 Powersmiths.

.6 Rex Power Magnetics.

.7 Siemens.

.8 Schneider Electric.

.9 STI.

.2 Substitutions: permitted if approved by the Consultant prior to Tender closing date.

2.3 REGULATORY REQUIREMENTS

.1 Products: Listed and classified by CSA (Canadian Standards Association).

.2 Efficiency ratings:

.1 Meet or exceed the efficiency levels indicated in CSA C802.2-12, and ASHRAE 90.1-2013, Table 8.4.4.

2.4 GENERAL PURPOSE TRANSFORMERS

.1 NEMA ST-20, factory-assembled, air cooled low-inrush dry type transformer, ratings and voltages as indicated on drawings.

.2 Single or three phase as indicated on drawings.

.3 Type: AN/AA ventilated self-cooled.

.4 Copper or Aluminum windings.

.5 Finish: Final coating to be ANSI 61 Grey Epoxy Powder.

.6 T-connected transformers are not acceptable.

.7 Isolate core and coil from enclosure using vibration-absorbing mounts.

.8 Impedance: standard (3% to 5% nominal for up to 75 kVA, 4% to 6% for transformers 112.5 kVA and greater).

2.5 K-FACTOR RATED TRANSFORMERS

.1 Provide where indicated on drawings.

.2 K-Factor Rating: Transformers shall be K-Factor 7, 13, or higher rated and comply with UL 1561 requirements for non-sinusoidal load current-handling capability to the degree defined by designated K-factor.

.1 Unit shall not overheat when carrying full-load current with harmonic distortion corresponding to designated K-factor.

.2 Indicate value of K-factor on transformer nameplate.

2.6 PRIMARY VOLTAGE

.1 600 V delta, 3 phase;

2.7 SECONDARY VOLTAGE

.1 120/208 V, 3 phase wye.

2.8 INSULATION SYSTEM AND AVERAGE WINDING TEMPERATURE RISE

.1 1-15 kVA: Class 185 with 150°C rise.

.2 16-500 kVA: Class 220 with 150°C rise.

.3 Above 500 kVA: Class 220 with 150°C rise.

2.9 CASE TEMPERATURE

.1 Limits in accordance with CSA C22.2 No. 47.

2.10 WINDING TAPS

.1 To NEMA ST-20.

.2 Four full capacity 5 per cent adjustment taps, 2 at 2.5 per cent FCBN (full capacity below nominal) and 2 at 2.5 per cent FCAN (full capacity above nominal).

2.11 BASIC IMPULSE LEVEL

.1 10 kV BIL.

2.12 GROUNDING

.1 Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap.

2.13 MOUNTING

.1 1-15 kVA: suitable for wall mounting.

.2 16-75 kVA: suitable for wall, or floor, as shown.

.3 Larger than 75 kVA: suitable for floor mounting.

2.14 COIL CONDUCTORS

.1 Continuous windings with terminations brazed or welded.

2.15 ENCLOSURE

.1 NEMA ST-20, CSA type 2 ventilated, sprinkler-proof. Provide lifting eyes or brackets.

.2 CSA type 3R for outdoor locations.

2.16 CATCHER/DRIP BASE PLATE

.1 Constructed from galvanized steel sheet metal having the minimum thickness as that of the transformer's enclosure.

.2 To be provided for all transformers that are wall mounted, or suspended off the floor.

2.17 SOUND LEVELS

.1 To NEMA ST-20 for transformers up to 300 kVA:

.1 Up to 9 kVA: 40 dB.

.2 10 – 50 kVA: 45 dB.

.3 51 – 150 kVA: 50 dB.

.4 151 – 300 kVA: 55 dB.

.2 Sound levels 3 dB less than NEMA ST-20 for transformers 301 kVA and greater:

.1 301 – 500 kVA: 57 dB.

.2 501 – 700 kVA: 59 dB.

.3 701 – 1000 kVA: 61 dB.

.4 Above 1000 kVA: 3 dB less than NEMA ST-20.

2.18 NAMEPLATE

.1 Transformer shall have embossed aluminum or stainless steel nameplate indicating, but not restricted to the following:

.1 kVA rating.

.2 Voltage rating.

.3 Impedance.

.4 Type.

.5 Insulation class.

.6 Temperature rise.

.7 Connection diagram.

.8 Serial number.

2.19 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 53.

2.20 SOURCE QUALITY CONTROL

.1 Production test each unit according to NEMA ST-20.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Mounting:

.1 Mount dry type transformers up to 75 kVA, on floor, wall, or suspended from celling, as indicated on plans.

.2 Maintain clear space as described in 2021 OESC Rule 2-312.

.3 Mount dry type transformers rated above 75 kVA on floor.

.4 For wall mounted transformers, provide rubber-in-shear isolation mounts above bracket-supported rails secured from the wall.

.5 For ceiling mounted transformers, provide trapeze hangers and provide rubber-in-shear isolation mounts.

.6 Where a transformer is wall mounted or suspended off the floor, provide a metal catcher/drip base plate, and bolt to the bottom of the transformer below the base channel to conform to CSA C22.2 No. 47. Install in accordance with transformer manufacturer’s instructions and recommendations.

.7 Mount floor mounted transformers on concrete housekeeping pads, minimum 100 mm (4”) thick, and extending a minimum of 150 mm (6”) beyond the footprint of the transformer.

.8 Mount vibration isolating pads suitable for isolating the transformer noise from the building structure in accordance with Section 26 05 48.13.

.2 Set transformer plumb and level.

.3 Use flexible conduit, under the provisions of Section 26 05 33.13, 600 mm minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.

.4 Provide grounding and bonding to Section 26 05 26.

.5 Ensure adequate clearance around transformer for ventilation.

.6 Install transformers in level upright position.

.7 Remove shipping supports only after transformer is installed and just before putting into service.

.8 Loosen isolation pad bolts until no compression is visible.

.9 Make primary and secondary connections in accordance with wiring diagram.

.10 Energize transformers after installation is complete.

3.2 FIELD QUALITY CONTROL

.1 Section 01 43 00: Field Inspection, Testing, Adjusting.

.2 Perform inspections and tests listed in NETA ATS, Section 7.2.

3.3 ADJUSTING

.1 Measure primary and secondary voltages and make appropriate tap adjustments.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Power distribution panelboards – Circuit breaker type.

.2 Lighting and appliance branch circuit panelboards.

1.2 RELATED REQUIREMENTS

.1 Section 26 28 16.02 – Molded Case Circuit Breakers.

.2 Section 26 43 13 – Surge Protective Devices for Low-Voltage Electrical Power Circuits: externally mounted surge protective devices.

1.3 REFERENCES

.1 CSA Group:

.1 CSA C22.1:21, Canadian Electrical Code, Part 1 (25th Edition), Safety Standard for Electrical Installations.

.2 Ontario Electrical Safety Code (28th edition/2021).

.3 CSA C22.2 No. 5-16 – Molded Case Circuit Breakers, molded-case switches, and circuit-breaker enclosures.

.4 CSA C22.2 No. 29-15 – Panelboards and Enclosed Panelboards.

.2 NEMA:

.1 NEMA ICS 2-2000 (R2020) – Industrial Control and Systems: Controllers, Contactors, and Overload Relays Rated 600 volts.

.2 NEMA KS 1-2013 – Heavy Duty Enclosed and Dead-Front Switches (600 volts Maximum).

.3 NEMA PB 1-2011 – Panelboards.

.4 NEMA PB 1.1-2013 – General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 volts or Less.

.3 NETA ATS – Acceptance Testing Specifications for Electrical Power Distribution Equipment (published by the International Electrical Testing Association).

1.4 SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Work of this Section is to be submitted for review after Consultant's review of Coordination Study per Section 26 05 73.16 is completed.

.3 Shop drawings shall contain overall panelboard dimensions, interior mounting dimensions, and wiring gutter dimensions. The location of the main, branches, and solid neutral shall be clearly shown. In addition, the drawing shall illustrate one line diagrams with applicable voltage systems.

.4 Shop drawings:

.1 Indicate the following:

.1 Outline and support point dimensions.

.2 Voltage.

.3 Main bus ampacity.

.4 Integrated short circuit ampere rating.

.5 Circuit breaker arrangement, types, and sizes.

.2 The following information shall be submitted to the Consultant:

.1 Breaker layout drawing with dimensions indicated and nameplate designation.

.2 Component list.

.3 Conduit entry/exit locations.

.4 Assembly ratings including:

.1 Short-circuit rating.

.2 Voltage.

.3 Continuous current.

.5 Cable terminal sizes.

.6 Product data sheets.

.3 Where applicable, the following additional information shall be submitted to the Consultant:

.1 Key interlock scheme drawing and sequence of operations.

.5 Submittals for Construction

.1 The following information shall be submitted for record purposes:

.1 Installation information.

1.5 CLOSEOUT SUBMITTALS

.1 Refer to Section 01 78 00.

.2 Record actual locations of panelboards and record actual circuiting arrangements in project record documents.

.3 Maintenance Data: Include spare parts listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

.4 Final as-built drawings and information shall incorporate all changes made during the manufacturing and installation process.

.5 Include a copy of each panelboard schedule in the Operation and Maintenance manual.

1.6 MAINTENANCE MATERIAL SUBMITTALS

.1 Manufacturer shall provide installation instructions and NEMA Standards Publication PB 1.1 – Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 volts or Less.

.2 Equipment operation and maintenance manuals shall be provided with each assembly shipped and shall include instruction leaflets, instruction bulletins and renewal parts lists where applicable, for the complete assembly and each major component.

.3 Provide two of each panelboard key.

.4 Provide final panelboard schedules indicating panelboard data, phasing, breaker sizes, and loads served.

1.7 QUALITY ASSURANCE

.1 Regulatory Requirements

.1 Products: Listed and classified by CSA (Canadian Standards Association).

.2 Qualifications

.1 Company specializing in manufacturing of panelboard products with a minimum of 20 years' experience.

.2 The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.

.3 For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.

.4 The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Consultant, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

1.8 DELIVERY, STORAGE, AND HANDLING

.1 Inspect and report concealed damage to carrier within their required time period.

.2 Handle carefully to avoid damage to panelboard internal components, enclosure, and finish.

.3 Store in a clean, dry environment. Maintain factory packaging and, if required, provide an additional heavy canvas or heavy plastic cover to protect enclosure(s) from dirt, water, construction debris, and traffic.

.4 Equipment shall be handled and stored in accordance with manufacturer's instructions. One copy of these instructions shall be included with the equipment at time of shipment.

1.9 WARRANTY

.1 Warrant specified equipment to be free from defects in materials and workmanship for eighteen (18) months from the date of purchase.

PART 2 - PRODUCTS

2.1 GENERAL

.1 Description: CSA C22.2 No. 29, circuit breaker type.

2.2 DISTRIBUTION PANELBOARDS – CIRCUIT BREAKER TYPE

.1 Manufacturers:

.1 Square D by Schneider Electric, I-LINE Series.

.2 Eaton Cutler-Hammer, PRL 3 and PRL4 Series.

.3 Equal by Siemens.

.2 The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety. Products in compliance with the specification and manufactured by others not named will be considered only if pre-approved by the Consultant ten days prior to bid date.

.3 Panelboard Bus:

.1 Copper, ratings as indicated.

.2 Provide copper neutral bus for panelboards indicated for 4-wire systems.

.3 Provide copper ground bus in each panelboard.

.4 Short Circuit Ratings:

.1 Panelboards rated 600 V shall have minimum integrated short-circuit ratings as shown on the drawings or as herein scheduled, but not less than 65 000 amperes RMS symmetrical.

.2 Distribution panelboards with bolt-on devices contained therein shall have interrupting ratings as specified herein or indicated on the drawings.

.3 Panelboards shall be fully rated.

.4 Where indicated, provide circuit breakers ULC listed for application at 100 per cent of their continuous ampere rating in their intended enclosure.

.5 Minimum integrated short circuit rating: Panelboards rated 240 V shall have minimum integrated short-circuit ratings as shown on the drawings or as herein scheduled, but not less than 10 000 amperes RMS symmetrical.

.6 Molded Case Circuit Breakers: To Section 26 28 16.02.

.7 Circuit Breaker Accessories: Trip units and auxiliary switches as indicated.

.8 Cabinet Front: Surface type, fastened hinge and latch, metal directory frame, finished in manufacturer's standard gray enamel.

.9 Enclosures: CSA type 2 sprinklerproof complete with drip hood, or as noted.

.10 Trims shall be equipped with a flush lock.

.11 Breaker positions labeled as “Spare” or “Space” shall constitute no less than 20 per cent of available breaker positions, whether indicated or not in panelboard schedules.

.12 Each panel shall be complete with a directory which shall be mounted inside door in a metal frame with clear plastic cover and copy in each Data Book. Use final Room Numbers for directories.

2.3 BRANCH CIRCUIT PANELBOARDS

.1 Manufacturers:

.1 Square D by Schneider Electric, NQ or NQOD Series.

.2 Eaton Cutler-Hammer, POW-R-LINE 1, POW-R-LINE 2, POW-R-LINE 3 Series.

.3 Equal by Siemens.

.2 Description: CSA C22.2 No.29, circuit breaker type, lighting and appliance branch circuit panelboard.

.3 Panelboard Bus:

.1 Copper, ratings as indicated.

.2 Provide copper neutral bus in each panelboard.

.3 Provide copper ground bus in each panelboard.

.4 Provide insulated ground bus where scheduled.

.4 Minimum Integrated Short Circuit Rating: 10 000 amperes RMS symmetrical for 240 V panelboards, or as indicated.

.5 Molded Case Circuit Breakers: NEMA AB 1, plug-on type thermal magnetic trip circuit breakers, with common trip handle for all poles, listed as Type SWD for lighting circuits, Type HACR for air conditioning equipment circuits, Class A ground fault interrupter circuit breakers where scheduled. Do not use tandem circuit breakers.

.6 Current Limiting Molded Case Circuit Breakers where indicated: NEMA AB 1, circuit breakers with integral thermal and instantaneous magnetic trip in each pole, coordinated with automatically resetting current limiting elements in each pole. Interrupting rating 100,000 symmetrical amperes, let-through current and energy level less than permitted for same size Class RK-5 fuse.

.7 Cabinet Front: Surface cabinet front with concealed trim clamps, concealed hinge, metal directory frame, and flush lock all keyed alike. Finish in manufacturer's standard gray enamel.

.8 Enclosure shall be CSA type 2 sprinklerproof complete with drip hood, or as noted.

.9 Trims shall be equipped with a flush lock.

.10 Breaker positions labeled as “Spare” or “Space” shall constitute no less than 20 per cent of available breaker positions, whether indicated or not in panelboard schedules.

.11 Panelboards: to CSA C22.2 No.29 and product of one manufacturer.

.1 Install circuit breakers in panelboards before shipment.

.2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.

.12 Panelboards rated 240 VAC or less shall have short-circuit ratings as shown on the drawings or as herein scheduled, but not less than 10,000 amperes RMS symmetrical.

.13 Bus and breakers rated for symmetrical interrupting capacity, as indicated.

.14 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.

.15 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.

.16 Two keys for each panelboard and key panelboards alike.

.17 Copper bus with neutral of same ampere rating as mains.

.18 Mains: suitable for bolt-on breakers.

.19 Trim with concealed front bolts and hinges.

.20 Trim and door finish: baked grey enamel.

.21 The minimum short-circuit rating for branch circuit panelboards shall be as specified herein or as indicated on the drawings. Panelboards shall be fully rated.

.22 Bolt-on type, heavy-duty, quick-make, quick-break, single- and multi-pole circuit breakers of the types specified herein, shall be provided for each circuit with toggle handles that indicate when unit has tripped.

.23 Circuit breakers shall be thermal-magnetic type with common type handle for all multiple pole circuit breakers. Circuit breakers shall be minimum 100 A frame and through 100 A trip sizes shall take up the same pole spacing. Circuit breakers shall be ULC listed as type SWD for lighting circuits.

.1 Circuit breaker handle locks shall be provided for all circuits that supply exit signs, emergency lights, energy management, and control system (EMCS) panels and fire alarm panels.

.24 Circuit breakers shall have a minimum interrupting rating of 10 000 A symmetrical at 240 V, and 14 000 amperes symmetrical at 480 V, unless otherwise noted on the drawings.

.25 Each panel shall be complete with a directory which shall be mounted inside door in a metal frame with clear plastic cover and copy in each Data Book. Use final Room Numbers for directories.

.26 Panels shall be dead front type in code gauge steel enclosures. All panels shall be sprinkler proof c/w drip hoods as required.

.27 Panels shall have mains of voltage and capacity, and main and branch breakers, as shown on the drawings. Spaces shall include necessary bus work such that Owners, at a later date, need buy only the breakers.

.28 Where branch circuit metering is used on a panelboard, provide 762 mm (30”) tub width to accommodate the metering devices within the panelboard.

.29 Where panels exceed 84 circuits, use multi-section panel with main cross-over solid bus bars unless noted otherwise on drawings. Main bus capacity of each section shall be full size to match cross-over bus.

.30 Breakers shall have bolted type connections. Multi-pole breakers shall be common trip type with a single handle, suitable for voltage applied and of same manufacture as single pole breakers.

.31 Panels for 120/208 V, 3-phase, 4-wire systems shall be complete with full size breakers.

.32 Where shown on drawings or required by code, certain breakers shall include ground fault interrupter.

.33 Provide lighting and receptacle panels suitable for surface, or flush-mounting type, as shown.

.34 Provide locking bars on non-switched circuits where panels are used for switching lighting circuits.

.35 Panels for non-linear loads shall be complete with lugs for double neutrals.

.36 Panels shall be given a rust-resistant treatment to both tub and trim.

.37 Flush panels shall have concealed hinges and flush type combination lock latch. Locks shall be chrome plated. Doors shall open minimum 135 degrees. Trims shall have fasteners concealed and shall be prime coated to receive room finish paint.

.38 Surface mounted panels shall have manufacturer's standard surface door trim complete with lock and latch. Finish shall be grey.

.39 Recessed panels shall have standard flush trims.

.40 Co-ordinate panel finish with Room Finish Schedule.

2.4 MOLDED CASE CIRCUIT BREAKERS

.1 Breakers: to Section 26 28 16.02.

.2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.

.3 Main breaker: separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.

.4 Lock-on devices for 10 per cent of 15 A to 30 A breakers installed as indicated. Turn over unused lock-on devices to Owner.

.5 Lock-on devices for fire alarm, security, and sprinkler circuits.

.6 Provide shunt trips, bell alarms, and auxiliary switches as shown on the contract drawings.

.7 Provide breakers for externally mounted Surge Protective Devices in accordance with Section 26 43 13.

2.5 CONSTRUCTION

.1 General:

.1 Interiors shall be completely factory assembled. They shall be designed such that switching and protective devices can be replaced without disturbing adjacent units and without removing the main bus connectors.

.2 Surface trims shall be same height and width as box. Flush trims shall overlap the box by 3/4 of an inch on all sides.

.3 A temporary directory card with a clear plastic cover shall be supplied and mounted on the inside of each door.

.4 All locks shall be keyed alike.

.2 Branch Circuit Panelboards:

.1 Trims for branch circuit panelboards shall be supplied with a hinged door over all circuit breaker handles. Doors in panelboard trims shall not uncover any live parts. Doors shall have a semi flush cylinder lock and catch assembly. Door-in-door trim shall be provided. Both hinged trim and trim door shall utilize three point latching. No tools shall be required to install or remove trim. Trim shall be equipped with a door-actuated trim locking tab. Equip locking tab with provision for a screw such that removal of trim requires a tool, at the owner's option. Installation shall be tamper resistant with no exposed hardware on the panelboard trim.

.3 Distribution Panelboards:

.1 Distribution panelboard trims shall cover all live parts. Switching device handles shall be accessible.

2.6 BUS

.1 Lugs: Copper and listed by CSA, or cUL, for use with copper conductors and sized to accept copper conductors of the ampacity specified.

.2 Main bus bars shall be copper sized in accordance with CSA standards to limit temperature rise on any current carrying part to a maximum of 65°C above an ambient of 40°C maximum.

.3 A copper system ground bus shall be included in all panelboards.

.4 Full-size (100 per cent rated) insulated copper neutral bars shall be included for panelboards shown with neutral. Bus bar taps for panels with single-pole branches shall be arranged for sequence phasing of the branch circuit devices. Neutral busing shall have a suitable lug for each outgoing feeder requiring a neutral connection. 200 per cent rated neutrals shall be supplied for panels designated on drawings with oversized neutral conductors.

2.7 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 53.

.2 Nameplate for each panelboard size 4 engraved.

.3 Nameplate for each branch circuit in distribution panelboards size 2 engraved.

.4 Complete circuit directory with typewritten legend showing location and load of each circuit.

.5 Provide an engraved nameplate for each panelboard section.

.6 Provide copies of all circuit directories in manuals.

2.8 SOURCE QUALITY CONTROL

.1 The following standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of NEMA and CSA standards.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install panelboards to CSA C22.1.

.2 Install panelboards plumb.

.3 Height: 1800 mm to top of panelboard; install panelboards taller than 1800 mm with bottom no more than 100 mm above floor.

.4 Provide filler plates for unused spaces in panelboards.

.5 Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads.

.6 Provide engraved plastic nameplates under the provisions of Section 26 05 53.

.7 Ground and bond panelboard enclosure according to Section 26 05 26.

.8 Locate panelboards as indicated and mount securely, plumb, true, and square, to adjoining surfaces.

.9 Install surface mounted panelboards on fire rated plywood backboards in accordance with Section 26 05 29. Where practical, group panelboards on common backboard.

.10 Connect loads to circuits.

.11 Connect neutral conductors to common neutral bus with respective neutral identified.

.12 Deliver five (5) duplicate keys for each panel lock to the Owner.

.13 Mount electrical panels, where possible, with top of trim at uniform height of 2000 mm.

.14 Cap ends of conduits in accessible locations in ceiling spaces above panels, to allow for future wiring.

.15 The Contractors shall install all equipment per the manufacturer’s recommendations and the contract drawings.

.16 Install panelboards in accordance with manufacturer's written instructions, NEMA PB 1.1 and Electrical Code requirements.

.17 After completion of wiring, type directory showing a clear description of each circuit being controlled from panel and place in metal frame inside door.

.18 Provide circuit breaker handle locks for all circuits that supply exit signs, emergency lights, energy management, and control system (EMCS) panels and fire alarm panels.

3.2 FIELD QUALITY CONTROL

.1 Perform inspections and tests listed in NETA ATS, Section 7.4 for switches, Section 7.5 for circuit breakers.

.2 Inspect complete installation for physical damage, proper alignment, anchorage, and grounding.

.3 Measure steady state load currents at each panelboard feeder; rearrange circuits in the panelboard to balance the phase loads within 20 per cent of each other. Maintain proper phasing for multi-wire branch circuits.

.4 Check tightness of bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer's written specifications.

3.3 ADJUSTING

.1 Measure steady state load currents at each panelboard feeder; rearrange circuits in the panelboard to balance the phase loads to within 20 percent of each other.

.2 Maintain proper phasing for multi-wire branch circuits.

END OF SECTION

Added through ADD#10

PART 1 - GENERAL

1.1 REFERENCES

.1 ANSI/IEEE C12.20 – American National Standard for Electricity Meters

.2 NEMA C12.1 – Electric Meters; Code for Electricity Metering.

.3 IEEE C57.13 – Standard Requirements for Instrument Transformers

.4 Ontario Electrical Safety Code c/w Bulletins and Amendments.

.5 Ontario Building Code and its referenced standards.

.6 Underwriters Laboratories UL 1283 and UL 1449 (most recent edition).

.7 Canadian Standards (cUL or cETL).

1.2 SCOPE

.1 Install and commission a power monitoring, analysis and control system that employs computer technologies to provide a robust, reliable, and secure data network.

.2 The system shall be complete with web-enabled Power Monitoring and Control (PMAC) software package intended to monitor the entire data centre electrical distribution infrastructure.

.3 The system shall be designed to monitor and manage energy consumption throughout an enterprise, to improve energy availability and reliability, and manage and measure energy efficiency.

1.3 SUBMITTALS

.1 Shop Drawings:

.1 Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.

.2 Include devices, locations, connections, conduit runs, wiring type, details, and attachments to other work.

.2 Product Data: Provide dimensions, ratings, and performance data.

.3 Submit manuals, simultaneously with the shop drawings, companion copies of complete maintenance and operating manuals including technical data sheets, wiring diagrams, and information for ordering replacement parts.

.1 Wiring diagrams shall have their terminals identified to facilitate installation, maintenance, and operation.

.2 Wiring diagrams shall indicate internal wiring for each item of equipment and the interconnection between the items of equipment.

.3 Provide a clear and concise description of operation, which gives, in detail, the information required to properly operate the equipment.

.4 Approvals will be based on complete submissions of manuals together with shop drawings.

1.4 CLOSEOUT SUBMITTALS

.1 Submit manufacturer's operation and maintenance instructions for each product.

.2 Software installation CD’s, etc.

.3 Manuals:

.1 The manuals submitted for review shall be updated to include any information necessitated by shop drawing approval.

.2 Complete “As Installed” wiring and schematic diagrams shall be included which show all items of equipment and their interconnecting wiring.

.3 Show all terminal identification.

.4 Include information for testing, repair, troubleshooting, assembly, disassembly, and recommended maintenance intervals.

.5 Provide a replacement part list with current prices. Include a list of recommended spare spares, tools, and instruments for testing and maintenance purposes.

.4 Certification by the contractor that assemblies have been properly installed, adjusted, and tested.

.5 Certified copies of all factor design and production tests, and field test data sheets and reports for the assemblies.

1.5 SUMMARY

.1 The specifications in this section describe the performance, furnishing, installation and connection of a digital electric metering system installed on electrical equipment such as low voltage switchboards, distribution panels and/or low voltage branch circuit panelboards of the power system. The specified system shall provide effective revenue quality metering of the loads indicated on the single line diagram. The system shall be accessible either at the meter(s) located in the data centre, or remotely by computer.

1.6 ENVIRONMENTAL REQUIREMENTS

.1 The operating temperature range shall be -40°C to 70°C (-40°F to 160°F).

1.7 QUALITY ASSURANCE AND WARRANTY

.1 The meter and supporting components shall be guaranteed by the manufacturer to be free of defects in material and workmanship for a period of three (3) years from the date of substantial completion of service and activation of the system to which the meter(s) are attached.

.2 Warranty service may be performed by the manufacturer or authorized representative.

.3 The contractor shall support the system for two years after commissioning.

1.8 MANUFACTURER QUALIFICATIONS

.1 The meter shall be manufactured by a manufacturer that has been regularly engaged in the design, manufacturing and testing of digital meters of the types and ratings required for a period of not less than five years. Manufacturers requesting product approval must meet or exceed the written specification contained herein. Manufacturers requesting approval must receive written verification of product acceptance by the specifying engineer 10 days prior to the bid date.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 The Digital Power Instrumentation Package shall be a complete system from one of the following:

.1 The Digital Power Instrumentation Package shall be a 7330 ION series as Manufactured by Power Measurement Limited.

.1 Model P7330R0B0B0E0A0A or approved equal.

.2 The PMAC Software shall be ION Enterprise V6.0 or latest version with a 10 device license as manufactured by Power Measurement Ltd.

.2 Eaton.

.3 Intellimeter

.4 Siemens.

.5 Electro Industries/GaugeTech.

2.2 REGULATORY REQUIREMENTS

.1 Products: Listed and classified by CSA (Canadian Standards Association), ULC (Underwriters' Laboratories of Canada), or CUL.

2.3 INSTRUMENT TRANSFORMERS

.1 General

.1 Mount and brace transformers to withstand 100,000 A short circuit current.

.2 Install in feasible location near upstream overcurrent device.

.3 Meters shall be revenue grade.

.2 Current Transformers (CTs)

.1 ANSI C57.13; 5 A secondary, with primary/secondary ratio as shown on drawings, to suit size of associated upstream overcurrent devices.

.2 All Current Transformers shall be split-core type with 80 mA secondary unless noted otherwise.

.1 Provide donut or square type to suit cable or bus, respectively.

.3 CTs shall be Measurement Canada type approved or have a minimum accuracy of 0.3%.

.4 One CT is required for each phase being metered.

.3 Potential Transformers (PTs).

.1 ANSI C57.13, 120 V secondary.

.2 Burden and accuracy consistent with connected metering and relay devices, 60 Hz.

.3 Potential transformers are required for metering an all electrical systems above 120/208 V.

.4 Potential transformers on 347/600 V systems shall be rated 347-120 V, connected phase-to-neutral, and installed on each phase.

.5 PTs shall be wired line-neutral for Wye systems and line-line for delta systems.

.6 CTs shall be Measurement Canada type approved or have a minimum accuracy of 0.3%.

.7 Meter shall not be powered from the PT secondary.

.8 Voltage inputs shall be fed from a dedicated 15 A breaker in distribution panel where practical.

.9 Supply and install appropriate 1 A fuses.

2.4 DIGITAL POWER INSTRUMENTATION PACKAGE

.1 The Digital Power Instrumentation Package shall be a true RMS, bi-directional, four quadrant meter capable of measuring, calculating and directly displaying on the front panel display the following information in user programmable groups.

.1 Voltage.

.2 Current.

.3 kW.

.4 kVAR.

.5 kVA Power Factor.

.6 Harmonics.

.7 Demand.

.8 minimums and maximums for each phase.

.9 minimum and maximum totals for all phases.

.10 KWh, kVARh, kVAh totals for all phases.

.11 Voltage and current unbalance.

.12 Frequency.

.13 k-factor.

.14 Harmonic distortion for each voltage and current input, up to the 15th harmonic.

.2 The Digital Power Instrumentation Package shall:

.1 Perform continuous true RMS measurement based on 32 samples-per-cycle sampling on all voltage and current signals. Readings shall be updated once per second.

.2 Retain all setup data in non-volatile memory (NVRAM).

.3 The PMAC Instrument shall include 512 kB of non-volatile memory with two fully programmable 16-channel data recorders.

.4 The PMAC instrument shall support multiport communications that provides two ports for RS-485 communications. Interface via ION, DNP3.0, Modbus TCP, and Modbus RTU protocols, through serial or Ethernet communications.

.5 Include 10BaseT Ethernet communications port and Ethergate networking capabilities.

.6 Have an on-board WebMeter.

.7 The PMAC Instrument shall provide setpoint control to four digital output relays.

.8 Meet the following standards:

.1 Measurement Canada Revenue approved.

.2 Certified to CAN/CSA-C22.2 No.1010-1.

.3 All inputs pass ANSI/IEEE C37.90-1989 surge withstand and fast transient tests.

.4 Manufactured under ISO 9002 Quality Assurance Standard.

.3 The Digital Power Instrumentation Package shall:

.1 Require no PTs on voltage inputs Wye (Star) for 120/208/240 V systems. PTs can be used on higher voltage systems.

.2 Must meet all ISO 9001 standards for quality control where all meters test to a minimum of +/-0.5% accuracy.

.3 The current transformers shall have a full scale output of 330 mV (split core), 80 mA (solid core donut) or 5 A (solid core or split-core donut) outputs for safety purposes.

.4 Meters to be complete with a Liquid Crystal Display (LCD) to access all energy measurements and phase diagnostics when needed.

.5 Meter to have backup storage power so no data is lost during power outages. Device must be capable of holding 2 years of interval data for a 20 year period. The system shall continue to function after resumption of power.

.6 Failure of the building electrical normal power system shall not result in loss of data and will not require manual restarting of the metering system.

2.5 METER ENCLOSURES

.1 The digital meters shall be installed in pre-wired, NEMA 12, CSA approved enclosures.

.1 Multiple meters shall be installed in the same enclosure.

.2 Meters supplied from two different switchboards or different sources cannot be installed in the same enclosure.

.3 Meters shall be wired according to manufacturer's recommended method.

.4 Each meter shall be labeled.

2.6 COMMUNICATIONS AND NETWORKING COMPONENTS

.1 RS485 communications for all meters shall be terminated in the enclosure according to manufacturer's recommended practice.

.2 To enable the meters to communicate to the central monitoring software, a Lantronix UDS10 or equivalent RS485 to Ethernet serial server shall be provided in each enclosure.

.3 Routers or other required networking components shall be provided according to Owner's standard.

.4 The electrical contractor shall be responsible for providing all metering communication wiring between the meters and shall provide a single Ethernet communication point from the meters(s) to the data centre infrastructure patch panel. All Ethernet wiring shall be minimum Category 6A CMP rated. Ethernet wiring shall be installed in EMT conduit.

.5 Coordinate with Division 27.

2.7 POWER MEASUREMENT AND CONTROL (PMAC), MONITORING AND REPORTING SOFTWARE

.1 Supply and install all software to be installed on one server as directed by the Owner.

.2 The metering system shall interface with a computing server component: Windows 7 operating system, 1 RU or 2 RU server, rack mountable form factor.

.3 Hardware shall meet the Software manufacturer's recommended requirements.

.4 Install and commission a power monitoring, analysis and control system that employs the latest computer technologies to provide a robust, reliable, and secure data network.

.5 The PMAC Enterprise software shall have the following functionality:

.1 Server Workstations shall be used for connection to PMAC instruments located at monitoring as recommended by the manufacturer.

.1 Workstations shall have minimum hardware features as recommended by the manufacturer.

.2 The Communications Server shall support communication between software components and IEDs with an arbitrary number of IEDs, multiple concurrent serial and Ethernet communications links.

.3 Require no proprietary network communication hardware.

.4 Support automatic alarm call-back for any IED equipped with this capability.

.5 Support any combination of the following communication protocols directly to IEDs: ION; Modbus RTU; Modbus TCP; Serial or TCP/IP.

.2 Data Storage and Data Sharing

.1 The PMAC software shall support an arbitrary number of Windows-based Server Workstations, each running log acquisition software (Log Server) that provides the ability to:

.1 Autonomously retrieve, from any or all IEDs in the PMAC network, log records of the following type:

.1 Event log records containing device event information.

.2 Historical log records containing numerical and Boolean data.

.3 Historical log records containing waveform data.

.2 Dynamically manage database tables to reflect changes in the configuration of any IED's waveform log or data log, with no need to shutdown and restart any software.

.3 Report the occurrence of events to all user interface software components that are in use for event and alarm indication. To ensure fast event annunciation, all event information shall be made available to the user interface software and the database software concurrently.

.2 The PMAC software shall include a database management component that provides the ability to:

.1 Selectively remove a range of records from the database

.2 Archive database files on magnetic tape or other buyer-approved off-line storage media.

.3 Use the MS SQL Server database software as the database engine. If the license is less than 10 nodes the MSDE database that is included with the

software can be used. If there are more than 10 nodes communicating with the PMAC, then MS SQL Server DB license must be included.

.3 Integrated Object Processing Software

.1 The PMAC software shall support an arbitrary number of Windows-based Server Workstations, each running an Integrated Object Processing software component.

.2 The Integrated Object Processing software can be used to autonomously collate information (objects) that has been acquired from multiple sources, using diverse protocols, and allows the information to be processed for user-defined analysis and logging purposes. The Integrated Object Processing software shall be ION-compliant.

.3 The software license shall be purchased to accommodate all nodes with communications to the software, plus an additional 10% nodes shall be included for future addition.

.4 User Interface

.1 The PMAC software shall support an arbitrary number of each of the following types of Graphical User Interface components:

.2 User Display software.

.3 Device Configuration software.

.4 Network Configuration software.

.5 WebReach Browser based viewer using IIS.

.6 The User Display component shall provide the graphical interface to power monitoring, analysis, and control functions through an arbitrary number of user diagrams.

.7 There shall be a summary screen of the electrical single line diagram showing all energy monitoring nodes in real-time on the same screen, with drill-down icons for more detailed real-time data on each node. If it is not practical to show all nodes on one screen, multiple screens can be developed.

.5 Reports.

.1 The PMAC software shall include a report generation tool written in Visual Basic Macros using MS Excel spreadsheets. The reports must allow for cost allocation, load aggregation and power quality.

.2 The number and type of reports and will be defined by the owner before commissioning.

.3 The software shall have the provision to include IMO real time pricing and shadow billing functionality that matches with the local utility billing structure to create accurate bills for comparison and verification. The future shadow billing package shall also support tenant billing or cost allocation based on the IMO real-time price structure and local utility rates.

2.8 LOCATIONS OF METERING DEVICES

.1 Locate as shown on Drawings and as recommended by Manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 All power supply and communications wiring connections shall be performed in accordance with the guidelines set out in the product documentation.

.2 The meters shall be mounted in the locations indicated.

.3 All unused openings shall be covered with a metal closure plate painted to match the existing enclosure.

.4 Any extension of wiring needed to accommodate the meters shall be done using terminal blocks and 10 AWG stranded copper wire, 600 V type SIS insulation. Splices are not allowed.

.5 Dangerous voltage will develop in the open circuit secondary windings of energized current transformers. De-energize the current transformers by short circuiting the secondary windings before disconnecting or connecting instruments to current transformers.

.6 Verify the proper operation of all meters. Compare the meter display readings to measurements taken with a clamp on amp-meter and handheld volt meter.

.7 This contractor shall provide all communication trunk wiring to provide for a single connection point to the data centre LAN.

.8 All communications networking equipment, including hubs, routers, etc. required to enable a single connection to the owner's IT infrastructure shall be provided by this contractor. Provide local circuit from UPS source.

.9 Communications networking shall be tested and proved to be working before acceptance.

.10 All voltage sending connections to PMAC instrumentation shall be made with 2 A fuses.

.11 Appropriately sized current transformers must be installed on each phase and must be installed with CT shorting blocks.

.12 Meters must be powered from an auxiliary power supply, and not powered from the PTs.

.13 The installation must be in accordance with the Ontario Electrical Safety Code.

.14 The contractor is responsible for ensuring pulse inputs are wired properly to the meter.

3.2 COMMISSIONING AND CONSTRUCTION VERIFICATION

.1 Contractor is responsible for utilizing construction verification checklists supplied under commissioning section.

3.3 SOFTWARE CONFIGURATION

.1 Contractor shall ensure the software is properly configured and communicating to all meters and related devices specified and as noted on the drawings.

.2 Provide system configuration documentation that can be used for an emergency recovery.

3.4 TRAINING

.1 The contractor shall conduct a training course for meter configuration, operation, and maintenance of the system as specified. The training shall be oriented for all components and systems installed under this contract. The training shall include:

.1 Physical layout of each piece of hardware.

.2 Meter configuration, troubleshooting and diagnostic procedures.

.3 Repair instructions.

.4 Preventative maintenance procedures and schedules.

.5 Testing and calibration procedures.

.6 Use of metering software.

.2 Contractor shall include hands-on training with a factory trained representative or local integrator to ensure the end user is comfortable with the software. Schedule training during normal business hours.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Electrical cabinets.

.2 Electrical enclosures.

.3 Splitters.

1.2 RELATED REQUIREMENTS

.1 Section 26 27 26 – Wiring Devices.

1.3 REFERENCES

.1 CSA Group:

.1 CSA C22.1:21, Canadian Electrical Code, Part 1 (25th Edition), Safety Standard for Electrical Installations.

.2 Ontario Electrical Safety Code (28th edition/2021).

.3 CSA C22.2 No. 94.2:20 – Enclosures for Electrical Equipment, Environmental Considerations.

.2 Underwriters Laboratories Inc. (UL):

.1 UL 50 – Enclosures for Electrical Equipment, Non-Environmental Considerations.

.2 UL 50E – Enclosures for Electrical Equipment, Environmental Considerations

1.4 SUBMITTALS

.1 Comply with Section 01 33 00.

.2 Product Data: Provide manufacturer's catalogue information showing dimensions, colours, and configurations.

1.5 QUALITY ASSURANCE

.1 Manufacturer Qualifications: Products shall be free of defects in material and workmanship.

.2 Furnished products shall be listed or classified by third party agencies as suitable for the intended purpose.

1.6 WARRANTY

.1 Product is warranted free of defects in material and workmanship.

.2 Product is warranted to perform the intended function within design limits.

PART 2 - PRODUCTS

2.1 GENERAL

.1 NEMA 12/4X screw cover enclosures.

.2 NEMA 12/4X hidden hinge cover enclosures.

.3 NEMA 12/4X external hinge cover enclosures.

2.2 MANUFACTURERS

.1 Bel Products.

.2 EXM Manufacturing.

.3 Hammond Manufacturing.

.4 Hoffman.

.5 Thomas & Betts.

.6 Ralston Metal.

2.3 REGULATORY REQUIREMENTS

.1 Provide products listed and classified by CSA (Canadian Standards Association).

2.4 DESIGN AND PERFORMANCE REQUIREMENTS

.1 NEMA 12/4X screw cover enclosures:

.1 Enclosure shall be UL listed in accordance with UL-50 and CSA or cUL certified to CSA C22.2 No. 94.2.

.2 Enclosure shall have CSA enclosure ratings type 1, 2, 3, 3S, 3X, 3SX, 4, 4X and 12.

.3 Body shall be manufactured from a high-impact, corrosion resistant solid engineering thermoplastic material; UV stabilized for outdoor use and complies with UL-94 minimum V-2 requirements.

.4 Cover shall be manufactured from either a high-impact, corrosion resistant solid engineering material, UV stabilized for outdoor use and comply with UL-94 minimum V-2 requirements, or a clear polycarbonate material, UV stabilized for outdoor use and comply with UL-94 minimum V-2 requirements.

.5 Body and cover shall maintain physical properties through overall temperature range of -35°C to 110°C (-31°F to 230°F).

.6 Body shall be an industrial grey colour, and lid shall be either industrial grey or clear.

.7 Cover and body shall be free of rough corners, sharp edges, or burrs.

.8 Cover screws (10-32) shall be captive with a slotted stainless steel (type 304) fillister head.

.9 Factory installed brass inserts shall be provided for cover (10-32), mounting flanges (1/4-20), and panel mounting (10-32) screws.

.10 Mounting flanges shall be removable and shall permit vertical or horizontal placement on the body.

.11 Back panel mounting means shall accept standard size back panels.

.12 Interior body corners shall have dovetail to permit panel to be mounted at any depth.

.13 Swing out panel mounts shall be utilized when a second panel is desired, or when access to the rear of the primary panel is desired.

.14 Hardware kit for adjustable panel mounting shall be available.

.15 Hardware kit for swing out panel mounting shall be available.

.16 Enclosure gasket shall be oil resistant continuous closed cell neoprene.

.17 Enclosure body shall have tapered edges to keep liquids away from cover opening.

.18 Back panel shall be available in either 14 gauge steel, painted white, or in 7 mm (1/4 in) PVC.

.19 Enclosure shall be available as factory assembly or as individual components.

.2 NEMA 12/4X hidden hinge cover enclosures:

.1 Enclosure shall be UL listed in accordance with UL-50 and CSA or cUL certified to CSA C22.2 No. 94.2.

.2 Enclosure shall have CSA enclosure ratings type 1, 2, 3, 3S, 3X, 3SX, 4, 4X, and 12.

.3 Body shall be manufactured from a high-impact, corrosion resistant solid engineering thermoplastic material; UV stabilized for outdoor use and comply with UL-94 minimum V-2 requirements.

.4 Cover shall be manufactured from either a high-impact, corrosion resistant solid engineering material, UV stabilized for outdoor use and comply with UL-94 minimum V-2 requirements, or a clear polycarbonate material, UV stabilized for outdoor use and comply with UL-94 minimum V-2 requirements.

.5 Body and cover shall maintain physical properties through overall temperature range of -35°C to 110°C (-31°F to 230°F).

.6 Body shall be an industrial grey colour, and lid shall be either industrial grey or clear.

.7 Cover and body shall be free of rough corners, sharp edges, or burrs.

.8 Cover shall be mounted to body with integral hidden non-metallic hinges that shall provide 145° opening.

.9 Cover shall be removable and interchangeable.

.10 Body shall have integral boss for mounting quick release latches.

.11 Quick release (lockable) latches shall be available in either non-metallic, or in type 304 stainless steel.

.12 Cover screws (10-32) shall be captive with a slotted stainless steel (type 304) fillister head.

.13 Factory installed brass inserts shall be provided for cover (10-32), mounting flanges (1/4-20), and panel mounting (10-32) screws.

.14 Mounting flanges shall be removable and shall permit vertical or horizontal placement on the body.

.15 Back panel mounting means shall accept standard size back panels.

.16 Interior body corners shall have dovetail to permit panel to be mounted at any depth.

.17 Swing out panel mounts shall be utilized when a second panel is desired, or when access to the rear of the primary panel is desired.

.18 Hardware kit for adjustable panel mounting shall be available.

.19 Hardware kit for swing out panel mounting shall be available.

.20 Enclosure gasket shall be oil resistant continuous closed cell neoprene.

.21 Enclosure body shall have tapered edges to keep liquids away from cover opening.

.22 Back panel shall be available in either 14 gauge steel, painted white, or in 7 mm (1/4 in) PVC.

.23 Enclosure shall be available as factory assembly or as individual components.

.3 NEMA 12/4X external hinge cover enclosures:

.1 Enclosure shall be UL listed in accordance with UL 50 and CSA or cUL certified to CSA C22.2 No. 94.2.

.2 Enclosure shall have CSA enclosure ratings type 1, 2, 3, 3S, 3X, 3SX, 4, 4X, and 12.

.3 Body shall be manufactured from a high-impact, corrosion resistant solid engineering thermoplastic material, UV stabilized for outdoor use and comply with UL-94 minimum V-2 requirements.

.4 Cover shall be manufactured from either a high-impact, corrosion resistant solid engineering material, UV stabilized for outdoor use and comply with UL-94 minimum V-2 requirements, or a clear polycarbonate material, UV stabilized for outdoor use and comply with UL-94 minimum V-2 requirements.

.5 Body and cover shall maintain physical properties through overall temperature range of -35°C to 110°C (-31°F to 230°F).

.6 Body shall be an industrial grey colour, and lid shall be either industrial grey or clear.

.7 Cover and body shall be free of rough corners, sharp edges, or burrs.

.8 Cover shall be mounted to body with integral external non-metallic hinges that shall provide 240° opening.

.9 Cover shall be removable and interchangeable.

.10 Body shall have integral boss for mounting quick release latches.

.11 Quick release (lockable) latches shall be available in either non-metallic, or in type 304 stainless steel.

.12 Cover screws (10-32) shall be captive with a slotted stainless steel (type 304) fillister head.

.13 Factory installed brass inserts shall be provided for cover (10-32), mounting flanges (1/4-20), and panel mounting (10-32) screws.

.14 Mounting flanges shall be removable and shall permit vertical or horizontal placement on the body.

.15 Back panel mounting means shall accept standard size back panels.

.16 Interior body corners shall have dovetail to permit panel to be mounted at any depth.

.17 Swing out panel mounts shall be utilized when a second panel is desired, or when access to the rear of the primary panel is desired.

.18 Hardware kit for adjustable panel mounting shall be available.

.19 Hardware kit for swing out panel mounting shall be available.

.20 Enclosure gasket shall be oil resistant continuous closed cell neoprene.

.21 Enclosure body shall have tapered edges to keep liquids away from cover opening.

.22 Back panel shall be available in either 14 gauge steel, painted white, or in 7 mm (1/4 in) PVC.

.23 Enclosure shall be available as factory assembly or as individual components.

2.5 SPLITTER TROUGHS

.1 CSA approved.

.2 NEMA 1, formed, factory primed and painted steel box enclosure with knockouts.

.3 Hinged front cover plate.

.4 Suitable mounting provisions.

.5 Nameplate giving its rating.

.6 Terminal blocks consist of pressure type main lugs and branch lugs approved for copper wiring and mounted on porcelain bases.

.7 Splitter trough ratings are scheduled on the drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install to CSA C22.1.

.2 Install devices plumb and level.

3.2 CLEANING

.1 Clean exposed surfaces to remove splatters and restore finish.

END OF SECTION

No Floor Boxes
SEE ADD#4,Q#97

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Switches, receptacles, wiring devices, cover plates, and their installation.

1.2 RELATED REQUIREMENTS

.1 Section 26 09 23 – Lighting Control Devices.

.2 Section 26 27 26.13 – Floor Box Assemblies.

1.3 REFERENCES

.1 CSA Group:

.1 CSA C22.1:21, Canadian Electrical Code, Part 1 (25th Edition), Safety Standard for Electrical Installations.

.2 Ontario Electrical Safety Code (28th edition/2021).

.3 CSA C22.2 No. 14-13, Industrial control equipment.

.4 CSA C22.2 No. 42-10 (R2015), General use receptacles, attachment plugs, and similar devices.

.5 CSA C22.2 No. 42.1-13, Cover plates for flush-mounted wiring devices.

.6 CSA C22.2 No. 55-15 (R2020), Special use switches.

.7 CSA C22.2 No.111-10 (R2015), General-use snap switches.

.8 CSA C22.2 No. 182.1-17, Plugs, receptacles, and cable connectors of the pin and sleeve type.

1.4 INFORMATIONAL SUBMITTALS

.1 Submit shop drawings and product data in accordance with Section 01 33 00.

.2 Product Data: Provide manufacturer's catalogue information showing dimensions, colours, and configurations.

.3 Submit manufacturer's installation instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Eaton.

.2 Hubbell Bryant.

.3 Leviton.

.4 Molex.

.5 Pass & Seymour (Legrand).

2.2 WALL SWITCHES

.1 Single pole, double pole, three-way, four-way switches to: CSA C22.2 No. 55 and CSA C22.2 No.111.

.2 Description: CSA 22.2 No. 111, Commercial Spec Grade, AC only general-use snap switch.

.3 Local switches shall be 20 A, silent, brown coloured, AC type and CSA certified, specification grade. Provide switches rated to suit system voltage 120 V or 347 V.

.4 Manually-operated general purpose AC switches with following features:

.1 Terminal holes approved for 10 AWG wire.

.2 Silver alloy contacts.

.3 Urea or melamine moulding for parts subject to carbon tracking.

.4 Suitable for back and side wiring.

.5 Voltage: 120 V or 347 V, AC as indicated.

.6 Current: 20 A.

.7 Body and Handle: white plastic with toggle handle. Confirm finish colour prior to ordering.

.8 Toggle operated fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads.

.9 Example Products (Decorator style):

.1 120 V:

.1 Hubbell HBL2121 series.

.2 347 V:

.1 Pass & Seymour 2601-347 series.

.10 Example Products (Toggle style):

.1 120 V:

.1 Hubbell HBL1221 (single pole).

.2 Hubbell HBL1222 (double pole).

.3 Hubbell HBL1223 (three-way).

.4 Hubbell HBL1224 (four-way).

.2 347 V:

.1 Hubbell HBL18221 (single pole).

.2 Hubbell HBL18223 (three-way).

.3 Pass & Seymour PS372030I.

.11 Local switches and receptacles shall be of the same manufacturer throughout except where a specified item is not made by that manufacturer.

2.3 RECEPTACLES

.1 General

.1 Description: CSA C22.2 No. 42, Commercial Spec Grade general use receptacles.

.2 Device Body: white plastic.

.3 Configuration: Type as specified and indicated.

.4 Convenience Receptacle: Type 5-15, 5-20 where indicated.

.5 GFCI Receptacle: Convenience receptacle with integral ground fault circuit interrupter to meet regulatory requirements.

.6 Data Room Receptacle Types: As indicated on drawings.

.7 Receptacles of one manufacturer throughout project.

.2 Receptacles shall be white coloured, specification grade, unless noted otherwise.

.3 Receptacles shall be as listed below:

.1 15 A, 120 V, single phase grounded duplex receptacle shall be NEMA-U- ground type CSA Configuration 5-15R.

.2 20 A, 120 V, single phase grounded duplex receptacle shall be NEMA-U-ground type CSA Configuration 5-20RA

.3 15 A, 120 V, weatherproof receptacles shall be equal to those above but complete with gasketed cast plate and hinged covers.

.4 Other types of receptacles shall be provided as shown on Drawings.

.5 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, to: CSA C22.2 No. 42 with following features:

.1 White urea moulded housing.

.2 Suitable for No. 10 AWG for back and side wiring.

.3 Break-off links for use as split receptacles.

.4 Eight back wired entrances, four side wiring screws.

.5 Triple wipe contacts and riveted grounding contacts.

.6 Single receptacles CSA type 5-15 R, 125 V, 15 A, U ground with following features:

.1 White urea moulded housing.

.2 Suitable for No. 10 AWG for back and side wiring.

.3 Four back wired entrances, 2 side wiring screws.

.7 Other receptacles with ampacity and voltage as indicated.

.8 Example Products (Decorator style duplex 5-15R):

.1 Pass & Seymour 26252 Series.

.2 Hubbell HBL2152 Series.

.9 Ground Fault Circuit Interrupter (GFCI or GFI) Receptacles

.1 Protected by a ground fault circuit interrupter of the Class A type.

.2 Any receptacle within 1.5 m (5 ft) of a sink must be GFCI protected.

.3 Any receptacle located outdoor must be GFCI protected.

.10 Isolated Ground (IG) Receptacles:

.1 Marked as such (green triangle).

.2 Example Products:

.1 Hubbell IG2152 (15 A duplex decorator style, orange faceplate).

.11 Tamper-resistant receptacles.

.1 Marked as such (for example “TR”).

.2 To be used in the following spaces:

.1 Child care facilities and kindergarten classrooms.

.2 Guest rooms and suites of hotels and motels.

.3 Preschools and elementary education facilities, including kindergarten facilities.

.4 Dwelling units.

.3 Example Products:

.1 Hubbell BR15WHITR (15 A duplex decorator style).

.2 Hubbell BR20WHITR (20 A duplex decorator style).

.12 USB Charger receptacles: duplex tamper resistant device.

.1 USB ports: one type A and one type C USB charging port, 5 A, 5 V.

.2 Example: Hubbell USB15AC5WWR.

2.4 COVER PLATES

.1 Cover plates for wiring devices to: CSA C22.2 No. 42.1.

.2 Cover plates from one manufacturer throughout project.

.3 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.

.4 Stainless steel, vertically brushed, cover plates, thickness 2.5 mm for wiring devices mounted in flush-mounted outlet box.

.5 Cast cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.

.6 Weatherproof double lift spring-loaded cast aluminum cover plates, complete with gaskets for duplex receptacles as indicated.

.7 Weatherproof spring-loaded cast aluminum cover plates complete with gaskets for single receptacles or switches.

.8 Decorative Cover Plate: Polycarbonate.

.1 Pass & Seymour TP26W series.

.9 Switch, receptacle, telephone, and other plates shall be stainless steel 18-8 chrome metal alloy, Type 302, non-metallic in finished areas and pressed steel in unfinished areas. Finish brush marks shall be run in a vertical direction.

.10 Wet Location and weatherproof devices: receptacles and cover plates shall be suitable for wet locations and provide shielding with and without a plug inserted into the receptacle in accordance with 2021 OESC rule 26-708.

2.5 PENDANT RECEPTACLES

.1 Pendant cord mounted single receptacles complete with strain relief device.

.2 Strain relief system: Hubbell Kellems Grips, Molex, or equal.

2.6 SPECIAL WIRING DEVICES

.1 Pilot lights as indicated, with neon type 0.04 W, 125 V lamp and red plastic jewel flush type.

2.7 PIN AND SLEEVE DEVICES

.1 Manufacturers:

.1 Crouse-Hinds by Eaton.

.2 Hubbell.

.3 Meltric.

.4 Mennekes.

.5 Russellstoll (Thomas & Betts).

.6 Walther Electric.

.2 Refer to equipment schedule and plans for locations and specific requirements.

2.8 HAZARDOUS (CLASSIFIED) LOCATION RECEPTACLES

.1 In accordance with CSA C22.2 No. 159-18, Plugs, connectors, receptacles, and similar wiring devices for use in hazardous locations.

.2 Manufacturers:

.1 Crouse-Hinds.

.2 Appleton Electric.

.3 Killark; Division of Hubbell Inc.

2.9 REGULATORY REQUIREMENTS

.1 Provide products listed and classified by CSA (Canadian Standards Association).

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verify that outlet boxes are installed at proper height.

.2 Verify that wall openings are neatly cut and will be completely covered by wall plates.

.3 Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.2 PREPARATION

.1 Provide extension rings to bring outlet boxes flush with finished surface.

.2 Clean debris from outlet boxes.

3.3 INSTALLATION

.1 Install to CSA C22.1.

.2 Mounting heights in accordance with Section 26 05 00.

.3 Install devices plumb and level.

.4 Install switches with OFF position down.

.5 Install wall dimmers to achieve full rating specified and indicated after de-rating for ganging as instructed by manufacturer.

.6 Do not share neutral conductor on load side of dimmers.

.7 Install receptacles with grounding pole on bottom.

.8 Connect wiring device grounding terminal to outlet box with bonding jumper.

.9 Install decorative plates on switch, receptacle, and blank outlets in finished areas.

.10 Connect wiring devices by wrapping conductor around screw terminal.

.11 Use jumbo size plates for outlets installed in masonry walls.

.12 Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.

.13 Switches:

.1 Install single throw switches with handle in "UP" position when switch closed.

.2 Install switches in gang type outlet box when more than one switch is required in one location.

.14 Receptacles:

.1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.

.2 Where split receptacle has one portion switched, mount vertically and switch upper portion.

.3 Connect receptacle grounding terminal to the outlet box with an insulated green ground strap.

.4 Receptacles for maintenance of HVAC and similar equipment located on rooftops.

.1 Provide weatherproof GFI 5-20R receptacles on roof, installed at 750 mm (30 in) above finished roof level, complete with wet location “while in use” “extra duty” cover plate.

.2 Locate within 7500 mm (25 ft) of new HVAC equipment, and at least 2000 mm (6.5 ft) away from roof line.

.3 Refer to 2021 OESC rules 2-316, 26-708, and 26-710, and OESC bulletin 26-27-0, or latest edition.

.15 Cover plates:

.1 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.

.2 Install suitable common cover plates where wiring devices are grouped.

.3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

.4 Do not install plates until final painting of room or area is completed. Remove protective covering.

.16 Circuit identification: in accordance with Section 26 05 53.

3.4 FIELD QUALITY CONTROL

.1 Inspect each wiring device for defects.

.2 Operate each wall switch with circuit energized and verify proper operation.

.3 Verify that each receptacle device is energized.

.4 Test each receptacle device for proper polarity.

.5 Test each GFCI receptacle device for proper operation.

3.5 ADJUSTING

.1 Adjust devices and wall plates to be flush and level.

3.6 CLEANING

.1 Clean exposed surfaces to remove splatters and restore finish.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 CSA C22.2 No. 248 series.

1.2 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:

.1 Provide fuse performance data characteristics for each fuse type and size above 200 amps. Performance data to include average melting time-current characteristics.

.3 Shop Drawings:

.1 Provide shop drawings in accordance with Section 01 33 00.

1.3 DELIVERY, STORAGE, AND HANDLING

.1 Ship fuses in original containers.

.2 Do not ship fuses installed in switchboard.

.3 Store fuses in original containers in storage cabinet.

.4 Waste Management and Disposal:

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 00.

1.4 MAINTENANCE MATERIAL SUBMITTALS

.1 Provide maintenance materials in accordance with Section 01 78 00.

.2 3 spare fuses of each type and size installed above 600 A.

.3 6 spare fuses of each type and size installed up to and including 600 A.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Bussman by Eaton.

.2 GEC.

.3 Littelfuse.

.4 Mersen.

.5 Substitutions: not permitted.

2.2 FUSES - GENERAL

.1 Fuse type references L1, L2, J1, R1, etc. have been adopted for use in this specification.

.2 Fuses: product of one manufacturer.

.3 Fuses shall be sized as shown, time delay type, and of the same type throughout.

.4 Fuses shall be CSA certified Class-J for 1-600 A or Class-L for 650 A and above.

.5 Provide the following accessories where indicated or where required to complete installation:

.1 Fuseholders: Compatible with indicated fuses.

.2 [Fuse Reducers: For adapting indicated fuses to permit installation in switch designed for uses with larger ampere ratings.]

2.3 FUSE TYPES

.1 Class J fuses.

.1 Type J1, time delay, capable of carrying 500 per cent of its rated current for 10 seconds minimum.

.2 Type J2, fast acting.

.2 Class L fuses.

.1 Type L1, time delay, capable of carrying 500 per cent of its rated current for 10 seconds minimum.

.2 Type L2, fast acting.

.3 Class R fuses.

.1 Type R1, (UL Class RK1), time delay, capable of carrying 500 per cent of its rated current for 10 seconds minimum, to meet UL Class RK1 maximum let-through limits.

.2 Type R2, time delay, capable of carrying 500 per cent of its rated current for 10 seconds minimum.

.3 Type R3, (UL Class RK1), fast acting Class R, to meet UL Class RK1 maximum let-through limits.

2.4 FUSE REQUIREMENTS

.1 Dimensions and Performance: CSA C22.2 No. 248 Series, Class as specified or indicated.

.2 Voltage: Provide fuses with voltage rating suitable for circuit phase-to-phase voltage.

.3 Power Load Feeder Switches: HRC-1 Class J time delay type.

.4 Other Feeder Switches: HRC-1 Class J time delay type.

2.5 SPARE FUSE CABINET

.1 Description: Wall-mounted sheet metal cabinet, suitably sized to store spare fuses and fuse pullers specified.

.2 Doors: Hinged, with hasp for Owner's padlock.

.3 Finish: Prime finish for field painting.

.4 Dimensions: Minimum 914 mm by 914 mm by 305 mm (3 ft by 3 ft by 1 ft).

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install fuses to manufacturer's instructions.

.2 Install fuse with label oriented such that manufacturer, type, and size are easily read.

.3 Install spare fuse cabinet in electrical room.

.4 Provide a complete set of fuses in each fusible device supplied under this Division and provide 3 spare fuses for each size used in spare fuse cabinet.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Molded-case circuit breakers.

.2 Molded-case switches.

.3 Accessories.

1.2 RELATED REQUIREMENTS

.1 Section 26 24 13 – Switchboards.

.2 Section 26 24 16 – Panelboards.

1.3 REFERENCES

.1 CSA C22.1:21, Canadian Electrical Code, Part 1 (25th Edition), Safety Standard for Electrical Installations.

.2 Ontario Electrical Safety Code (28th edition/2021).

.3 CSA C22.2 No. 5-16, Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures.

.4 NEMA AB1 - Molded Case Circuit Breakers, Molded Case Switches, and Circuit - Breaker Enclosures.

.5 NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment (published by the International Electrical Testing Association).

1.4 SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00.

.2 Include time-current characteristic curves for breakers with ampacity of 400 A and above, or with interrupting capacity of 22,000 A symmetrical (rms) and over at system voltage.

.3 Include termination temperature rating in degrees C.

.4 Certificate of Origin

.1 Prior to any installation of circuit breakers in either a new or existing installation, Contractor must submit three (3) copies of a certificate of origin from the manufacturer, duly signed by the factory and the local manufacturer's representative, certifying that all circuit breakers come from this manufacturer, they are new and they meet standards and regulations. These certificates must be submitted to the Consultant for review.

.2 A delay in the production of the certificate of origin won't justify any extension of the contract and additional compensation.

.3 Any work of manufacturing, assembly or installation should begin only after acceptance of the certificate of origin by the Consultant. Unless complying with this requirement, Consultant reserves the right to mandate the manufacturer listed on circuit breakers to authenticate all new circuit breakers under the contract, and that, to Contractor's expense.

.4 In general, the certificate of origin must contain:

.1 The name and address of the manufacturer, and the person responsible for authentication. The responsible person must sign and date the certificate;

.2 The name and address of the licensed dealer, and the person of the distributor responsible for the Contractor's account.

.3 The name and address of the Contractor, and the person responsible for the project.

.4 The name and address of the local manufacturer's representative. The local representative must sign and date the certificate.

.5 The name and address of the building where circuit breakers will be installed:

.1 Project title.

.2 End user's reference number.

.3 The list of circuit breakers.

PART 2 - PRODUCTS

2.1 GENERAL

.1 Molded-case circuit breakers, Circuit breakers, and Ground-fault circuit-interrupters, Fused circuit breakers, and Accessory high-fault protectors: to CSA C22.2 No. 5.

.2 Bolt-on Molded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.

.3 Plug-in Molded case circuit breakers: quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.

.4 Common-trip breakers: with single handle for multi-pole applications.

.5 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.

.1 Trip settings on breakers with adjustable trips to range from 3-8 times current rating.

.6 Circuit breakers with interchangeable trips.

2.2 INTERRUPTING CAPACITY

.1 Protective devices shall be fully rated, for required available fault current. Series rated shall not be used on this installation.

.2 Refer to Section 26 24 13, and Section 26 24 16.

2.3 MOLDED CASE CIRCUIT BREAKERS – GENERAL

.1 Molded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

.2 NEMA AB 1, circuit breakers with integral thermal and instantaneous magnetic trip in each pole.

.3 Provide circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.

.4 1-, 2-, or 3-pole bold on, single-handle common trip voltage as indicated on drawings.

.5 Overcentre toggle-type mechanism, quick-make, quick-break action. Trip indication is by handle position.

.6 Calibrate for operation in 40 degree C ambient temperature.

2.4 MOLDED CASE CIRCUIT BREAKERS – UP TO 150 AMPERE

.1 Permanent trip unit containing individual thermal and magnetic trip elements in each pole, unless noted otherwise on drawings.

2.5 MOLDED CASE CIRCUIT BREAKERS – 151 TO 224 AMPERE

.1 Variable magnetic trip elements. Provide push-to-trip button on cover of breaker for mechanical tripping.

2.6 MOLDED CASE CIRCUIT BREAKERS – 225 AMPERE AND ABOVE

.1 Electronic trip type with adjustments for long-time, instantaneous, and short-time functions.

.2 Provide ground fault function for breakers greater than 1000 Amps.

.3 1000 Amp and Above:

.1 Modbus Communications

.1 Breaker status.

.1 Open.

.2 Closed.

.3 Tripped.

.2 Cause of trip.

.3 Time of trip.

.4 Current at time of trip.

.5 RMS currents per phase and ground.

.6 Peak demand.

.7 Present demand.

.8 Energy consumption.

.4 1200 Amp and Above:

.1 Provide handle mechanisms that are lockable in the open (off) position.

2.7 ADDITIONAL FEATURES

.1 Provide as indicated on drawings:

.1 Shunt trip.

.2 Auxiliary switch.

.3 Motor-operated mechanism.

.4 Under-voltage release.

.5 On-off locking device.

.6 Handle mechanism.

2.8 MOLDED-CASE SWITCHES

.1 Molded-case circuit breaker with fixed, high-set instantaneous trip only, and short-circuit withstand rating equal to equivalent breaker frame size interrupting rating.

.2 Accessories:

.1 Lugs: Mechanical style suitable for number, size, trip ratings, and material of conductors.

.2 Application Listing: Type HACR for heating, air-conditioning, and refrigerating equipment.

2.9 ENCLOSED BREAKERS AND ENCLOSED MOLDED-CASE SWITCHES

.1 Molded case, front operated, automatic circuit breakers sized as specified on drawings each secured in a NEMA 1, flush wall mounting enclosure with steel front panel.

.2 Voltage rating suitable for circuit phase to phase voltage as indicated on drawings.

.3 Units to include solid state adjustable trip units and contactors. Contactors to be of rating and type to suit application.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install circuit breakers as per related sections.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Fusible and non-fusible enclosed low-voltage disconnect switches from 30 amps to 800 amps.

1.2 RELATED REQUIREMENTS

.1 Section 26 28 13 – Fuses.

1.3 REFERENCES

.1 CSA Group:

.1 CSA C22.1:21, Canadian Electrical Code, Part 1 (25th Edition), Safety Standard for Electrical Installations.

.2 Ontario Electrical Safety Code (28th edition/2021).

.3 CSA C22.2 No. 4-16, Enclosed and Dead-Front Switches.

.4 CSA C22.2 No. 248 series, Low-voltage fuses.

.2 NETA (International Electrical Testing Association) ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

1.4 SUBMITTALS

.1 Product Data: Provide switch ratings, and enclosure dimensions.

1.5 CLOSEOUT SUBMITTALS

.1 Record actual locations of enclosed switches in project record documents.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Eaton Cutler-Hammer.

.2 Siemens.

.3 Square D by Schneider Electric.

2.2 REGULATORY REQUIREMENTS

.1 Products: Listed and classified by CSA or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

2.3 DISCONNECT SWITCHES

.1 Provide dedicated disconnect switches at electrical equipment.

.2 Fused or un-fused disconnect or safety switches: Type "A", quick-make, quick-break construction with provision for padlocking switches in either "ON" or "OFF" position.

.1 Quick-make, quick-break.

.2 Heavy duty industrial type.

.3 Lockable with up to 3 padlocks.

.4 Cover interlocked with switch mechanism.

.5 Viewing window for viewing blades.

.3 Fused switches equipped with fuse clips designed for Class "J" fuses and designed to reject standard NEC fuses.

.4 Enclosure: CSA Type 1 sprinkler-proof, or as noted.

.5 Switches throughout project of same manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Provide fused or un-fused safety or disconnect switches as shown and as required by Code.

.2 Install disconnect switches complete with fuses, if applicable, to CSA C22.1.

.3 Apply neatly typed adhesive tag on inside door of each fusible switch indicating NEMA fuse class and size installed.

.4 Coordinate fuse ampere rating with installed equipment. Fuse ampere rating variance between original design information and installed equipment, size in accordance with Bussmann Fusetron 40 degree C recommendations. Do not provide fuses of lower ampere rating than motor starter thermal units.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Loose motor starters.

.2 The section number for the work of this Section is assigned in accordance with MasterFormat numbers and titles, and classification within this division does not assign responsibility to a specific trade.

1.2 RELATED REQUIREMENTS

.1 Section 20 05 00 – Common Work Results for Mechanical.

.2 Section 20 05 13 – Common Motor Requirements for Mechanical Equipment.

.3 Section 26 28 13 – Fuses.

.4 Section 26 29 23 – Variable-Frequency Motor Controllers.

1.3 REFERENCES

.1 CSA C22.2 No. 14-18, Industrial control equipment.

.2 CSA C22.2 No. 106:05 (R2019), HRC-Miscellaneous fuses.

1.4 QUALITY ASSURANCE

.1 Starters, and all components shall be designed, manufactured, and tested in accordance with the latest applicable standards of NEMA, ANSI, and CSA 22.2 No. 14.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 ABB.

.2 Allen-Bradley products from Rockwell Automation.

.3 Benshaw.

.4 Eaton.

.5 Siemens.

.6 Square D by Schneider Electric.

2.2 MOTOR STARTERS, GENERAL

.1 Enclosures for starters located in sprinklered areas shall be CSA type 2.

.2 All other loose starter enclosures shall be CSA type 1, unless otherwise noted.

2.3 MOTOR STARTERS, SINGLE PHASE

.1 Starters for single phase motors shall be manual type, combination switch with overload relay and pilot light.

2.4 MOTOR STARTERS, THREE PHASE

.1 Unless otherwise noted, starters for 3-phase motors shall be combination "quick-make" and "quick-break" fused disconnects and full voltage, non-reversing magnetic starters for across-the-line service. Full protection of each phase shall be included in the starters by means of one overload relay per phase per starter. Starters shall be equipped with "hand-off-automatic" switches and pilot light required as a minimum.

.2 Starters for three phase motors shall include the following:

.1 Three overload elements sized to suit the characteristics of the motor.

.2 Manual reset button.

.3 CSA type 1 enclosure.

.4 Auxiliary contacts as required to satisfy interlocking and automatic control requirements. Include one spare contact for future connection to a Central Computer System.

.5 120 V fused control transformer inside the starter enclosure where control wiring extends outside the starter enclosure.

.6 Hand-Off-Auto switch, and pilot light.

.7 Additional components as noted in documents.

2.5 REDUCED VOLTAGE STARTERS

.1 Provide reduced voltage starters on all motors 10 hp, and larger.

.2 Manufacturers:

.1 Benshaw.

2.6 FUSES FOR MOTOR PROTECTION

.1 Fuses in accordance with Section 26 28 13.

.2 Fuses shall be CSA certified HRCI-J, and energy limiting type 200,000 ampere interrupting capacity to CSA C22.2 No. 106, time delay type.

.3 Supply a list of motors, with their starting and operating characteristics, and the type of equipment associated with the motors, to the Fuse Manufacturer for verification of fuse sizes.

.4 Size fuses in accordance with fuse manufacturer's recommendations. Note that fan motors are to be sized for 15 second maximum start-up time as specified in Article "Electric Motors".

.5 Where fuses supplied cause unnecessary outages or do not provide adequate protection, retain the Fuse Manufacturer's representative to determine the cause. Replace such blown fuses at no cost to Owner.

.6 Provide one spare set of fuses for each rating and type of fuse used in this Contract, and hand over to Owner at completion of Work.

.7 Fuses shall be NEMA type "J" as manufactured by:

.1 Chase Shawmutt - Amp. Trap.

.2 English Electric Co. of Canada Ltd.

.3 Appleton Electric Co.

.8 Size fuses installed in combination magnetic starters used in conjunction with magnetic starters, for a branch circuit and motor protection for over-current protection in accordance with Fuse Manufacturer's recommendations.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install starters in accordance with Section 26 05 83.

.2 A starter, and/or start/stop station as required, together with required pilot lights, remote switches and auxiliary contacts shall be supplied by trade Section of Mechanical Divisions for each motor or electrical item requiring control provided by that trade. This equipment shall be submitted to Division 26 for installation.

.3 Where individual starters and controls are grouped together, a panel for mounting this equipment shall be provided by Contractor under Electrical Division 26.

.4 Conduit and wiring to line side of remotely located starters or to line terminals of Motor Control Centres and from these points to a disconnect and/or motor will be provided under the Electrical Division 26.

.5 Wiring to water unit heaters and cabinet unit heaters will be under Electrical Division 26. Wiring and conduit required for a thermostat will be provided by as described in Section 26 05 23.

.6 Mechanical Divisions will provide all control wiring regardless of voltage for all of the equipment provide under Mechanical Divisions but not limited to:

.1 Interlocking of supply or exhaust air fans.

.2 Wiring for automatic controls.

.3 Individual fan shut-down due to fire stat, freeze stat duct smoke detector, etc.

.7 Wiring, motors, control devices and electrical equipment provided under Mechanical Divisions shall conform to the Canadian Electrical Code as amended to date.

.8 Wiring methods and standards shall conform to those specified in Electrical Division 26 for the area of the building in which the installation is to be made.

.9 Install wiring in conduit unless otherwise noted.

.10 Use thin wall conduit up to and including 32 mm size for wiring in ceilings, furred spaces, in hollow walls and partitions and where not exposed to mechanical injury. Use rigid galvanized steel conduit for wiring in poured concrete, where exposed and for conduit 38 mm size and larger. Plastic conduit is not acceptable above ground.

.11 Run conduit and cables in finished areas concealed above ceilings and in partitions. Run conduit and cable exposed in any unfinished areas such as mechanical rooms, rooms with no suspended ceilings, service tunnels and penthouses and install at right angles or parallel to building lines. Boxes shall be cast type.

.12 Wiring shall be RW90 X-Link type sized to carry 125% of the full load running current in accordance with the Electrical Code. Wiring shall be minimum No. 12 gauge, except for control wiring which shall be colour coded No. 14 gauge.

END OF SECTION

Updated through ADD#8

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Factory assembled packaged gas-engine generator set equipment with digital (microprocessor-based) electronic generator set controls, digital governor, and digital voltage regulator.

.2 Exhaust silencer and fittings.

.3 Fuel fittings.

.4 Remote control panel.

.5 Battery and charger.

.6 Weatherproof skin-tight enclosure.

.7 Accessories.

1.2 RELATED REQUIREMENTS

.1 Section 03 30 00 – Cast-in-Place Concrete.

.2 Section 23 11 23 – Facility Natural-Gas Piping.

.3 Section 26 08 32.16 – Performance Checklist for Natural-Gas Generators.

.4 Section 26 36 23.13 – Bypass-Isolation Automatic Transfer Switches.

.5 Section 26 36 23.16 – One-Way Bypass-Isolation Automatic Transfer Switches.

.6 Section 26 52 13.13 – Emergency Lighting.

.7 Section 28 46 13 – Fire-Alarm Systems.

1.3 ALTERNATIVES

.1 Not used

1.4 REFERENCES

.1 CSA Group:

.1 CSA C22.1:21, Canadian Electrical Code, Part 1 (25th Edition), Safety Standard for Electrical Installations.

.2 Ontario Electrical Safety Code (28th edition/2021).

.3 CSA C22.2 No. 5-16 – Molded-Case Circuit Breakers: Molded case switches and circuit breaker enclosures (Tri-National standard, with UL 489 and NMX-J-266-ANCE).

.4 CSA C22.2 No. 100-14 – Motors and Generators.

.5 CSA C22.2 No. 141-15 (R2020) – Emergency Lighting Equipment.

.6 CSA B149.1:20 – Natural Gas and Propane Code.

.7 CSA Z245.1-18, Steel pipe.

.2 Ontario Fire Code, latest edition.

.3 O.Reg. 524/98, Environmental Compliance Approvals – Exemptions for Section 9 of the Act.

.4 National Fire Code of Canada 2010.

.5 Technical Standards & Safety Authority (TSSA) of Ontario:

.1 FS-255-21 – Gaseous Fuels Code Adoption Document Amendment: Ontario amendments to CSA B149:20 series.

.6 Underwriters' Laboratories of Canada:

.1 CAN/ULC-S524-14 – Standard for Installation of Fire Alarm Systems.

.2 CAN/ULC-S1001-11, Integrated Systems Testing of Fire Protection and Life Safety Systems.

1.5 SUBMITTALS

.1 To Section 01 33 00.

.2 Work of this Section is to be submitted for review after Consultant's review of Coordination Study per Section 26 05 73.16 is completed.

.3 Shop Drawings:

.1 Indicate electrical characteristics and connection requirements. Show plan and elevation views with overall and interconnection point dimensions, fuel consumption rate curves at various loads, ventilation and combustion air requirements, and electrical diagrams, including schematic and interconnection diagrams.

.2 Outline drawings of assembly, including sound attenuated weatherproof enclosure and accessories.

.3 Weight of complete assembly, including fuel.

.4 One line diagrams and wiring diagrams for assembly and components.

.5 Interconnection wiring diagrams.

.4 Product data:

.1 Provide data showing dimensions, weights, ratings, interconnection points, and internal wiring diagrams for engine, generator, control panel, battery, battery rack, battery charger, exhaust silencer, vibration isolators, and remote radiator.

.2 Technical data on all major components. Technical data must include an alternator thermal damage curve, description and operating characteristics of the alternator protection device, and an alternator reactive capability curve. Alternator data demonstrating compliance to section.

.3 Certification of the emissions performance of the generator set engine by the engine manufacturer.

.4 Acoustical information of enclosure.

.5 Line-by-line compliance statement that demonstrates compliance with this Section.

.6 Test Reports: Indicate results of performance testing.

.7 Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

.8 Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

.9 Manufacturer's Field Reports: Indicate procedures and findings.

.10 Data for Ministry of Environment Environmental Activity and Sector Registry (Certificate of Approval).

.1 The maximum electrical output rating of the generator set (kW).

.2 Manufacturer's combustion contaminant emissions data or U.S. EPA emissions standard certification sheet.

.3 Layout drawing showing engine exhaust stack orientation, for generator sets installed in outdoor enclosures.

.4 Enclosure layout drawing.

.5 Manufacturer's enclosure noise emissions data.

.11 Colour samples for custom enclosure colour.

.12 Project information:

.1 Test reports and certifications.

.2 Factory test procedures.

1.6 CLOSEOUT SUBMITTALS

.1 Startup reports:

.1 Manufacturer's startup reports.

.2 Section 26 08 32.16 – Performance Checklist for Natural-Gas Generators.

.2 AHJ inspection documentation:

.1 Fuelling compliance certificate.

.2 Variance approval correspondence, as applicable.

.3 Maintenance Contracts:

.1 Manufacturer to maintain model and serial number records of each generator set provided for at least 20 years.

.2 The manufacturer shall itemize the complete offering of preventative and full-service maintenance contracts for the generator with submission, as described for each maintenance period described below.

.3 Maintenance service as part of base bid submission:

.1 Provide 7 x 24 x 365 service and maintenance of Generator for 2 years from Date of Substantial Completion. Price is to include two (2) full service maintenance program visits per each year.

.4 Additional maintenance service offers:

.1 Provide a separate price to extend 7 x 24 x 365 service and maintenance of generator for year three to year five.

.4 Operation and Maintenance Data:

.1 Operation Data: Include instructions for normal operation.

.2 Maintenance Data: Include instructions for routine maintenance requirements, service manuals for engine, oil sampling and analysis for engine wear, and emergency maintenance procedures.

.3 Provide electronic copies of all documents, test data, shop drawings, etc.

.5 Training records including attendance sheet, date, and training syllabus.

1.7 MAINTENANCE MATERIAL SUBMITTALS

.1 Provide three copies of maintenance materials.

.2 Spare Parts:

.1 Provide two of each of the following:

.1 Fuel oil filter element.

.2 Lube oil filter element.

.3 Air filter element.

.4 Fuel water separator.

.3 Tools: provide one set of tools required for preventative maintenance of the engine generator system. Package tools in adequately sized metal tool box.

.4 Keys.

1.8 MANUFACTURER'S QUALIFICATIONS

.1 The manufacturer of the generator set shall maintain service parts inventory at a central location which is accessible to the service location 24 hours per day, 365 days per year.

.2 The generator set shall be serviced by a local service organization that is trained and factory certified in generator set service. The supplier shall maintain an inventory of critical replacement parts at the local service organization, and in service vehicles. The service organization shall be on call 24 hours per day, 365 days per year.

.3 The manufacturer shall maintain model and serial number records of each generator set provided for at least 20 years.

.4 The generator set manufacturer shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.

.5 The manufacturer of this equipment shall have produced similar equipment for a minimum period of ten years. When requested by the Consultant, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

.6 Manufacturer: Company specializing in manufacturing the products specified in this section with minimum 2 years documented experience, and with service facilities within 160 km of project.

.7 Supplier: Authorized or franchised distributor of specified manufacturer with minimum 3 years documented experience.

1.9 DELIVERY, STORAGE, AND HANDLING

.1 Store equipment in original, undamaged package.

.2 Deliver to the project site in manufacturer's original wrapping and containers, labelled with manufacturer's name, product information, etc.

.3 Coordinate delivery date and time with the Owner and equipment supplier.

.4 Installing contractor to accept unit on site, inspect for damage, provide craning complete with spreader bars, and install equipment.

1.10 WARRANTY

.1 Warrant the material and workmanship of the generator set and associated equipment for a minimum of [two] years from registered commissioning and start-up, or 30 months from date of arrival on site.

.2 The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts cost, etc.

.3 Warrant all equipment provided under this section, whether or not is manufactured by the generator set manufacturer, so that there is one source for warranty and product service. Service of the generators sets to be performed by technicians specifically trained and certified by the manufacturer to support the product and employed by the generator set supplier.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Manufacturer List:

.1 Paramount Power Systems Ltd.

.2 Cummins Power Generation.

.3 Caterpillar.

.4 Kohler Power Systems.

.5 LMR Power Systems Inc.

.6 Generac Power Systems by Total Power Ltd.

.2 Substitution Limitations: Only those manufacturers listed above shall supply equipment provided under this contract. Proposals must include a line-by-line compliance statement based on this specification.

2.2 REGULATORY REQUIREMENTS

.1 Generator set to be listed and labelled by a certification organization accredited by the Standards Council of Canada.

.2 Comply with all applicable EPA emissions standards at the date of installation.

.3 Conform to requirements of CSA C22.1, the Ontario Electrical Safety Code, and other requirements of the Electrical Safety Authority (ESA).

2.3 GENERATOR SET

.1 Ratings

.1 The generator set shall operate at 1800 rpm and at a voltage of: 347/600 volts AC, three phase, 4-wire, 60 Hz.

.2 The generator set shall be rated per ISO 8528 at (per drawing) kW] at 0.8 PF, standby rating, based on site conditions of:

.1 Altitude: 914 m (3000 ft).

.2 Ambient temperatures up to 40°C (104°F)

.3 Emissions:

.1 25 kW to 300 kW – EPA Tier 3 certified.

.2 350 kW to 2250 kW – EPA Tier 3 certified.

.4 Standby rating, based on site conditions of: Altitude 400 m above sea level, ambient temperatures of 40°C, based on temperature measured at the control for indoor installations, and measured at the air inlet closest to the alternator for outdoor equipment.

.2 Performance

.1 Voltage regulation shall be plus or minus 0.5 percent for any constant load between no load and rated load for both parallel and non-parallel applications. Random voltage variation with any steady load from no load to full load shall not exceed plus or minus 0.5 percent.

.2 Frequency regulation shall be isochronous from steady state no load to steady state rated load. Random frequency variation with any steady load from no load to full load shall not exceed plus or minus 0.25%.

.3 The engine-generator set shall be capable of single step load pick up of 100% nameplate kW and power factor, less applicable derating factors, with the engine generator set at operating temperature.

.4 Motor starting capability shall be a minimum of [64 kVA]. The generator set shall be capable of sustaining a minimum of 90% of rated no load voltage with the specified kVA load at near zero power factor applied to the generator set.

.5 The alternator shall produce a clean AC voltage waveform, with not more than 5% total harmonic distortion at full linear load, when measured from line to neutral, and with not more than 3% in any single harmonic. Telephone influence factor shall be less than 40.

.6 The generator set shall be certified by the engine manufacturer to be suitable for use at the installed location and rating, and shall meet all applicable exhaust emission requirements at the time of commissioning.

.7 The time required to automatically start, accelerate to rated speed and voltage, synchronize, to the system bus on a normal power failure shall not exceed 15 seconds, assuming that the generator sets are in an ambient temperature of 15 degrees C or greater, and water jacket heaters are operating properly.

.8 The generator set, complete with sound attenuated enclosure, shall be tested by the generator set manufacturer per ANSI S1.13. Data documenting performance shall be provided with submittal documentation.

.3 Construction

.1 The engine generator set shall be mounted on a heavy-duty steel base to maintain alignment between components. The base shall incorporate a battery tray with hold-down clamps within the rails.

.2 All switches, lamps, and meters in the control system shall be oil tight and dust tight, and the enclosure door shall be gasketed. There shall be no exposed points in the control (with the door open) that operate in excess of 50 V.

.4 Connections

.1 The generator set load connections shall be composed of silver or tin plated copper bus bars, drilled to accept mechanical or compression terminations of the number and type as described in this specification. Sufficient lug space shall be provided for use with cables.

.2 Power connections to auxiliary devices shall be made at the devices, with required protection located at a wall-mounted common distribution panel.

.3 Generator set control interfaces to other system components shall be made on a common, permanently labeled terminal block assembly.

2.4 ENGINE AND ENGINE EQUIPMENT

.1 The engine shall be natural gas fueled, radiator and fan cooled. The horsepower rating of the engine at its minimum tolerance level shall be sufficient to drive the alternator and all connected accessories. Engine accessories and features shall include:

.1 Complete engine fuel system, including all pressure regulators, strainers, and control valves. The fuel system shall be plumbed to the generator set skid for ease of site connections to the generator set.

.2 An electronic governor system shall provide automatic isochronous frequency regulation. The governing system dynamic capabilities shall be controlled as a function of engine coolant temperature to provide fast, stable operation at varying engine operating temperature conditions. The control system shall actively control the fuel rate and excitation as appropriate to the state of the generator set. Fuel rate shall be regulated as a function of starting, accelerating to start disconnect speed, accelerating to rated speed, and operating in various isochronous or parallel states.

.3 Skid mounted radiator and cooling system rated for full load operation in 40°C (104°F) ambient as measured at the generator air inlet, based on 0.5 in H2O external static head. Radiator shall be sized based on a core temperature that is 20°F higher than the rated operation temperature, or prototype tested to verify cooling performance of the engine/radiator/fan operation in a controlled environment. Radiator shall be provided with a duct adapter flange. The equipment manufacturer shall fill the cooling system with a 50/50-ethylene glycol/water mixture. Rotating parts shall be guarded against accidental contact.

.4 Electric starter(s) capable of three complete cranking cycles without overheating.

.5 Positive displacement, mechanical, full pressure, lubrication oil pump.

.6 Full flow lubrication oil filters with replaceable spin on canister elements and dipstick oil level indicator.

.7 Replaceable dry element air cleaner with restriction indicator.

.8 Flexible fuel lines.

.9 Engine mounted battery charging alternator, 40 A minimum, and solid-state voltage regulator.

.2 Coolant Heater

.1 Engine mounted, thermostatically controlled, coolant heater(s) for each engine. Heater voltage shall be as shown on the project drawings. The coolant heater shall be UL499 listed and labeled.

.2 The coolant heater shall be installed on the engine with SAEJ20 compliant materials. Steel tubing shall be used for connections into the engine coolant system wherever the length of pipe run exceeds 300 mm (12 in). The coolant heater installation shall be specifically designed to provide proper venting of the system. The coolant heaters shall be installed using isolation valves to isolate the heater for replacement of the heater element. The design shall allow the heater element to be replaced without draining the engine cooling system or significant coolant loss.

.3 The coolant heater shall be provided with a 24 VDC thermostat, installed at the engine thermostat housing. An AC power connection shall be provided for a single AC power connection to the coolant heater system.

.4 Coolant heater(s) sized as recommended by the engine manufacturer to warm the engine to a minimum of 40°C in a 15°C ambient, in compliance with CSA C282 requirements, as a minimum, or the temperature required for starting and load pickup requirements of this section.

.3 Provide vibration isolators, spring/pad type, quantity as recommended by the generator set manufacturer. Isolators shall include seismic restraints if required by site location.

.4 Starting and Control Batteries: lead acid type, 24 VDC, sized as recommended by the engine manufacturer for compliance to CSA C282 starting requirements, complete with battery cables and connectors.

.5 Exhaust Silencer:

.1 Provide exhaust silencer for each engine of size and type as recommended by the generator set manufacturer and approved by the engine manufacturer.

.2 The silencer shall be selected by the manufacturer to suit the overall noise rating of the enclosed unit in Part 2 Article “Weatherproof Skin-Tight Enclosure”.

.3 Exhaust system shall be installed according to the engine manufacturer's recommendations and applicable codes and standards.

.4 Complete exhaust system to be installed within the enclosure, with vertical exhaust discharge.

.1 Vertical exhaust discharge extends a minimum of 1.2 m (4 ft) above the roof of the enclosure to ensure the following:

.1 Hot air does not recirculate in the air intake and overheat the engine.

.2 In case any snow builds up on the enclosure roof, the exhaust discharge is not covered which could prevent operation of the unit.

.2 Vertical exhaust discharge be complete with rain cap.

.5 Includes provisions for draining moisture that condenses in the exhaust system that could lead to corrosion.

.6 Provide Stainless Steel exhaust flex connector to suit engine outlet connection, minimum 610 mm (24”) length.

.6 Provide a minimum 10 A battery charger for each generator set battery bank. The charger shall include the following capabilities:

.1 Chargers shall be UL 1236-BBHH listed and CSA or CUL certified for use in emergency applications.

.2 The charger shall be compliant with UL 991 requirements for vibration resistance.

.3 The charger shall comply with the requirements of EN61000-4-5 for voltage surge resistance; EN50082-2 for immunity; EN61000-4-2 for ESD; N61000-4-3 for radiated immunity; ANSI/IEEE C62.41 category B and IN61000-4-4 for electrically fast transient; EN61000-4-6 for conducted emissions; and FCC Part 15 Class A for radiated emissions.

.4 The charger shall be capable of charging a fully discharged battery without damage to the charger. It shall be capable of returning a fully discharged battery to fully charged condition within 24 hours. The charger shall be UL-labeled with the maximum battery amp-hour rating that can be recharged within 24 hours.

.5 The charger shall incorporate a 4-state charging algorithm, to provide trickle charge rate to restore fully discharged batteries, a bulk charge rate to provide fastest possible recharge

after normal discharge, an absorption state to return the battery to 100 percent of charge, and a float stage to maintain a fully charge battery and supply battery loads when the generator set is not operating. In addition, the charger shall include an equalization timer. Charge rates shall be temperature compensated based on the temperature directly sensed at the battery.

.6 The DC output voltage regulation shall be within plus or minus 1%. The DC output ripple current shall not exceed 1 A at rated output current level.

.7 The charger shall include the following features:

.1 Two line alphanumeric display with programming keys to allow display of DC output ammeter and voltmeters (5% accuracy or better), display alarm messages, and perform programming;

.2 LED indicating lamp(s) to indicating normal charging condition (green), equalize charge state (amber), and fault condition (red);

.3 AC input overcurrent, over voltage, and undervoltage protection;

.4 DC output overcurrent protection;

.5 Alarm output relay;

.6 Corrosion resistant aluminum enclosure

.7 Emissions Requirements

.1 NOx not to exceed 9.2 g NOx per kWh.

.2 Engine exhaust to be complete with catalytic converter for units over 80 kWe.

2.5 AC ALTERNATOR

.1 The AC alternator shall be; synchronous, four pole, 2/3 pitch, brushless, revolving field, drip-proof construction, single pre-lubricated sealed bearing, air cooled by a direct drive centrifugal blower fan, and directly connected to the engine with flexible drive disc. The alternator design shall prevent shaft current from flowing and eliminate the need for insulated bearings. All insulation system components shall meet NEMA MG1 requirements for Class H insulation systems. Actual temperature rise measured by resistance method at full load shall not exceed 105°C in a 40°C ambient.

.2 The alternator shall be capable of delivering rated output (kVA) at rated frequency and power factor, at any voltage up to 5 percent above or below rated voltage.

.3 A permanent magnet generator (PMG) shall be included to provide a reliable source of excitation power for optimum motor starting and short circuit performance. The PMG and controls shall be capable of sustaining and regulating current supplied to a single phase or three phase fault at approximately 300% of rated current for not more than 10 seconds.

.4 The alternator shall be supplied with a dedicated, independent power source for the voltage regulation system, which provides sufficient excitation for the alternator to supply 300 per cent of rated output current for 10 seconds.

.5 The subtransient reactance of the alternator to not exceed 15 per cent, based on the standby rating of the generator set.

.6 Provide an anti-condensation heater for the alternator for generator sets installed outdoors or in unheated environments.

.7 Provide two embedded resistance temperature detectors per phase and temperature indication equipment. The control system shall annunciate high alternator temperature as a fault condition.

.8 The alternator shall be capable of operation with reverse kVAR of 0.15 per unit.

2.6 GENERATOR SET CONTROL

.1 The generator set shall be provided with a microprocessor-based control system that is designed to provide automatic starting, monitoring, protection, and control functions for the generator set. The control system shall also be designed to allow local monitoring and control of the generator set, and remote monitoring and control as described in this specification.

.2 The control shall be mounted on the generator set in an accessible location. The control shall be vibration isolated, and prototype tested to verify the durability of all components in the system under the vibration conditions encountered.

.3 The generator set mounted control shall include the following features and functions:

.1 Control Switches

.1 Mode Select Switch.

.1 The mode select switch shall initiate the following control modes. When in the RUN or Manual position the generator set shall start, and accelerate to rated speed and voltage as directed by the operator. In the OFF position the generator set shall immediately stop, bypassing all time delays. In the AUTO position the generator set shall be ready to accept a signal from a remote device to start and accelerate to rated speed and voltage.

.2 EMERGENCY STOP switch.

.1 Switch shall be Red "mushroom-head" push-button. Depressing the emergency stop switch shall cause the generator set to immediately shut down, and be locked out from automatic restarting. The switch shall include a lockout provision for use in safely disabling the generator set for necessary service.

.2 Locate inside Generator enclosure.

.3 RESET switch.

.1 The RESET switch shall be used to clear a fault and allow restarting the generator set after it has shut down for any fault condition.

.4 PANEL LAMP switch.

.1 Operating the panel lamp switch shall cause the entire panel to be lighted with DC control power. The panel lamps shall automatically be switched off 10 minutes after the switch is operated, or after the switch is operated a second time.

.5 Voltage and Frequency Adjustment. The genset mounted control shall include digital raise/lower switches for adjustment of voltage and frequency.

.2 Generator Set AC Output Metering. The generator set shall be provided with a metering set including the following features and functions:

.1 Digital metering set, 1% accuracy, to indicate generator RMS voltage and current, frequency, output current, output kW, kWh, and power factor. Generator output

voltage shall be available in line-to-line and line-to-neutral voltages, and shall display all three-phase voltages (line to neutral or line to line) simultaneously.

.2 Analog voltmeter, ammeter, frequency meter, power factor meter, and kilowatt (kW) meter. Voltmeter and ammeter shall display all three phases. Meter scales shall be colour coded in the following fashion: green shall indicate normal operating condition, amber shall indicate operation in ranges that indicate potential failure, and red shall indicate failure impending. Metering accuracy shall be within 1% at rated output. Both analog and digital metering are required.

.3 The control system shall monitor the total load on the generator set, and maintain data logs of total operating hours at specific load levels ranging from 0 to 110% of rated load, in 10% increments. The control shall display hours of operation at less than 30% load and total hours of operation at more than 90% of rated load.

.4 The control system shall log total number of operating hours, total kWh, and total control on hours, as well as total values since reset.

.3 Generator Set Alarm and Status Display.

.1 The generator set control shall include LED alarm and status indication lamps. The lamps shall be high intensity LED type. The lamp condition shall be clearly apparent under bright room lighting conditions. Functions indicated by the lamps shall include:

.2 The control shall include five configurable alarm-indicating lamps. The lamps shall be field adjustable for any status, warning, or shutdown function monitored by the genset. They shall also be configurable for colour, and control action (status, warning, or shutdown).

.3 The control shall include green lamps to indicate that the generator set is running at rated frequency and voltage, and that a remote start signal has been received at the generator set. The running signal shall be based on actual sensed voltage and frequency on the output terminals of the generator set.

.4 The control shall include a flashing red lamp to indicate that the control is not in automatic state, and red common shutdown lamp.

.5 The control shall include an amber common warning indication lamp.

.6 The generator set control shall indicate the existence of the warning and shutdown conditions on the control panel. All conditions indicated below for warning shall be field-configurable for shutdown. Conditions required to be annunciated shall include:

.1 low oil pressure (warning).

.2 low oil pressure (shutdown).

.3 oil pressure sender failure (warning).

.4 low coolant temperature (warning).

.5 high coolant temperature (warning).

.6 high coolant temperature (shutdown).

.7 high oil temperature (warning).

.8 engine temperature sender failure (warning).

.9 low coolant level (warning).

.10 fail to crank (shutdown).

.11 fail to start/overcrank (shutdown).

.12 overspeed (shutdown).

.13 low DC voltage (warning).

.14 high DC voltage (warning).

.15 weak battery (warning).

.16 low gas pressure (warning).

.17 high AC voltage (shutdown).

.18 low AC voltage (shutdown).

.19 under frequency (shutdown).

.20 over current (warning).

.21 over current (shutdown).

.22 short circuit (shutdown).

.23 over load (warning).

.24 emergency stop (shutdown).

.25 natural gas supply valve(s) closed.

.26 (4) configurable conditions

.7 Provisions shall be made for indication of four customer specified alarm or shutdown conditions. Labeling of the customer-specified alarm or shutdown conditions shall be of the same type and quality as the above-specified conditions. The non-automatic indicating lamp shall be red, and shall flash to indicate that the generator set is not able to automatically respond to a command to start from a remote location.

.4 Engine Status Monitoring.

.1 The following information shall be available from a digital status panel on the generator set control:

.1 engine oil pressure (psi or kPa).

.2 engine coolant temperature (degrees F or C).

.3 engine oil temperature (degrees F or C).

.4 engine speed (rpm).

.5 number of hours of operation (hours).

.6 number of start attempts.

.7 battery voltage (DC volts).

.2 The control system shall also incorporate a data logging and display provision to allow logging of the last 10 warning or shutdown indications.

.5 Engine Control Functions.

.1 The control system provided shall include a cycle cranking system, which allows for user selected crank time, rest time, and # of cycles. Initial settings shall be for 3 cranking periods of 15 seconds each, with 15 second rest period between cranking periods.

.2 The control system shall include an idle mode control, which allows the engine to run in idle mode in the RUN position only. In this mode, the alternator excitation system shall be disabled.

.3 The control system shall include an engine governor control, which functions to provide steady state frequency regulation as noted elsewhere in this specification. The governor control shall include adjustments for gain, damping, and a ramping function to control engine speed and limit exhaust smoke while the unit is starting.

.4 The control system shall include time delay start (adjustable 0-300 seconds) and time delay stop (adjustable 0-600 seconds) functions.

.5 The control system shall include sender failure monitoring logic for speed sensing, oil pressure, and engine temperature which is capable of discriminating between failed sender or wiring components, and an actual failure conditions.

.6 Alternator Control Functions:

.1 The generator set shall include a full wave rectified automatic digital voltage regulation system that is matched and prototype tested by the engine manufacturer with the governing system provided. It shall be immune from misoperation due to load induced voltage waveform distortion and provide a pulse width modulated output to the alternator exciter. The voltage regulation system shall be equipped with three phase line to neutral RMS sensing and shall control buildup of AC generator voltage to provide a linear rise and limit overshoot. The system shall include a torque-matching characteristic, which shall reduce output voltage in proportion to frequency below an adjustable frequency threshold. Torque matching characteristic shall be adjustable for roll-off frequency and rate, and be capable of being curve-matched to the engine torque curve with adjustments in the field. The voltage regulator shall include adjustments for gain, damping, and frequency roll off. Adjustments shall be broad range, and made via digital raise-lower switches, with an alphanumeric LED readout to indicate setting level. Rotary potentiometers for system adjustments are not acceptable.

.2 Controls shall be provided to monitor the output current of the generator set and initiate an alarm (over current warning) when load current exceeds 110% of the rated current of the generator set on any phase for more than 60 seconds. The controls shall shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator (over current shutdown). The protective functions provided shall be in compliance to the requirements of NFPA 70 article 445. The protection for this function shall be 3rd party certified to very performance.

.3 Controls shall be provided to individually monitor all three phases of the output current for short circuit conditions. The control/protection system shall monitor the current level and voltage. The controls shall shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator (short circuit shutdown). The protective functions provided shall be in compliance to the requirements of NFPA 70 article 445. The protection for this function shall be 3rd party certified to very performance.

.4 Controls shall be provided to monitor the kW load on the generator set, and initiate an alarm condition (over load) when total load on the generator set exceeds the generator set rating for in excess of 5 seconds. Controls shall include a load shed control, to operate a set of dry contacts (for use in shedding customer load devices) when the generator set is overloaded.

.5 A line to neutral sensing AC over/under voltage monitoring system that responds only to true RMS voltage conditions shall be provided. The system shall initiate shutdown of the generator set when alternator output voltage exceeds 110% of the operator-set voltage level for more than 10 seconds, or with no intentional delay when voltage exceeds 130%. Under voltage shutdown shall occur when the output voltage of the alternator is less than 85% for more than 10 seconds.

.6 The generator set control shall include a 120 VAC control heater.

.7 Other Control Functions

.1 The generator set shall be provided with a network communication module to allow LonMark compliant communication with the generator set control by remote devices. The control shall communicate all engine and alternator data, and allow starting and stopping of the generator set via the network in both test and emergency modes.

.2 A battery monitoring system shall be provided which initiates alarms when the DC control and starting voltage is less than 25 VDC or more than 32 VDC. During engine cranking (starter engaged), the low voltage limit shall be disabled, and DC voltage shall be monitored as load is applied to the battery, to detect impending battery failure or deteriorated battery condition.

2.7 OTHER EQUIPMENT TO BE PROVIDED WITH THE GENERATOR SET

.1 Control Interfaces for Remote Monitoring:

.1 The control system shall provide four programmable output relays. These relay outputs shall be configurable for any alarm, shutdown, or status condition monitored by the control. The relays shall be configured to indicate: (1) generator set operating at rated voltage and frequency, (2) common warning, (3) common shutdown, (4) load shed command.

.2 A fused 10 A switched 24 VDC power supply circuit shall be provided for customer use. DC power shall be available from this circuit whenever the generator set is running.

.3 A fused 10 A, 24 VDC power supply circuit shall be provided for customer use. DC power shall be available from this circuit at all times from the engine starting/control batteries.

.4 The control shall be provided with a direct serial communication link for the LonWorks communication network interface as described elsewhere in this specification and shown on the drawings.

.2 Provide and install a 20-light LED type remote alarm annunciator with horn, located as shown on the drawings or in a location that can be conveniently monitored by facility personnel. The remote annunciator shall provide all the audible and visual alarms called for by NFPA Standard 110 for level 1 systems for the local generator control panel. Spare lamps shall be provided to allow future addition of other alarm and status functions to the annunciator. Provisions for labeling of the annunciator in a fashion consistent with the specified functions shall be provided. Alarm silence and lamp test switch(es) shall be provided. LED lamps shall be replaceable, and indicating lamp colour shall be capable of changes needed for specific application requirements. Alarm horn shall be switchable for all annunciation points. Alarm horn (when switched on) shall sound for first fault, and all subsequent faults, regardless of whether first fault has been cleared, in compliance with NFPA 110 3-5.6.2. The interconnecting wiring between the annunciator and other system components shall be monitored and failure of the interconnection between components shall be displayed on the annunciator panel.

.3 The annunciator shall include the following alarm labels, audible annunciation features, and lamp colours:

Condition	Lamp Colour	Audible Alarm
Normal Power (to Loads)	Green	No
Genset Supplying Load	Amber	No
Genset Running	Green	No
Not in Auto	Red (Flashing)	Yes
High Battery Voltage	Red	Yes
Low Battery Voltage	Red	Yes
Charger AC Failure	Red	Yes
Fail to Start	Red	Yes
Low Engine Temperature	Amber	Yes
Pre-High Engine Temperature	Amber	Yes
High Engine Temperature	Red	Yes
Pre-Low Oil Pressure	Amber	Yes
Low Oil Pressure	Red	Yes
Overspeed	Red	Yes
Low Coolant Level	Amber	Yes
Low Fuel Pressure	Amber	Yes
Network OK	Green	Yes
Natural gas supply valve closed	Red	Yes
(4) Spares	Configurable	Configurable

.4 Low battery voltage lamp shall also be lighted for low cranking voltage or weak battery alarm.

.5 The generator set shall be provided with a mounted main line circuit breaker, sized to carry the rated output current of the generator set. The circuit breaker shall incorporate an electronic trip unit that operates to protect the alternator under all overcurrent conditions, or a thermal-magnetic trip with other overcurrent protection devices that positively protect the alternator under overcurrent conditions. The supplier shall submit time overcurrent characteristic curves and thermal damage curve for the alternator, demonstrating the effectiveness of the protection provided.

2.8 CIRCUIT BREAKERS

.1 CSA C22.2 No. 5, molded case circuit breakers on generator output with integral thermal and instantaneous magnetic trip in each pole, sized to CSA C22.1. Include battery-voltage operated shunt trip, connected to open circuit breakers on engine failure. Unit mount in enclosure to meet CSA C22.2 No. 100, Type 1 requirements.

.2 Bolt-on, molded case, temperature compensated for 40°C ambient, dual thermal-magnetic trip. Electronic trip type with adjustments for long-time, instantaneous, and short-time functions.

.3 Interrupting capacity: To suit available fault current from Generator set alternator.

.1 Minimum 25 kA IC.

.2 The emergency generator main overcurrent device shall be coordinated with the overcurrent devices of feeders and branch circuits downstream and in accordance with the Coordination Study specified in Section 26 05 73.16.

.4 Schedule of generator output circuit breakers:

.1 Generator Output Breaker to feed emergency terminals of Automatic Transfer Switches.

.2 Load Bank Breaker

.1 Rating and ampacity of load bank breaker to match generator output breaker.

.2 Equipped with shunt trip capability to ensure that the breaker will be tripped during testing upon receiving engine start signal from Automatic Transfer Switch. Electrical contractor to provide cables from each Automatic Transfer Switch to breaker to suit manufacturer's instructions.

.3 Provide lugs allowing ease of connection for load bank cables.

2.9 REMOTE ANNUNCIATION AND MONITORING

.1 Provide remote annunciator panel for field installation by installing Contractor.

.2 Provide BACnet/BACnet-IP and other interface required in order to connect the generator control panel to the Building Automation System. The BAS must be able to read all the monitoring and operation signals from genset. Provide all the conduit and wires to the BAS panel and coordinate with Division 25 for final connection. At a minimum, include the following:

.1 ON/OFF status.

.2 Oil Pressure.

.3 Coolant Level.

.4 Coolant temperature.

.5 Oil Temperature.

.6 Up to 10 additional points should be allowed to be programmable for Generator on the BAS.

.3 The Generator graphics should also be included on the BAS with the points listed above.

.4 Coordinate with Division 25 to ensure necessary critical alarm parameters are programmed to allow alarms to be sent to relevant stakeholders via email.

2.10 WEATHERPROOF SKIN-TIGHT ENCLOSURE

.1 Sound attenuating enclosure with sound attenuation to provide sound levels of no greater than 75 dB(A) at 7 m perimeter.

.2 To suit conduit entry from below grade.

.3 Access doors with key locks, welded hinges, and door lock port hole to keep door open during maintenance. Maximum access door width 1000 mm.

.4 Primed for corrosion protection and finish painted in a custom colour to be selected by the Owner and confirmed at submittal review.

.5 Interior of enclosure to consist of high reflectance materials to improve light levels when servicing or maintaining unit.

2.11 ACCESSORIES

.1 Factory provided accessories in the generator enclosure prewired to a panelboard in the generator enclosure:

.1 Heating:

.1 Battery thermal wrap, 120 V, minimum 75 W per battery to maintain battery temperature of 27°C (80°F), and complete with thermostat to eliminate batter damage caused by overheating or acid spill.

.2 Motorized intake dampers, 5 kW 208 V 3-phase forced flow heater in enclosure complete with reverse acting thermostat for control to maintain 10°C at all times.

.3 Engine block circulating coolant heater with thermostat, sized to engine manufacturer's recommendations].

.4 Regulator heater.

.2 Lighting:

.1 Two LED strip luminaires 4100 lumen nominal, 3500 K CCT, standard driver, frosted lens, wire guard, and control.

.1 Signify FluxStream series.

.2 Substitution by Acuity Brands, Cree, Cooper Lighting Solutions, Hubbell, Visioneering.

.2 Control for luminaires: white decorator style switch installed in surface mount utility box, complete with galvanized steel cover plate with rounded corners.

.3 Emergency lighting battery unit complete with 2 hours runtime on loss of utility power and complete with two MR16 LED heads, light output equivalent to two 20 W MR16 incandescent lamps, in accordance with CSA C282 clause 6.11.1.

.1 Minimum illumination: 50 lx (5 fc).

.2 Battery units shall include automatic self-diagnostic circuitry, and a transient voltage surge suppressor on the supply site of power to the unit.

.3 Battery unit to be complete with CSA 5-15 plug and plugged into a dedicated emergency lighting receptacle installed immediately adjacent to the battery unit.

.3 Minimum one 5-15R GFI duplex receptacle on generator (in addition to the battery unit receptacle).

.4 If spring isolators are to be used, provide generator frame-bottom metal sealing plate to maintain heat inside enclosure, proper directionality of airflow, maintain noise rating, and prevent animal ingress.

.5 Other accessories as indicated on the generator enclosure layout drawing, and as required for a complete operating system, and as recommended by the generator manufacturer.

.6 Accessories to be fed from a panelboard pre-installed within the generator enclosure, rated 100 A 120/208 V, 3-Ph, 4W, 10 kA IC, complete with main breaker, and complete with full size, bolt-on breakers, installed with vibration isolation from the generator enclosure.

.1 Plug-on breaker panelboard, or use of tandem circuit breakers will be rejected and field replaced at manufacturer's expense.

.2 Acceptable panelboard and circuit breaker manufacturers:

.1 Eaton PRL1 series.

.2 Schneider Electric NQ series.

.3 Siemens equal.

.3 Provide a minimum of one (1) spare 15 A single pole breaker.

.2 Supplier to include an inspection for unit enclosure and generator accessories by the Electrical Authority Having Jurisdiction (ESA in Ontario) prior to shipment to site. Submit ESA inspection report to the Consultant.

2.12 SEQUENCE OF OPERATION

.1 Start generator set on receipt of a start signal from remote equipment (automatic transfer switch). The start signal shall be via hardwired connection to the generator set control and a redundant signal over the required network connection.

.2 The generator set shall complete a time delay start period as programmed into the control.

.3 The generator set control shall initiate the starting sequence for the generator set. The starting sequence shall include the following functions:

.1 The control system shall verify that the engine is rotating when the starter is signalled to operate. If the engine does not rotate after three attempts, the control system shall shut down and lock out the generator set, and indicate “fail to crank” shutdown.

.2 The engine shall start and accelerate as quickly as practical to start disconnect speed. If the engine does not start, it shall complete a cycle cranking process as described elsewhere in this specification. If the engine has not started by the completion of the cycle cranking sequence, it shall be shut down and locked out, and the control system shall indicate “fail to start”.

.3 The engine shall accelerate to rated speed and the alternator to rated voltage. Excitation shall be disabled until the engine has exceeded programmed idle speed, and regulated to prevent over voltage conditions and oscillation as the engine accelerates and the alternator builds to rated voltage.

.4 On reaching rated speed and voltage, the generator set shall operate as dictated by the control system in isochronous, synchronize, load share, load demand, or load govern state.

.5 When all start signals have been removed from the generator set, it shall complete a time delay stop sequence. The duration of the time delay stop period shall be adjustable by the operator.

.6 On completion of the time delay stop period, the generator set control shall switch off the excitation system and shall shut down.

.1 Any start signal received after the time stop sequence has begun shall immediately terminate the stopping sequence and return the generator set to isochronous operation.

2.13 SOURCE QUALITY CONTROL

.1 Provide factory test, start-up by a supplier authorized by the equipment manufacturer(s), and on-site testing of the system.

.2 The generator set manufacturer shall perform a complete operational test on the generator set prior to shipping from the factory. A certified test report shall be provided to the Consultant. All testing shall be performed with calibrated metering.

.3 Factory testing may be witnessed by the Owner and the Consultant. Costs for travel expenses will be the responsibility of the Owner and the Consultant. Supplier is responsible to provide two weeks notice for testing.

.4 Generator set factory tests on the equipment shall be performed at rated load and rated power factor. Generator sets that have not been factory tested at rated power factor will not be acceptable. Tests shall include:

.1 4 hour run at full load.

.2 Maximum power.

.3 Voltage regulation.

.4 Transient and steady-state governing.

.5 Single step load pickup:

.1 Zero to 100% to zero.

.2 Zero to 75% to zero.

.3 Zero to 50% to zero.

.4 Zero to 25% to zero.

.6 Function of safety shutdowns.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 All equipment shall be physically inspected for damage. Scratches and other installation damage shall be repaired prior to final system testing. Equipment shall be thoroughly cleaned to remove all dirt and construction debris prior to final testing of the system.

.2 Remove battery from emergency lighting equipment and store indoors in a climate controlled area prior to installation of the generator set.

3.2 PREPARATION

.1 Location of generator in accordance with the National Fire Code of Canada:

.1 Locate at a minimum distance of 1 m to a building on the same property.

.2 Locate at a minimum distance of 1 m to a property line.

.3 Located such that the exhaust vent or chimney is minimum 3 m (10 ft) from any building.

3.3 INSTALLATION

.1 Install equipment in accordance with final submittals and contract documents. Comply with applicable provincial and local codes as required by the Authority Having Jurisdiction. Install equipment in accordance with manufacturer's instructions and instructions included in the listing or labeling of CSA listed products.

.2 Perform Work to CSA C22.1.

.3 Conform to CSA B149.1.

.4 Concrete housekeeping pad:

.1 Install generator on concrete housekeeping pads [designed by Structural Engineer] to Section 03 30 00.

.2 Cast-in-place concrete housekeeping pad to extend a minimum of 1 m beyond footprint of generator.

.3 Coordinate exact conduit entry point with equipment submittals prior to fabricating pad.

.4 Sleeve conduit stubs and caulk conduits after concrete pour.

.5 Permanently fasten equipment to the pad in accordance with manufacturer's instructions and seismic requirements of the site.

.5 Provide all interconnecting wiring between all major equipment provided for the on-site power system. Provide interconnecting wiring between equipment sections (when required), under the supervision of the equipment supplier.

.6 Provide a minimum 60 A, 2-wire plus neutral plus ground feeder, fed from a 60A/2P breaker in the local 120/208 V emergency receptacle panel to feed generator accessory panel, unless noted otherwise by the manufacturer.

.7 Install remote annunciator adjacent to the automatic transfer switch, or as noted on drawings.

3.4 GROUNDING AND BONDING (3-POLE ATS)

.1 Ground and bond to Electrical Code requirements, and Section 26 05 26.

.2 Remove bonding jumper from generator neutral to suit 3-pole ATS.

.3 For 3-pole transfer switches utilized on 4-wire systems with unswitched neutrals, provide warning sign at the generator to clearly indicate the use of a floating neutral and that the generator neutral is not separately grounded.

3.5 NOT USED

3.6 FIELD QUALITY CONTROL

.1 Inspect equipment for physical damage. Repair scratches and other installation damage prior to final system testing. Thoroughly clean equipment to remove all dirt and construction debris prior to initial operation and final testing of the system.

.2 Manufacturer Services:

.1 On completion of the installation, conduct a site evaluation to verify that the equipment is installed per manufacturer's recommended practice.

.2 Equipment shall be initially started and operated by representatives of the manufacturer. All protective settings shall be adjusted as instructed by the Consultant.

.3 Inspections

.1 Complete all verifications, inspections, and reports prior to scheduling TSSA inspection.

.2 Carry for the cost of all inspections by authorities having jurisdiction, including, but not limited to, the Electrical Safety Authority (ESA), and Technical Standards Safety Authority (TSSA).

.3 Carry the cost of all TSSA variances, or as detailed in CSA B149.1.

.4 Confirm the emergency lighting unit is fully operational.

.4 On Site Acceptance Test

.1 The complete installation shall be tested to verify compliance with the performance requirements of this specification following completion of all site work. Testing shall be conducted by representatives of the manufacturer. Notify the Consultant in advance of the test for the option to witness the tests. The generator set manufacturer shall provide a site test specification covering the entire system.

.2 Prior to start of active testing, all field connections for wiring, power conductors, and bus bar connections shall be checked for proper tightening torque.

.3 Installation acceptance tests to be conducted on-site shall include a "cold start" test, a 4 hour full load (resistive) test, and a one step rated load pickup test in accordance with CSA C282. Provide a resistive load bank and make temporary connections for full load test, if necessary.

.4 Perform a power failure test on the entire installed system. This test shall be conducted by opening the power supply from the utility service, and observing proper operation of the system for at least 2 hours. Coordinate timing and obtain approval for start of test with site personnel.

.5 The generator set supplier shall issue a test report documenting the results of testing, and including a complete list of all settings in the control system.

.5 Provide labour and material to conduct the integrated systems testing of interconnected life safety systems in accordance with CAN/ULC-S1001-11.

3.7 TRAINING

.1 The equipment supplier shall provide training for the facility operating personnel covering operation and maintenance of the equipment provided. The training program shall be not less than 4 hours in duration and the class size shall be limited to 5 persons. Training date shall be coordinated with the Owner.

.2 Familiarize the Owner’s Representative in the testing and maintenance requirements prescribed by Ontario Regulations, O.Reg 524/98:

.1 The system shall be used and operated for the purpose of testing or performing maintenance for a maximum of 60 hours in any 12 month period.

.2 The system shall be used and operated for the purpose of testing or performing maintenance only between the hours of 7 a.m. and 7 p.m.

.3 When the system is used and operated for the purpose of testing or performing maintenance, the air intakes, doors and windows of any buildings or structures located on the same site as the system shall be closed, if doing so would reduce the likelihood of emissions from the system entering the building or structure.

.4 If more than one generator unit is part of the system, only one unit shall be used and operated at any time for the purpose of testing or performing maintenance.

.5 If the Ministry of the Environment issues a smog advisory that identifies an area in which the system is located, the system shall not be used or operated for the purpose of testing or performing maintenance until a termination notice with respect to the advisory has been issued for that area.

3.8 MAINTENANCE

.1 Perform equipment maintenance as described in PART 1 of this section.

END OF SECTION

Updated through ADD#8

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Provide complete factory assembled power transfer equipment with field programmable digital electronic controls designed for fully automatic operation and including, voltage sensors on all phases of both sources, linear operator, permanently attached manual handles, positive mechanical and electrical interlocking, and mechanically held contacts for both sources.

.2 The Automatic Transfer Switch will transfer the load in delayed transition (break and delay-before-make) mode.

.3 Automatic transfer switches are to be electrically operated, mechanically held open contact type, without integral overcurrent protection. Transfer switches utilizing automatic or non-automatic molded case circuit breakers as switching mechanisms are not acceptable.

.4 The transfer switch shall feature a double-sided bypass isolation mechanism.

1.2 RELATED REQUIREMENTS

.1 Section 26 08 36 – Performance Checklist for Automatic Transfer Switches.

.2 Section 26 32 13.13 – Diesel-Engine-Driven Generator Sets.

.3 Section 26 32 13.16 – Gas-Engine-Driven Generator Sets.

.4 Section 28 46 13 – Fire-Alarm Systems.

1.3 REFERENCES

.1 CSA Group:

.1 CSA C22.1:21, Canadian Electrical Code, Part 1 (25th Edition), Safety Standard for Electrical Installations.

.2 Ontario Electrical Safety Code (28th edition/2021).

.3 CSA C22.2 No.5:16 (R2021), Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, NMX-J-266-ANCE-2010).

.4 CSA C22.2 No. 178.1-14 (R2019), Transfer Switch Equipment.

.5 CSA C282:19, Emergency Electrical Power Supply for Buildings.

.6 CAN/CSA C60044-1-07 (R2011), Instrument Transformers.

.2 IEEE

.1 IEEE 446, Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications.

.3 National Electrical Manufacturers Association (NEMA)

.1 ANSI/NEMA ICS 2-1996(R2009), Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC, Part 8: Disconnect Devices for Use in Industrial Control Equipment.

.2 NEMA ICS 1 - General Standards for Industrial Control and Systems.

.3 NEMA ICS 2 -Industrial Control and Systems: Controllers, Contactors, and Overload Relays Rated 600 Volts.

.4 NEMA ICS 6 - Industrial Controls and Systems: Enclosures.

.5 NEMA ICS 10-1993, AC Automatic Transfer Switches.

1.4 ACTION SUBMITTALS

.1 Within ten days after award of contract, provide electronic copies of the following information for review:

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for transfer switches and include product characteristics, performance criteria, physical size, finish and limitations, including voltage, switch size, ratings and size of switching and overcurrent protective devices, operating logic, short circuit ratings, dimensions, weights, and enclosure details.

.2 A copy of the markings that are to appear on the transfer switches when installed.

.3 Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

.4 Interconnection wiring diagrams showing all external connections required; with field wiring terminals marked in a consistent point-to-point manner.

.5 Manufacturer’s certification of prototype testing.

.6 Manufacturer’s published warranty documents.

.3 Shop Drawings:

.1 Indicate on drawings:

.1 Make, model and type.

.2 Single line diagram showing controls and relays.

.3 Description of equipment operation including:

.1 Automatic starting and transfer to standby unit and back to normal power.

.2 Test control.

.3 Manual control.

.4 Automatic shutdown.

.2 Submit drawing of the engraved phenolic equipment nameplate.

1.5 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for automatic load transfer equipment for incorporation into manual specified in Section 01 78 00. Make prints of electronic submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for transfer switches for incorporation into manual.

.3 Detailed instructions to permit effective operation, maintenance, and repair.

.4 Technical data:

.1 Schematic diagram of components, controls and relays.

.2 Illustrated parts lists with parts catalogue numbers.

.3 Certified copy of factory test results.

.5 On-site commissioning and functional testing reports.

.6 Warranty card, specifying the warranties for all ATS's.

1.6 OPERATIONS AND MAINTENANCE DATA

.1 Operation Data: Include instructions for operating equipment. Include instructions for operating equipment under emergency conditions.

.2 Maintenance Materials:

.1 Include routine preventative maintenance and lubrication schedule.

.2 List special tools, maintenance materials, and replacement parts, or indicate if there are no special tools or user serviceable parts.

.3 Provide two of each special tool required for maintenance, if applicable.

1.7 QUALITY ASSURANCE

.1 Manufacturer Qualifications

.1 Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience, and with service facilities to respond in timely manner.

.2 Supplier: Authorized distributor of specified manufacturer with minimum three years documented experience.

.3 The manufacturer of the transfer switch shall maintain service parts inventory at a central location which is accessible to the service location 24 hours/day, 365 days/year.

.4 The transfer switch shall be serviced by a local service organization that is trained and factory certified in transfer switch service. The supplier shall maintain an inventory of critical replacement parts at the local service organization, and in service vehicles. The service organization shall be on call 24 hours/day, 365 days/year.

.5 Manufacturer certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.

.2 Regulatory Requirements

.1 Provide products listed and classified by CSA or testing firm acceptable to authority having jurisdiction as suitable for purpose specified and indicated.

.2 CSA listed and labeled.

.3 Meet all requirements as described in CSA C282.

1.8 DELIVERY, STORAGE, AND HANDLING

.1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.2 Storage and Handling Requirements:

.1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect transfer switches from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

1.9 FIELD MEASUREMENTS

.1 Verify that field measurements are as indicated on shop drawings.

1.10 MAINTENANCE SERVICE

.1 Provide service and maintenance of transfer switch for one year from date of Substantial Completion.

1.11 WARRANTY

.1 Minimum one year from the date of commissioning, warranted against defects in materials and workmanship.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 ASCO 7000 Series automatic transfer and bypass isolation switch (basis of design).

.2 Cummins Power Generation.

.3 Caterpillar.

.4 Eaton.

.5 Kohler Power Systems.

.6 LMR Power Systems Inc.

2.2 RATINGS

.1 As indicated on single line diagram.

.2 Minimum interrupting capacity per the following table, unless a higher value is indicated on the drawings:

Switch Rating (amps)	AIC Rating (kA)
70 - 225	25
250	25
400	35
600, 800	65
1000, 1200	65
1600, 2000	65 [100 Optional]
2500, 3000	100
4000	100

2.3 SYSTEM DESCRIPTION

.1 Automatic load transfer equipment to:

.1 Monitor voltage on all phases of normal (utility) and emergency (generator) power sources.

.2 Initiate cranking of standby generator unit on normal power failure or abnormal voltage on any one phase below preset adjustable limits for adjustable period of time.

.3 Transfer load from normal supply to standby unit when standby unit reaches rated frequency and voltage pre-set adjustable limits.

.4 Transfer load from standby unit to normal power supply when normal power restored, confirmed by sensing of voltage on phases above adjustable pre-set limit for adjustable time period.

.5 Shut down standby unit after running unloaded to cool down using adjustable time delay relay.

2.4 AUTOMATIC TRANSFER AND BYPASS/ISOLATION SWITCH

.1 Description: NEMA ICS 2, automatic transfer switch with manual bypass switch suitable for continuous operation.

.2 Configuration: Draw-out type electrically-operated, mechanically-held transfer switch with manually-operated CONNECTED, TEST, AND DISCONNECTED draw-out positions, and with mechanically-operated, mechanically-held transfer switch connected to bypass automatic switch in both NORMAL and EMERGENCY positions.

.3 The transfer switch shall feature a double sided bypass-isolation mechanism to allow power transfer switches to be inspected, tested, and maintained without any interruption of power to the load.

.4 The isolate and bypass procedure shall not exceed 15 seconds.

.5 Transfer switch shall permit bypass of the load to either source without load interruption.

.6 Bypass Switch Ratings: Match automatic transfer switch for electrical ratings.

.7 Transition: Delayed.

2.5 CONSTRUCTION

.1 Transfer switches shall be double-throw, electrically and mechanically interlocked, and mechanically held in the source 1 and source 2 positions. The transfer switch shall be specifically designed to transfer to the best available source if it inadvertently stops in a neutral position.

.2 Transfer switches shall be equipped with permanently attached manual operating handles and quick-break, quick-make over-center contact mechanisms.

.3 Main switch contacts shall be high-pressure silver alloy. Contact assemblies shall have arc chutes for positive arc extinguishing. Arc chutes shall have insulating covers to prevent inter-phase flashover.

.4 Transfer switch internal wiring shall be composed of pre-manufactured harnesses that are permanently marked for source and destination. Harnesses shall be connected to the control system by means of locking disconnect plugs, to allow the control system to be easily disconnected and serviced without disconnecting power from the transfer switch mechanism.

.5 Power transfer switch shall be provided with flame retardant transparent covers to allow viewing of switch contact operation but prevent direct contact with components that could be operating at line voltage levels.

.6 Transfer switches shall be provided with a neutral bus and lugs. The neutral bus shall be sized to carry 100% of the current designated on the switch rating.

2.6 ENCLOSURE

.1 Enclosure: ICS 6, Type 1.

.2 Finish: Manufacturer's standard gray enamel.

.3 Maximum dimensions and space restrictions: refer to drawings.

.1 Ensure adequate space is available at sides and rear of the equipment as required to allow access during installation.

.4 Enclosures shall be UL listed. The enclosure shall provide wire bend space in compliance to the latest version of CSA standards. The cabinet door shall include permanently mounted key type latches.

.5 Transfer switch equipment shall be provided in a minimum NEMA 1 sprinklerproof enclosure.

.6 Enclosures shall be the NEMA type specified. The cabinet shall provide code-required wire bend space at point of entry as shown on the drawings. Manual operating handles and all control switches (other than key-operated switches) shall be accessible to authorized personnel only by opening the key-locking cabinet door. Transfer switches with manual operating handles and/or non key-operated control switches located on outside of cabinet do not meet this specification and are not acceptable.

.7 Enclosure shall be complete with wireway as required to accept top, side, or bottom cable entry.

2.7 CONNECTIONS

.1 Field control connections shall be made on a common terminal block that is clearly and permanently labeled.

.2 Transfer switch shall be provided with mechanical lugs suitable for copper conductors and sized to accept the full output rating of the switch.

.3 Lugs suitable for multiple parallel runs of conductors.

.4 Contractor to field verify exact size and quantity of existing conductors.

2.8 SERVICE CONDITIONS

.1 Transfer switches rated to carry 100 per cent of rated current continuously in the enclosure supplied, in ambient temperatures of -40°C to +60°C, relative humidity up to 95 per cent non-condensing, and altitudes up to 3000 m (10 000 feet).

2.9 MATERIALS

.1 Instrument transformers: to CAN/CSA C60044-1.

.2 Contactors: to NEMA ICS2.

2.10 CONTROLS AND INDICATORS

.1 Selector switches:

.1 2 position for system test with load “Test”, “Auto”

.2 3 position for generator control “Auto”, “Manual”, “Engine Start”

.3 Test position - normal power failure simulated. Engine starts and transfer takes place. Return switch to "Auto" to stop engine.

.4 Auto position - normal operation of transfer switch on failure of normal power; retransfers on return of normal voltage and shuts down engine.

.5 Manual position - transfer switch may be operated by manual handle but transfer switch will not operate automatically and engine will not start.

.6 Engine start position - engine starts but unit will not transfer unless normal power supply fails. Switch must be returned to "Auto" to stop engine.

.2 Control transformers: dry type with 120 V secondary to isolate control circuits from:

.1 Normal power supply.

.2 Emergency power supply.

.3 Relays: continuous duty, industrial control type, with wiping action contacts rated 10 A minimum:

.1 Voltage sensing: 3 phase for normal power and on three phases for emergency, solid state type, adjustable drop out and pick up, close differential, 2 V minimum undervoltage and over voltage protection.

.2 Time delays as indicated in the Sequence of Operation section

.3 Frequency sensing, to prevent transfer from normal power supply until frequency of standby unit reaches preset adjustable values.

.4 Product Options and Features

.1 Indicating Lights: Mount in cover of enclosure to indicate NORMAL SOURCE AVAILABLE, ALTERNATE SOURCE AVAILABLE, SWITCH POSITION, NORMAL BYPASS, ALTERNATE SOURCE BYPASS.

.2 Test Switch: Mount in cover of enclosure to simulate failure of normal source.

.3 Return to Normal Switch: Mount in cover of enclosure to initiate manual transfer from alternate to normal source.

.4 Transfer Switch Auxiliary Contacts: two normally open; two normally closed.

.5 Normal Source Monitor: Monitor each line of normal source voltage and frequency; initiate transfer when voltage drops below 85 percent or frequency varies more than 3 percent from rated nominal value.

.6 Alternate Source Monitor: Monitor alternate source voltage and frequency; inhibit transfer when voltage is below 85 percent or frequency varies more than 3 percent from rated nominal value.

.5 Operator Panel. Each transfer switch shall be provided with a control panel to allow the operator to view the status and control operation of the transfer switch. The operator panel shall be a sealed membrane panel rated NEMA 3R/IP53 or better that is permanently labeled for switch and control functions. The operator panel shall be provided with the following features and capabilities.

.1 High intensity LED lamps to indicate the source that the load is connected to (source 1 or source 2); and which sources are available. Source available LED indicators shall operate from the control microprocessor to indicate the true condition of the sources as sensed by the control.

.2 High intensity LED lamps to indicate that the transfer switch is “not in auto” (due to control being disabled or due to bypass switch enabled or in operation) and “Test/Exercise Active” to indicate that the control system is testing or exercising the generator set.

.3 “OVERRIDE” pushbutton to cause the transfer switch to bypass any active time delays for start, transfer, and retransfer and immediately proceed with its next logical operation.

.4 “TEST” pushbutton to initiate a pre-programmed test sequence for the generator set and transfer switch. The transfer switch shall be programmable for test with load or test without load.

.5 “LAMP TEST” pushbutton(s) to test all lamps on the panel by lighting them, either simultaneously from one control, or individually.

.6 The control system shall continuously log information on the number of hours each source has been connected to the load, the number of times transferred, and the total number of times each source has failed. This information shall be available via a PC-based service tool or an operator display panel.

.7 Security Key Switch or password on control panel to allow the user to inhibit adjustments.

.8 Key operated test operator switch to prevent manual operation or testing of the transfer switch unless key is in place and operated.

.9 Digital AC meter display panel, to display 3-phase AC Volts, Hz, kW load level, and load power factor. The display shall be colour-coded, with green scale indicating normal or acceptable operating level, yellow indicating conditions nearing a fault, and red indicating operation in excess of rated conditions for the transfer switch.

.10 Vacuum fluorescent or LCD alphanumeric display panel with push-button navigation switches. The display shall be clearly visible in both bright (sunlight) and no light conditions. It shall be visible over an angle of at least 120 degrees. The Alphanumeric display panel shall be capable of providing the following functions and capabilities:

.1 Display source condition information, including AC voltage for each phase of normal and emergency source, frequency of each source. Voltage for all three phases shall be displayed on a single screen for easy viewing of voltage balance.

.2 Display source status, to indicate source is connected or not connected.

.3 Display load data, including 3-phase AC voltage, 3-phase AC current, frequency, kW, kVA, and power factor. Voltage and current data for all phases shall be displayed on a single screen.

.4 The display panel shall allow the operator to view and make the following adjustments in the control system, after entering an access code:

.1 Adjust voltage and frequency sensor operation set points.

.2 Set up time clock functions.

.3 Set up load sequence functions.

.4 Enable or disable control functions in the transfer switch, including program transition.

.5 Set up exercise and load test operation conditions, as well as normal system time delays for transfer time, time delay start, stop, transfer, and retransfer.

.5 Display Real time Clock data, including date, and time in hours, minutes, and seconds. The real time clock shall incorporate provisions for automatic daylight savings time and leap year adjustments. The control shall also log total operating hours for the control system.

.6 Display service history for the transfer switch. Display source connected hours, to indicate the total number of hours connected to each source. Display number of times transferred, and total number of times each source has failed.

.7 Display fault history on the transfer switch, including condition, date/time of fault. Faults to include controller checksum error, low controller DC voltage, ATS fail to close on transfer, ATS fail to close on retransfer, battery charger malfunction, network battery voltage low, network communications error.

.6 Internal Controls

.1 Provide RMS voltage sensing and metering that is accurate to within plus or minus 1% of nominal voltage level. Frequency sensing shall be accurate to within plus or minus 0.2%. Voltage sensing shall be monitored based on the normal voltage at the site. Systems that utilize voltage monitoring based on standard voltage conditions that are not field configurable are not acceptable.

.2 Transfer switch voltage sensors shall be close differential type, providing source availability information to the control system based on the following functions:

.1 Monitoring all phases of the normal service (source 1) for under voltage conditions (adjustable for pickup in a range of 85 to 98% of the normal voltage level and dropout in a range of 75 to 98% of normal voltage level).

.2 Monitoring all phases of the emergency service (source 2) for under voltage conditions (adjustable for pickup in a range of 85 to 98% of the normal voltage level and dropout in a range of 75 to 98% of pickup voltage level).

.3 Monitoring all phases of the normal service (source 1) and emergency service (source 2) for voltage imbalance.

.4 Monitoring all phases of the normal service (source 1) and emergency service (source 2) for loss of a single phase.

.5 Monitoring all phases of the normal service (source 1) and emergency service (source 2) for phase rotation.

.6 Monitoring all phases of the normal service (source 1) and emergency service (source 2) for over voltage conditions (adjustable for dropout over a range of 105 to 135% of normal voltage, and pickup at 95-99% of dropout voltage level).

.7 Monitoring all phases of the normal service (source 1) and emergency service (source 2) for over or under frequency conditions.

.8 Monitoring the neutral current flow in the load side of the transfer switch. The control shall initiate an alarm when the neutral current exceeds a preset adjustable value in the range of 100-150% of rated phase current for more than an adjustable time period of 10 to 60 seconds.

.3 All transfer switch sensing shall be configurable from the Transfer Switch or a Remote PC-based service tool, to allow setting of levels, and enabling or disabling of features and

functions. Selected functions including voltage sensing levels and time delays shall be configurable using the operator panel. Designs utilizing DIP switches or other electromechanical devices are not acceptable. The transfer control shall incorporate a series of diagnostic LED lamps.

.4 The transfer switch shall be configurable to control the operation time from source to source (program transition operation). The control system shall be capable of enabling or disabling this feature, and adjusting the time period to a specific value. A phase band monitor or similar device is not acceptable.

.5 The transfer switch shall incorporate adjustable time delays for generator set start (adjustable in a range from 0-15 seconds); transfer (adjustable in a range from 0-120 seconds); retransfer (adjustable in a range from 0-30 minutes); and generator stop (cool-down) (adjustable in a range of 0-30 minutes).

.6 The transfer switch shall be configurable to accept a relay contact signal and a network signal from an external device to prevent transfer to the generator service.

.7 The control system shall be designed and prototype tested for operation in ambient temperatures from -40°C to +70°C. It shall be designed and tested to comply with the requirements of the noted voltage and RFI/EMI standards.

.8 The control shall have optically isolated logic inputs, high isolation transformers for AC inputs, and relays on all outputs, to provide optimum protection from line voltage surges, RFI and EMI.

2.11 ACCESSORIES

.1 Ensure pilot lights indicate power availability normal and standby, switch position, green for normal, red for standby, mounted in panel.

.2 Plant exerciser.

.3 Auxiliary Relays:

.1 Auxiliary relays to provide normally open (NO) and normally closed (NC) contacts for remote alarms.

.2 The transfer switch will provide the following dry contact monitoring points to determine status of the ATS remotely:

.1 Normal power available

.2 Emergency power available

.3 ATS in “Normal” position

.4 ATS in “Emergency” position

.5 ATS “Not in Auto”

.6 Pre-transfer

.7 Failure to Synchronize

.8 Extended Parallel Alarm

.4 Instruments:

.1 Digital true RMS, indicating type 2 per cent accuracy, flush panel mounting:

.1 Voltmeter: AC, scale 0 to nominal system voltage +10%.

.2 Ammeter: ac, scale 0 to 10% above continuous rating.

.3 Frequency meter: scale 55 Hz to 65 Hz.

.4 Voltmeter selector switch: rotary, maintained contacts, panel mounting type, round notched handle, four position, labelled "OFF-Phase A-Phase B-Phase C".

.5 Ammeter selector switch: rotary, maintained contacts, panel mounting type, designed to prevent opening of current circuits, round notched handle, four position labelled "OFF - Phase A - Phase B - Phase C".

.6 Bypass and Isolator

.1 A two-way bypass-isolation switch shall provide manual bypass of the load to either source and permit isolation of the automatic transfer switch from all source and load power conductors. All main contacts shall be manually driven.

.2 Power interconnections shall be silver-plated copper bus bar. The only field installed power connections shall be at the service and load terminals of the bypass-isolation switch. All control interwiring shall be provided with disconnect plugs.

.3 Separate bypass and isolation handles shall be utilized to provide clear distinction between the functions. Handles shall be permanently affixed and operable without opening the enclosure door. Designs requiring insertion of loose operating handles or opening of the enclosure door to operate are not acceptable.

.4 Bypass to the load-carrying source shall be accomplished with no interruption of power to the load (make before break contacts). Designs that disconnect the load when bypassing are not acceptable. The bypass handle shall have three operating modes: "Bypass to Normal," "Automatic," and "Bypass to Emergency." The operating speed of the bypass contacts shall be the same as the associated transfer switch and shall be independent of the speed at which the manual handle is operated. In the "Automatic" mode, the bypass contacts shall be out of the power circuit so that they will not be subjected to fault currents to which the system may be subjected.

.5 The isolation handle shall provide three operating modes: "Closed," "Test," and "Open." The "Test" mode shall permit testing of the entire emergency power system, including the automatic transfer switches with no interruption of power to the load. The "Open" mode shall completely isolate the automatic transfer switch from all source and load power conductors. When in the "Open" mode, it shall be possible to completely withdraw the automatic transfer switch for inspection or maintenance to conform to code requirements without removal of power conductors or the use of any tools.

.6 When the isolation switch is in the "Test" or "Open" mode, the bypass switch shall function as a manual transfer switch.

.7 Designs requiring operation of key interlocks for bypass isolation or ATSs which cannot be completely withdrawn when isolated are not acceptable.

.7 Communications Module

.1 The communications shall be capable of connecting to the Ethernet TCP/IP network with BacNet card for BAS communication. This module shall allow for the seamless integration of communication transfer devices.

.2 Allow remote viewing of transfer switch information from a PC, including transfer switch name, real time load in kW on the transfer switch, current source condition, and current operating mode.

2.12 EQUIPMENT IDENTIFICATION

.1 Identify equipment in accordance with Section 26 05 53.

.2 Control panel:

.1 For selector switch and manual switch: size 4 nameplates.

.2 For meters, indicating lights, minor controls: use size 3 nameplates.

.3 Warning labels:

.1 For 3-pole transfer switches utilized on 4-wire systems with unswitched neutrals, provide warning sign on transfer switch to clearly indicate the use of a floating neutral and that the generator neutral is not separately grounded.

.2 For 4-pole transfer switches utilized on a 4-wire system with a switch neutral, provide warning sign on transfer switch to clearly indicate that each source is separately grounded.

.4 Nameplates:

.1 Engraved phenolic nameplate, 3 mm (1/8 in) thick plastic engraved sheet.

.2 Red face, white core unless noted otherwise.

.3 To be mechanically attached with self-tapping screws.

.4 White letters, 12 mm (1/2 in.) high unless otherwise noted below.

.5 To include:

.1 Identity of equipment (i.e. ATS-1), 20 mm (3/4 in.) high letters.

.2 Voltage.

.3 Ampacity.

.4 Number of phases.

.5 Identity, switchboard section (if applicable), circuit number, and size of Normal Power source.

.6 Identity, switchboard section (if applicable), circuit number, and size of Emergency Power source.

.7 Identity of device or panelboard on the Load side of the transfer switch.

.8 Date of installation.

.9 If upstream or downstream device is located in a separate room from ATS, indicate the room name and number.

.6 Confirm exact colours and text with the engineer prior to fabrication.

.7 Example of nameplate:

AUTOMATIC TRANSFER AND BYPASS ISOLATION SWITCH

ATS-1

800 A-4P, SWITCHED NEUTRAL, 347/600 V, 3PH, 4W

NORMAL FED FROM 800 A-3P BREAKER IN MAIN SWITCHBOARD

EMERGENCY FED FROM 450 kW STANDBY GENERATOR OUTSIDE

CONTROLS 450 kW GENERATOR FOR DATA CENTRE

FEEDING PANEL DPSP6A

INSTALLED APRIL 2013

2.13 SOURCE QUALITY CONTROL

.1 Complete equipment, including transfer mechanism, controls, relays, and accessories factory assembled and tested in presence of the Consultant.

.2 Notify Consultant 5 days minimum in advance of date of factory test.

.3 Tests:

.1 Operate equipment both mechanically and electrically to ensure proper performance.

.2 Check selector switch, in modes of operation Test, Auto, Manual, Engine Start and record results.

.3 Check voltage sensing and time delay relay settings.

.4 Check:

.1 Automatic starting and transfer of load on failure of normal power.

.2 Retransfer of load when normal power supply resumed.

.3 Automatic shutdown.

.5 Provide copy of test reports and include with Commissioning Manual.

2.14 SEQUENCE OF OPERATION

.1 The automatic and manual control of an emergency electrical power supply system, including the starting of a generator set or generator sets, and actuation of automatic transfer switches to connect a load to the emergency supply and reconnect it to the normal supply, shall be in the following sequence:

.1 Confirm initial set points with the Consultant prior to start up and commissioning.

.2 The generator sets shall be started when the normal supply at the transfer switch on one or more phase has been interrupted or is at a voltage that is less than 70 per cent of the nominal system voltage for 3 seconds.

.1 Initiate time delay to start alternate source engine generator: Upon initiation by normal source monitor.

.2 Time delay to start alternate source engine generator: 0 to 3 seconds, adjustable. Initial set point 3 seconds.

.3 Initiate transfer load to alternate source: Upon initiation by normal source monitor and permission by alternate source monitor.

.4 Time delay before transfer to alternate power source: 0 to 60 minutes, adjustable.

.1 Initial set point for “Non-Life Safety” transfer switches: 30 seconds.

.5 The set points for the items above shall be configured such that the generator is connected to and powering life safety equipment within 15 seconds of the loss of normal power.

.3 Where delayed emergency loads are arranged to be connected to the emergency supply later than the emergency loads, all of the delayed emergency loads and any other loads that have been arranged for connection at the same time.

.4 On restoration of the normal supply, and after nominal voltage and frequency have been maintained at nominal levels on all phases of the transfer switch for a period of 1 to 30 minutes, the automatic transfer switches shall transfer the loads back to the normal supply, except that the transfer shall occur without delay when an emergency supply fails.

.1 Initiate retransfer load to normal source: upon permission by normal source monitor.

.2 Time delay before transfer to normal power: 0 to 60 minutes, adjustable; bypass time delay in event of alternate source failure. Initial set point 10 minutes.

.3 Delayed transition duration: 0.5 to 3 seconds. Initial set point 0.5 seconds.

.5 After the transfer of loads back to the normal supply, the automatic shutdown of the generator set shall be delayed for 5 minutes or a reasonable length of time to stabilize the operating temperature under no-load conditions.

.1 Time delay before engine shut down: 0 to 60 minutes, adjustable, of unloaded operation. Initial set point 5 minutes.

.2 Automatic engine exerciser:

.1 Engine Exerciser: Start engine every 7 days; run for 30 minutes before shutting down. Bypass exerciser control if normal source fails during exercising period.

.2 Alternate System Exerciser: Transfer load to alternate source during engine exercising period.

.3 Initial set point: turn off automatic engine exerciser.

.3 Generator Set Exercise (Test) With Load Mode. The control system shall be configurable to test the generator set under load. In this mode, the transfer switch shall control the generator set in the following sequence:

.1 Transfer switch shall initiate the exercise sequence at a time indicated in the exercise timer program, or when manually initiated by the operator.

.2 The transfer switch shall issue a compatible start command to the generator set, and cause the generator set to start and run at idle until it has reached normal operating temperature.

.3 When the generator set has reached normal operating temperature or after an adjustable time period (whichever is shorter), the control system shall accelerate the generator set to rated voltage and frequency.

.4 When the control systems senses the generator set at rated voltage and frequency, it shall operate to connect the loads to the generator set by opening the normal source contacts, and closing the alternate source contacts a predetermined time period later. The timing sequence for the contact operation shall be programmable in the controller.

.5 The generator set shall operate connected to the load for the duration of the exercise period. If the generator set fails during this period, the transfer switch shall automatically reconnect the generator set to the normal service.

.6 On completion of the exercise period, the transfer switch shall operate to connect the loads to the normal source by opening the alternate source contacts, and closing the normal source contacts a predetermined time period later. The timing sequence for the contact operation shall be programmable in the controller.

.7 The transfer switch shall operate the generator set unloaded for a cool-down period, and then remove the start signal from the generator set. If the normal power fails at any time when the generator set is running, the transfer switch shall immediately connect the system loads to the generator set.

.4 Generator Set Exercise (Test) Without Load Mode. The control system shall be configurable to test the generator set without transfer switch load connected. In this mode, the transfer switch shall control the generator set in the following sequence:

.1 Transfer switch shall initiate the exercise sequence at a time indicated in the exercise timer program, or when manually initiated by the operator.

.2 When the control systems senses the generator set at rated voltage and frequency, it shall operate the generator set unloaded for the duration of the exercise period.

.3 At the completion of the exercise period, the transfer switch shall remove the start signal from the generator set. If the normal power fails at any time when the generator set is running, the transfer switch shall immediately connect the system loads to the generator set.

2.15 SOURCE QUALITY CONTROL

.1 The transfer switch manufacturer shall perform a complete operational test on the transfer switch prior to shipping from the factory. Tests shall be conducted as per CSA standards. A certified test report shall be included in each copy of the Operations Manual. Test process shall include calibration of voltage sensors. The following factory tests shall be performed:

.1 Visual inspection to verify that each ATS is in accordance with the specifications.

.2 Mechanical test to verify that ATS sections are free of mechanical hindrances.

.3 Insulation resistance test to ensure integrity and continuity of entire system.

.4 Main switch contact resistance test.

.5 Electrical tests to verify complete system electrical operation and to set up time delays and voltage sensing settings.

.2 Provide for the Owner and Consultant to witness factory testing.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verify existing conditions, including restrictions for moving equipment into position and ensure equipment can suit these limitations.

.2 Coordinate disassembly and field assembly of equipment with the manufacturer.

3.2 INSTALLATION

.1 Install transfer switches to in accordance with codes, as shown on the drawings, and as recommended by manufacturer's instructions.

.2 Provide engraved plastic nameplates.

.3 Locate, install and connect transfer equipment as indicated.

.4 Check relays and solid state monitors and adjust as required to ensure correct operation.

.5 Install and connect remote alarms and IP based monitoring.

.6 Connect generator control wiring.

.1 Provide one pair of stranded conductors from the ATS “start-stop” signal contacts to the generator.

.2 Provide one-pair of conductors from the ATS “on generator source” contacts to the load bank shunt trip breaker.

.7 Set field-adjustable intervals and delays, relays, and engine exerciser. Verify exact set points with the Consultant.

3.3 MANUFACTURER'S FIELD SERVICES

.1 The manufacturer shall provide disassembly, field assembly, and field certification services to suit restrictions of moving equipment into place.

.2 A factory-authorized service representative is to perform start-up and testing of the ATS in the presence of the commissioning authority.

3.4 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00, and Section 26 08 00.

.2 Energize transfer equipment from normal power supply.

.3 Set selector switch in "Test" position to ensure proper standby start, running, transfer, retransfer. Return selector switch to "Auto" position to ensure standby shuts down.

.4 Set selector switch in "Manual" position and check to ensure proper performance.

.5 Set selector switch in "Engine start" position and check to ensure proper performance. Return switch to "Auto" to stop engine.

.6 Set selector switch in "Auto" position and open normal power supply disconnect. Standby should start, come up to rated voltage and frequency, and then load should transfer to standby. Allow to operate for 10 minutes, then close main power supply disconnect. Load should transfer back to normal power supply and standby should shutdown. Repeat, at 1 hour intervals, 4 times, complete test with selector switch in each position, for each test.

3.5 SITE TESTS AND INSPECTIONS

.1 Submit commissioning reports to the Consultant.

.2 A factory-authorized service representative is required to inspect components, assemblies, and equipment installation, including connections, and to assist in testing.

.3 Following completion of automatic transfer switch installation and after making proper adjustments and settings, site tests shall be performed by the manufacturer’s representative in accordance with manufacturer's written instructions to demonstrate that each automatic transfer

switch functions satisfactorily and as specified. Advise the Consultant of the site testing within five days prior to its scheduled date, and provide certified field test reports within 14 days following successful completion of the site tests. Test reports shall describe adjustments and settings made and site tests performed. Minimum operational tests shall include the following:

.1 Insulation resistance shall be tested, both phase-to-phase and phase-to-ground.

.2 Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.

.3 Verify that manual transfer warnings are properly placed.

.4 Perform manual transfer operation.

.5 After energizing circuits, demonstrate the interlocking sequence and operational function.

.6 Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.

.7 Simulate loss of phase-to-ground voltage for each phase of normal source.

.4 Verify time-delay settings.

.5 Verify pickup and dropout voltages by data readout or inspection of control settings.

.6 Verify proper sequence and correct timing of automatic engine starting, transfer time delay, re-transfer time delay on restoration of normal power, and engine cool-down and shut-down.

.7 Test bypass/isolation unit functional modes and related automatic transfer-switch operations.

.8 Power failure of normal source shall be simulated by opening upstream protective device. This test shall be performed a minimum of five times.

.9 Power failure of emergency source with normal source available shall be simulated by opening upstream protective device for emergency source. This test shall be performed a minimum of five times.

.10 Low phase-to-ground voltage shall be simulated for each phase of normal source.

.11 Operation and settings shall be verified for specified automatic transfer switch operational feature, such as override time delay, transfer time delay, return time delay, engine shutdown time delay, exerciser, auxiliary contacts, and supplemental features.

.12 Manual and automatic transfer and bypass isolation functions shall be verified.

3.6 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00. Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools, and equipment in accordance with Section 01 74 00.

3.7 DEMONSTRATION

.1 At the final inspection in the presence of the Consultant, demonstrate that the complete auxiliary electrical power system operates properly in every respect.

.2 Coordinate this demonstration with the demonstration of the engine-generator.

.3 Demonstrate operation of transfer switch in bypass, normal, and emergency modes.

.4 Demonstrate operation of IP based monitoring and configuration.

3.8 TRAINING

.1 The equipment supplier shall provide training for the facility operating personnel covering operation and maintenance of the equipment provided.

.2 The training program shall be not less than two hours in duration.

.3 Training date shall be coordinated with the Owner.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

.1 Section Includes

.1 These specifications describe pertinent material requirements and installation practices for externally mounted, Low Voltage AC Power Panel Surge Protective Devices (SPDs). Furnish and install the SPDs equipment having the electrical characteristics, ratings and modifications as specified herein and as shown on the contract drawings.

.2 The specifications in this section describe the electrical and mechanical requirements for a protection system provided by high-energy Surge Protective Devices. The specified system shall provide effective, high-energy surge current diversion and be suitable for application in ANSI/IEEE C62.41 Category A, B, and C environments (as tested by ANSI/IEEE C62).

.2 Applicability

.1 SPDs shall be fully applicable for the purpose of protecting all facility AC electrical circuits from the hazardous effects of transient voltages. These transients may be generated externally by lightning induced energies, utility load factor corrections, and substation switching, or they can be internally generated due to inductive and/or capacitive load switching.

.3 Suitability

.1 SPDs shall be suitable for all service entrance switchboards, panelboards and motor control centres as indicated on the electrical layouts and single line diagrams. Products are to be configured for parallel installation - no series designs shall be considered acceptable. Design products to allow installation as a stand-alone device allowing mounting adjacent to switchboards, panelboards, and motor control centres. Installation is to be accomplished by a qualified electrical contractor.

1.2 RELATED REQUIREMENTS

.1 Section 26 24 16 – Panelboards.

.2 Section 26 28 16.02 – Molded Case Circuit Breakers.

1.3 REFERENCES

.1 CSA Group:

.1 CSA C22.1:21, Canadian Electrical Code, Part 1 (25th Edition), Safety Standard for Electrical Installations.

.2 Ontario Electrical Safety Code (28th edition/2021).

.3 CSA C22.2 No. 269.2-17 – Surge Protective Devices - Type 2 - Permanently Connected.

.2 Institute of Electrical and Electronics Engineers (IEEE):

.1 IEEE C62.41.1-2002 - IEEE Guide on the Surge Environment in Low-Voltage (1000 V and less) AC Power Circuits.

.2 IEEE C62.41.2-2002 - IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits.

.3 IEEE C62.45-2002, Guide on Surge Testing for Equipment Connected to Low-Voltage AC Power Circuits.

.4 IEEE C62.62-2010, Standard Test Specifications for Surge Protective Devices.

.5 IEEE 142-2007, Recommended Practice for Grounding of Industrial and Commercial Power Systems - Green Book.

.6 IEEE 1100-2005, Recommended Practice for Powering and Grounding Electronic Equipment - Emerald Book.

.3 National Electrical Manufacturers Association (NEMA):

.1 NEMA LS-1. Document rescinded in entirety August 19, 2009. No replacement document has been issued.

.4 Ontario Building Code and its referenced standards.

.5 Underwriters Laboratories Inc. (UL):

.1 ANSI/UL 1449, (4th Edition), Standard for Safety, Surge Protective Devices.

.2 UL 1283 (4th Edition) - 2005, Standard for Electromagnetic Interference Filters.

.6 Other relevant standards:

.1 MIL-STD-220C, Method of Insertion-Loss Measurement.

1.4 DEFINITIONS

.1 Surge Protective Device: A device composed of at least one non-linear component and intended for limiting surge voltages on equipment by diverting or limiting surge current and is capable of repeating these functions as specified. SPDs were previously known as Transient Voltage Surge Suppressors (TVSS) or secondary surge arresters.

.2 SPD Types:

.1 Type 1 – Permanently connected device installed before or after the service disconnect overcurrent device and intended to be installed with no external overcurrent protective device.

.2 Type 2 – Permanently connected Type 2 SPDs are intended for installation on the load side of the service equipment overcurrent device, including SPDs located at the branch panel.

.3 Type 3 – Point of use SPDs that are installed with a minimum of 30 feet of conductor length from the service panel. These 30 feet of conductor length does not include conductors used to attach the SPD. Some examples of Type 3 SPDs are cord connected, direct plug-in and receptacle type SPDs.

.4 Type 4 – component assemblies.

.5 Type 5 – components.

.3 L-G: measurements from phase to equipment grounding conductor as line terminals of utilization equipment.

.4 L-L: measurements from phase to phase in a polyphase system, or from one line to another line in a single-phase system.

.5 L-N: measurement from phase(s) to neutral for both single and three phase systems.

.6 N-G: measurements from neutral to equipment grounding conductor at line terminal of utilization equipment.

.7 Externally mounted SPD: Surge Protective Device (SPD) mounted outside of the power panel as a separate component.

1.5 SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Shop Drawings:

.1 Line drawings or catalog sheets detailing dimensions and weight of enclosure, lifting and support points, and enclosure details.

.2 Internal wiring diagram illustrating all modes of protection in each type of SPD required.

.3 Wiring diagram showing all field connections and manufacturer's recommended wire size, recommended circuit breaker or fuse size, required overcurrent protection type, and maximum lead length.

.3 Provide the following product data:

.1 Voltage Protection Ratings (VPRs), I-nominal ratings, Short Circuit Current Ratings, SPD type designations, dimensions showing construction, per mode and per phase peak surge current, modes of discrete suppression circuitry, warranty period, and replacement terms.

.2 List and detail all protection systems such as fuses, disconnecting means, and protective features.

.4 Submit product data for all components and accessories.

.5 Manufacturer's Installation Instructions:

.1 Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements.

.2 Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

.6 Test reports:

.1 Submit cover sheet of test report from a recognized independent testing laboratory certifying compliance with CSA C22.2 No. 269.2.

.2 Provide verification that the SPD complies with CSA C22.2 No. 269.2.

.3 Provide spectrum analysis of each unit based on MIL-STD-220C test procedures between 10 kHz and 100 kHz verifying the devices noise attenuation equals or exceeds values indicated in this section.

.4 Documentation verifying Short Circuit Current Rating (SCCR).

.5 Proof of UL 1283 listing for EMI filters.

.7 Upon request, present unencapsulated but complete SPD for visual inspection; proprietary technology included. MOV type and quantity shall reflect kA ratings on cut sheets, verification of monitoring, thermal, overcurrent protection, etc.

.8 Include the following information:

.1 Data for each suppressor type indicating conductor sizes, conductor types, and connection configuration and lead lengths.

.2 Manufacturer's certified test data indicating the ability of the product to meet or exceed requirements of this specification.

.3 Drawings, with dimensions, indicating SPD mounting arrangement and lead length configuration, and mounting arrangement of any optional remote diagnostic equipment and assemblies.

.4 List and detail all protection systems such as fuses, disconnecting means and protective materials.

.5 Indicate SPD wiring, bonding, and grounding connections on wiring diagrams for each system. Include installation details demonstrating mechanical and electrical connections to equipment to be protected.

.6 Wiring diagram of SPD diagnostic indicators.

1.6 CLOSEOUT SUBMITTALS

.1 Maintenance data: submit operation and maintenance data, and engineering data for incorporation into manual specified in Section 01 78 00.

.2 Warranty document.

1.7 ENVIRONMENTAL REQUIREMENTS

.1 Operating temperature range: -40 degrees C to 70 degrees C (-40 degrees F to 160 degrees F).

.2 Elevation: Operation up to 3 658 m (12 000 feet) above sea level.

.3 Generate no appreciable magnetic fields.

1.8 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store, and handle in accordance with Section 01 61 00.

.2 Store materials in dry, secure location and protect from weather.

.3 Protect from moisture and humidity.

.4 Store in accordance with manufacturer's written instructions.

.5 Waste management and disposal in accordance with Section 01 74 00.

1.9 MANUFACTURER WARRANTY

.1 Five-year warranty.

.2 Since "Acts of Nature" or similar statements typically include the threat of lightning to which the SPD shall be exposed, any such clause limiting warranty responsibility in the general conditions of this specification shall not apply to this section. This is, the warranty shall cover the effects of lightning, single phasing, and all other electrical anomalies. The warranty shall cover the entire device, not just various components, such as modules only.

1.10 MANUFACTURER QUALIFICATIONS

.1 Manufacturer regularly engaged in the design, manufacturing and testing of SPD’s of the types and ratings required for a period of not less than five years. Manufacturers requesting product approval must meet or exceed the written specification contained herein. Manufacturers requesting approval must receive written verification of product acceptance by the Consultant ten days prior to the bid date.

1.11 QUALITY ASSURANCE

.1 All SPDs manufactured by a single ISO 9001 registered company normally engaged in the design, development, and manufacture of such devices for electrical and electronic system equipment protection.

.2 Manufacturer regularly engaged in the manufacture of surge suppression products for the specified categories for minimum of ten years.

.3 Manufacturer shall offer repair or replacement service for all materials and components incorporated in the Surge Protective Devices.

.4 Technical assistance (no cost to customer) provided by manufacturer through a factory representative or a local distributor and a factory staffed toll-free technical hotline.

.5 Manufacturer shall provide a toll-free customer service phone number to facilitate all inquiries regarding product returns, warranty claims, purchasing requirements and payment or credit issues.

.6 Listed to most recent edition of CSA C22.2 No. 269.2.

.7 Products certified by a recognized testing agency accredited by the Standards Council of Canada, and bear a certification mark from that agency indicating acceptance to Canadian standards.

.1 Equipment certification by one of the following bodies:

.1 Listed by Underwriters Laboratories, Inc. and exhibit the cUL Listing Mark for the category "Surge Protective Devices" or SPD. Provide UL Listing Card under category VZCA7 (SPDs certified for Canada) to confirm compliance to CSA C22.2 No. 269.2, and assigned Voltage Protection Ratings.

.2 Listed by ETL.

.3 Certified by CSA Group.

.2 SPD to be labeled with no less than a 100 kA Short Circuit Current Rating (SCCR).

PART 2 - PRODUCTS

2.1 OUTDATED AND DEFUNCT SPECIFICATION CRITERIA

.1 Selection of SPD is not be made, solely, or in part, based upon any of the following ambiguous specifications, and obsolete terminology. These terms are no longer recognized by ANSI, NEMA, IEEE, or IEC standards as bonafide suppressor performance parameters. Submittals bearing reference to any of the following will be rejected.

.1 A1 ringwave: removed in 2002 revisions of IEEE C62 documents.

.2 Joule ratings: there is no recognized standard for SPD joule ratings.

.3 NEMA LS-1: document rescinded by NEMA.

.4 Response time: not endorsed by IEEE, NEMA, or UL as a valid SPD rating parameter.

.5 Suppressed Voltage Ratings (SVR): terminology deprecated with UL 1449 third and subsequent editions.

2.2 MANUFACTURERS

.1 Manufacturer List

.1 Asco.

.2 Citel.

.3 Current Technology.

.4 Mersen.

.5 Raycap Electrical Protection Systems.

.2 Substitution Limitations: No unit will be accepted as an “approved equal” unless it meets the warranty, strength, safety features, performance ratings, and all other requirements of this specification.

.3 Product Options:

.1 The inclusion of a manufacturer in the following list does not indicate the manufacturer meets all the requirements in this specification. Likewise, the omission of a manufacturer is not indicative of any lack of qualification. The manufacturer and product must meet all the requirements of this specification.

.2 The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety. Products in compliance with the specification and manufactured by others not named will be considered only if pre-approved by the Consultant ten (10) days prior to bid date.

2.3 SURGE PROTECTION DEVICES – GENERAL

.1 Obtain all surge suppression devices through one source from a single manufacturer.

.2 SPD separate from panelboards. Integral SPDs not acceptable.

.3 The SPD listed by recognized testing agency accredited by the Standards Council of Canada, and bear a certification mark from that agency indicating acceptance to Canadian standards, and to UL’s 1283 and UL’s 1449 standards (latest edition, latest revision), and not merely the components or modules. Label all SPDs as a Type 2 for use in Type 1 and Type 2 locations.

.4 Protect all modes L-G, L-N, L-L, and N-G, have discrete suppression circuitry in L-G, L-N, and N-G, and have bidirectional, positive, and negative impulse protection. Line-to-neutral-to-ground protection is not acceptable where line-to-ground is specified, and accordingly reduced mode units with suppression circuitry built into only four modes are not acceptable. In delta systems, line-to-ground-to-line protection is not acceptable where line-to-line is specified.

.5 If a disconnect switch is specified, the disconnect switch and the SPD as a system shall be capable of interrupting up to a minimum 100 kA symmetrical fault current with 600 VAC applied.

.6 Suppression Components:

.1 Metal Oxide Varistors (MOVs).

.2 Gas tubes, silicon avalanche diodes, or selenium cells: not permitted.

.3 Every suppression component of every mode, including N-G, shall be protected by internal overcurrent and thermal overtemperature controls, such as through the use of Thermally Protected MOVs (TPMOVs).

.4 Where SPD is not equipped with overtemperature controls, pack all surge components, current carrying paths and fusing in fuse grade silica sand or epoxy potting for arc quenching capability, minimization of smoke and contaminates in the event of failure.

.7 Internal Fusing - Overcurrent Protection

.1 Individually fuse each suppression component for safety and performance.

.2 Fusing shall be present in every mode, including Neutral-to-Ground.

.3 All overcurrent protection must be included within the device, and not require external overcurrent protection.

.8 Surge Current Rating

.1 Service Entrance: 200 kA per phase.

.2 Distribution: 100 kA to 200 kA per phase.

.3 Point of Use: 100 kA per phase.

.9 Short Circuit Current Rating (SCCR), sometimes referred to as fault current rating: minimum 100 kA.

.10 Nominal Discharge Current (In, or I-nominal):

.1 UL labelled with a minimum 10 kA I-nominal.

.11 Maximum Continuous Operating Voltage (MCOV): The maximum continuous operating voltage (MCOV) of all components not less than 125 per cent for a 120 V system, 120 per cent for 220 and 240 V systems, and 115 per cent for 347 and 600 V systems.

.1 277 V systems: 320 V MCOV.

.2 480 V systems: 552 V MCOV.

.12 Voltage Protection Ratings (VPRs) to not exceed the following:

Voltage	**L-N**	**L-G**	**N-G**
208Y/120	800 V	800 V	800 V
480Y/277	1200 V	1200 V	1200 V
600Y/347	1500 V	1500 V	1500 V
Voltage	**L-L**	**L-G**	
480 Delta	1800 V	1800 V	
600 Delta	2500 V	2500 V	

.13 Minimum EMI/RFI filtering of -50 dB at 100 kHz.

.14 SPD enclosure:

.1 Minimum NEMA type 12 rating in indoor applications.

.2 Minimum NEMA type 4 in outdoor applications.

.15 Diagnostics and Monitoring:

.1 Visual LED diagnostics to indicate failure of a suppression component. Monitor every suppression component of every mode, including N-G.

.2 Form C dry contacts (NO or NC) for remote monitoring capability to indicate the failure of any MOV in the unit.

.3 Surge event counter with backup power source.

2.4 SERVICE ENTRANCE AND TRANSFER SWITCH SPDS

.1 CSA certified and labeled as a Type 2 device.

.2 SPDs relying on an external breaker or fuse as supplemental overcurrent protection do not meet the intent of this specification and will be rejected.

.3 CSA certified listed and labeled with a minimum I-nominal rating of 20 kA.

.4 An approved disconnect switch provided as a means of service disconnect if a 60 A breaker is not available.

.5 Connect SPD using the manufacturer’s breaker/wire recommendations. If recommendations are not available, use a 60 amp breaker and 6 AWG cable with full size ground.

.6 Minimum Surge Current Rating: 200 kA per phase (100 kA per mode).

2.5 DISTRIBUTION PANELBOARD AND MOTOR CONTROL CENTRE SPDS

.1 CSA certified listed and labeled as a Type 2 device.

.2 SPDs relying on an external breaker or fuse as supplemental overcurrent protection do not meet the intent of this specification and will be rejected.

.3 CSA certified listed and labeled with a minimum I-nominal rating of 20 kA.

.4 SPD connected using the manufacturer’s breaker/wire recommendations. If recommendations are not available a 60 A breaker and 6 AWG with full size ground will be used.

.5 Minimum Surge Current Rating: 100 kA per phase (50 kA per mode).

2.6 LIGHTING AND RECEPTACLE BRANCH CIRCUIT PANELBOARD SPDS

.1 CSA certified listed and labeled as a Type 2 device.

.2 SPDs relying on an external breaker or fuse as supplemental overcurrent protection do not meet the intent of this specification and will be rejected.

.3 CSA certified listed and labeled with a minimum I-nominal rating of 10 kA.

.4 SPD connected using the manufacturer’s breaker/wire recommendations. If recommendations are not available a 60 A breaker and 6 AWG will be used.

.5 Minimum Surge Current Rating: 100 kA per phase (50 kA per mode).

PART 3 - EXECUTION

3.1 PRE-INSTALLATION MEETINGS

.1 Pre-installation meetings: conduct pre-installation meeting one week prior to commencing work of this Section and on-site installations to verify project requirements, substrate conditions and co-ordination with other building sub-trades, to review manufacturer's installation instructions and warranty requirements.

3.2 FIELD QUALITY CONTROL

.1 Have manufacturer of products supplied under this Section review Work involved in the handling, installation, application, protection, and cleaning of its products. Submit written reports in acceptable format to verify compliance of Work with Contract in accordance with Section 01 33 00 and Section 01 78 00.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

.3 Schedule site visits to review work at stages listed:

.1 After delivery and storage of products, and when preparatory work on which the work of this Section depends is complete, but before installation begins.

.2 Twice during progress of work at 66 per cent and 99 per cent complete.

.3 Upon completion of the work, after cleaning is carried out.

.4 Obtain reports within three (3) days of review and submit immediately to the Consultant.

3.3 EXAMINATION

.1 Verify service and separately derived system Neutral to Ground bonding jumpers.

3.4 INSTALLATION

.1 Do complete installation in accordance with CSA C22.1, CSA C22.2 No. 0, ANSI/IEEE C62.41, and all other applicable codes.

.2 Manufacturer’s instructions:

.1 Install SPD in accordance with manufacturer’s installation instructions with lead lengths as short and as straight as practically possible. Lead lengths no greater than 600 mm (24 inches). Gently twist conductors together.

.2 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage, and installation instructions.

.3 Connect SPD to service panel being protected via a circuit breaker for each phase, based on the number of poles and the connecting wire size, with a 100 A maximum.

.4 Follow the SPD manufacturer’s recommended installation practice as outlined in the equipment installation manual. Ensure that all neutral conductors are bonded to the system ground at the service entrance or the serving isolation transformer prior to installation of the associated SPD.

.5 Installation position of SPD:

.1 Locate SPD adjacent to the panelboard, in a position as close as possible to the neutral and ground lugs. Rearrange breaker positions for SPDs to minimize the length of the phase, neutral, and ground conductors.

.2 Mount SPD as close as possible to panel being protected in a position that will minimize lead lengths between suppressor and control breaker(s) to which suppressor connects. Utilize conduit, preferably metallic, to accomplish these connections with a recommended minimum wire size of 10 AWG, a maximum wire size of 4 AWG (for ease of dressing), or as noted on the single line diagram. Do not extend suppressor leads beyond manufacturer's recommended maximum length without specific engineering approval. The rationale for this is the longer connecting leads between the SPD and the power panel, the higher the residual transient voltage.

.3 Locate surge suppressors as indicated and mount securely, plumb, true, and square to adjoining surfaces.

.4 Install surface mounted surge suppressors on fire-retardant plywood backboards as recommended in manufacturer's written instructions. Where practical, group SPDs on common backboard with other equipment.

.5 Mount housings and enclosures on fire-retardant plywood backboard with top not higher than 1.8 m (6 feet) above finished floor.

.6 Wiring:

.1 Install units on a breaker, sized, where indicated, that meets or exceeds the fault current rating of the switchgear or panelboard.

.2 Connect SPD to service panel being protected via a circuit breaker for each phase, based on the number of poles and the connecting wire size. Connect SPD using the manufacturer’s breaker/wire recommendations.

.1 If recommendations are not available, a 60 A breaker and 6 AWG phase, neutral, and ground conductors will be used.

.2 If the SPD is supplied with lead wires, match the overcurrent protection to the 75 degree C ampacity of the wiring as described in Ontario Electrical Safety Code, Table 2; i.e. a 30 A breaker to suit 10 AWG lead wires.

.3 Install SPD in a neat, workmanlike manner. Dress leads as short and as straight as possible and be consistent with recommended industry practices for the application on which these units are installed. Bind phase, neutral, and ground conductors tightly (one twist per 30 cm) over entire run, from suppressor to service panel, and always use the shortest length of connecting cable possible.

.4 If the SPD is supplied by the manufacturer with lead wires, cut excess lead length.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Solid state, light emitting diode (LED) source interior luminaires.

.2 New, fully integrated luminaires for indoor applications.

1.2 RELATED REQUIREMENTS

.1 Section 26 09 23 – Lighting Control Devices.

.2 Section 26 52 13.13 – Emergency Lighting.

1.3 REFERENCES

.1 CSA Group:

.1 CSA C22.1:21, Canadian Electrical Code, Part 1 (25th Edition), Safety Standard for Electrical Installations.

.2 Ontario Electrical Safety Code (28th edition/2021).

.3 CSA C22.2 No. 250.0 - Luminaires (Bi-National Standard, with UL 1598).

.2 DesignLights Consortium (DLC):

.1 Solid-State Lighting Technical Requirements v5.1, or latest edition.

.2 Where the specifications do not explicitly call for DLC qualified LED luminaires, the technical criteria provided in the DLC Technical Requirements provide the basis of the requirements for this section of the Specification.

.3 Energy Star:

.1 Program Requirements for Luminaires - Eligibility Criteria, Version 1.2, or latest edition.

.4 Illuminating Engineering Society (IES):

.1 IES HB-10-11 – The Lighting Handbook, 10th Edition.

.2 IES LM-79-08 – Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products.

.3 IES LM-80-08 – IES Approved Method for Measuring Lumen Maintenance of LED Light Sources.

.4 IES TM-21-11 – IES Technical Memorandum on Projecting Long Term Lumen Maintenance of LED Light Sources.

.5 IES TM-30-15 – IES Method for Evaluating Light Source Color Rendition.

.5 IEEE 1789-2015 – IEEE Recommended Practices for Modulating Current in High-Brightness LEDs for Mitigating Health Risks to Viewers.

.6 National Electrical Manufacturer's Association (NEMA):

.1 SSL-1-10 – Electronic Drivers for LED Devices, Arrays, or Systems.

.2 WD 6 - Wiring Devices - Dimensional Requirements.

1.4 DEFINITIONS

.1 CCT: Correlated colour temperature.

.2 CRI: Colour-rendering index.

.3 LED: Light Emitting Diode.

.4 Lumen: Measured output of lamp and luminaire, or both.

.5 Luminaire: Complete lighting fixture, including ballast housing if provided.

1.5 ACTION SUBMITTALS

.1 Refer to Section 01 33 00.

.2 Product submittals shall be accompanied by product specification sheets or other documentation that includes the designed parameters as detailed in this specification. These parameters include (but not limited to):

.1 Maximum power in Watts.

.1 If a transformer is used in conjunction with a driver (for example on some 347 volt lighting circuits), the maximum power shall include the transformer losses.

.2 L70 in hours, when extrapolated for the worse case operating temperature. TM-21 report shall be submitted to demonstrate this.

.3 Product submittals shall be accompanied by performance data that is derived in accordance with appropriate IESNA testing standards and tested in a laboratory that is NVLAP accredited for Energy Efficient Lighting Products.

1.6 INFORMATIONAL SUBMITTALS

.1 Installation instructions.

1.7 CLOSEOUT SUBMITTALS

.1 Section 01 78 00: Submittals for project closeout.

.2 Submit manufacturer's operation and maintenance instructions for each product.

.3 Warranty information.

1.8 QUALIFICATIONS

.1 Manufacturer: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.

1.9 REGULATORY REQUIREMENTS

.1 Products shall be listed and classified by CSA (Canadian Standards Association), ULC (Underwriter’s Laboratories of Canada), or certified by recognized independent testing organizations that test to CSA standards.

.2 Products shall be certified by a recognized testing agency accredited by the Standards Council of Canada and bear a certification mark from that agency.

.3 All luminaires shall be listed and labeled for installation in fireproof or non-fireproof construction, dry, damp, or wet locations as required.

.4 Recessed fixtures mounted in an insulated ceiling shall be listed for use in insulated ceilings.

1.10 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

1.11 EXTRA STOCK MATERIALS

.1 Refer to Section 01 78 00.

.2 Provide the following additional equipment as listed herein.

.1 Provide an additional 2 per cent spare luminaires of each new type to be provided.

.2 Provide 1 per cent of each plastic lens type.

.3 Provide three of each type of any special tools required for system use and maintenance.

1.12 WARRANTY

.1 Refer to Section 01 78 00 and Section 26 05 00.

.2 The manufacturer shall provide a warranty against loss of performance and defects in materials and workmanship for the luminaires for a period of 5 years after acceptance of the luminaires. Warranty shall cover all components comprising the luminaire.

.3 All warranty documentation shall be provided to customer prior to the first shipment.

.4 LED Luminaires shall have a manufacturer’s warranty for a period of not less than five years.

.5 LED boards, drivers and associated components shall have a warranty of 5 years on the LEDs, 5 years on the driver, 10 years on the paint finish.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 As noted on Lighting Fixture Schedule.

2.2 INDOOR LED LUMINAIRES, GENERAL

.1 Initial delivered lumens – thermal losses should be less than 10 per cent when operated at a steady state at an average ambient operating temperature of 25 degrees C, and optical losses should be less than 15 per cent.

.2 Average Delivered Lumens – Average delivered lumens over 50 000 hours should be minimum of 85 per cent of initial delivered lumens.

.3 All luminaires shall be tested per LM79/80 and published L70 data.

.4 Colour rendition:

.1 Interior luminaires with a CRI greater than or equal to 80, or as indicated on the lighting fixture schedule.

.2 Where minimum 90 CRI is indicated, the following may be considered acceptable in lieu, subject to confirmation with the Consultant by means of a Request for Interpretation during the bid period:

.1 CRI (Ra) ≥ 90.

.2 CRI (Ra) ≥ 80 and R9 (R9) ≥ 50.

.3 IES Rf ≥ 78, IES Rg ≥ 100, -1% ≤ IES Rcs,h1 ≤ 15%.

.5 Correlated colour temperature as indicated on the lighting fixture schedule.

.6 Accessibility and Maintenance:

.1 All LED luminaires shall be field serviceable, with LED arrays, LED modules, drivers, etc. fully serviceable and easily accessible. In the case of recessed ceiling mounted, and in the case of surface mounted ceiling fixtures, these components must be accessible from below. Luminaires in which any of these components are accessible only from above are not acceptable.

.2 Ballasts, drivers, LED arrays, LED modules, and lamps shall be serviceable while the fixture is in its normally installed position. Ballasts or drivers shall not be mounted to removable reflectors or wireway covers unless so specified. In the case of ceiling mounted luminaires, the serviceable components must be accessible from below.

.7 Housings:

.1 Formed to prevent warping and sagging. Housing, trim, and lens frame shall be true, straight (unless intentionally curved), and parallel to each other as designed.

.2 Sheet steel housings to be minimum 20 gauge.

.3 Wireways and fittings: free of burrs and sharp edges, and shall accommodate internal and branch circuit wiring without damage to the wiring.

.4 When installed, any exposed fixture housing surface, trim frame, door frame, and lens frame shall be free of light leaks.

.5 Hinged door frames shall operate smoothly without binding. Latches shall function easily by finger action without the use of tools.

.6 Drivers shall not be mounted to removable reflectors or wireway covers unless so specified.

.8 Mechanical Safety: Lighting fixture closures (lens doors, trim frame, hinged housings, etc.) shall be retained in a secure manner by captive screws, chains, aircraft cable, captive hinges, or fasteners such that they cannot be accidentally dislodged during normal operation or routine maintenance.

.9 Metal Finishes:

.1 Fixture finish and construction to meet ULC listings and CSA certifications related to intended installation.

.2 All metal components of fixtures shall be painted after fabrication to mitigate raw metal edges, and thus prevent premature corrosion.

.3 The manufacturer shall apply standard finish (unless otherwise specified) over a corrosion-resistant primer, after cleaning to free the metal surfaces of rust, grease, dirt and other deposits. Edges of pre-finished sheet metal exposed during forming, stamping or shearing processes shall be finished in a similar corrosion resistant manner to match the adjacent surface(s). Fixture finish shall be free of stains or evidence of rusting, blistering, or flaking, and shall be applied after fabrication.

.4 Interior light reflecting finishes shall be white with not less than 85 per cent reflectance, except where otherwise shown on the drawing.

.10 Wiring:

.1 Lighting fixtures shall have a specific means for grounding metallic wireways and housings to an equipment grounding conductor.

.2 Supplied complete with a luminaire disconnect plug.

.11 Control of Visual Perceptions of Temporal Light Modulation (flicker):

.1 All electric lights (except decorative lights, emergency lights and other special-purpose lighting) used in regularly occupied spaces meet at least one of the following requirements for flicker:

.1 A minimum frequency of 90 Hz at all 10% intervals from 10% to 100% light output.

.2 LED products with a “low risk” level of flicker (light modulation) of less than 5%, especially below 90 Hz operation as defined by IEEE standard 1789-2015 LED.

2.3 DRIVERS, GENERAL

.1 Electronic LED drivers shall be integral to the luminaire, and be designed to be accessible in the field for replacement and servicing.

.2 Input Voltage:

.1 Driver with a voltage range of (120-277) +/- 10% or (347-480) +/- 10%.

.2 Refer to lighting fixture schedule.

.3 For luminaires connected to a 347 volt circuit and utilizing a natively 120-277 volt driver, provide an appropriately sized step down transformer.

.3 Input frequency 60 Hz.

.4 Load regulation: +/- 1 per cent from no load to full load.

.5 Output ripple less than 10 per cent.

.6 Output should be isolated.

.7 Case temperature: rated for -40 degrees C through +80 degrees C.

.8 Overheat protection, self-limited short circuit protection and overload protected.

.9 Primary fused.

.10 Driver life rating not less than 50 000 hours

.11 Power Factor and Total Harmonic Distortion

.1 Power factor of greater than or equal to 0.9 at full load.

.2 THD of less than or equal to 20 per cent at full load.

.12 Dimming Control:

.1 Coordinate with Section 26 09 23.

.2 0-10 V dimming control typical for all fixtures unless otherwise noted.

.3 Control range: 10 per cent to 100 per cent typical, unless noted otherwise.

.4 Provide a mock-up to demonstrate the luminaire is free of flicker throughout the dimming range when used with the dimming controllers described in related sections.

2.4 INTERIOR WALL-WASH LED LUMINAIRES

.1 Minimum Light Output: 575 lm.

.2 Zonal lumen density:

.1 Minimum 60 per cent between 0 degrees and 90 degrees from nadir.

.2 Minimum 60 per cent of the lumens must be produced in the “forward” hemisphere, towards the wall.

.3 Minimum luminaire efficacy: 45 lumens per watt.

.4 Correlated Colour Temperature (CCT): 3500 K

.5 Colour Rendition Index (CRI): 80 CRI minimum.

.6 Minimum L70 lumen maintenance to occur at 50 000 hours in accordance with LM-80 testing data and TM-21 extrapolation.

2.5 TRACK OR MONO-POINT DIRECTIONAL LED LUMINAIRES

.1 Minimum Light Output: 250 lm.

.2 Zonal lumen density:

.1 Minimum 85 per cent between 0 degrees and 90 degrees from nadir.

.3 Minimum luminaire efficacy: 45 lumens per watt.

.4 Correlated Colour Temperature (CCT): 3500 K

.5 Colour Rendition Index (CRI): 80 CRI minimum.

.6 Minimum L70 lumen maintenance to occur at 50 000 hours in accordance with LM-80 testing data and TM-21 extrapolation.

2.6 DOWNLIGHT LUMINAIRES

.1 Minimum Light Output: 500 lm.

.2 Zonal lumen density: Minimum 75 per cent between 0 degrees and 60 degrees from nadir.

.3 Minimum luminaire efficacy: 45 lumens per watt.

.4 Correlated Colour Temperature (CCT): 3500 K

.5 Colour Rendition Index (CRI): 80 CRI minimum.

.6 Minimum L70 lumen maintenance to occur at 50 000 hours in accordance with LM-80 testing data and TM-21 extrapolation.

2.7 NOMINAL 610 MM BY 610 MM (2 FOOT BY 2 FOOT) LUMINAIRES FOR AMBIENT LIGHTING OF INTERIOR SPACES

.1 Minimum Light Output: 2 000 lm.

.2 Zonal lumen density:

.1 Minimum 75 per cent between 0 degrees and 60 degrees from nadir.

.3 Spacing Criteria:

.1 0 degrees to 180 degrees: 1.0 to 2.0

.2 90 degrees to 270 degrees: 1.0 to 2.0

.4 Minimum luminaire efficacy: 85 lumens per watt.

.5 Correlated Colour Temperature (CCT): 3500 K

.6 Colour Rendition Index (CRI): 80 CRI minimum.

.7 Minimum L70 lumen maintenance to occur at 50 000 hours in accordance with LM-80 testing data and TM-21 extrapolation.

2.8 NOMINAL 305 MM BY 1220 MM (1 FOOT BY 4 FOOT) LUMINAIRES FOR AMBIENT LIGHTING OF INTERIOR SPACES

.1 Minimum Light Output: 1 500 lm.

.2 Zonal lumen density:

.1 Minimum 75 per cent between 0 degrees and 60 degrees from nadir.

.3 Spacing Criteria:

.1 0 degrees to 180 degrees: 1.0 – 2.0

.2 90 degrees to 270 degrees: 1.0 – 2.0

.4 Minimum luminaire efficacy: 85 lumens per watt.

.5 Correlated Colour Temperature (CCT): 3500 K

.6 Colour Rendition Index (CRI): 80 CRI minimum.

.7 Minimum L70 lumen maintenance to occur at 50 000 hours in accordance with LM-80 testing data and TM-21 extrapolation.

2.9 NOMINAL 610 MM BY 1220 MM (2 FOOT BY 4 FOOT) LUMINAIRES FOR AMBIENT LIGHTING OF INTERIOR SPACES

.1 Minimum Light Output: 3 000 lm.

.2 Zonal lumen density:

.1 Minimum 75 per cent between 0 degrees and 60 degrees from nadir.

.3 Spacing Criteria:

.1 0 degrees to 180 degrees: 1.0 – 2.0

.2 90 degrees to 270 degrees: 1.0 – 2.0

.4 Minimum luminaire efficacy: 85 lumens per watt.

.5 Correlated Colour Temperature (CCT): 3500 K

.6 Colour Rendition Index (CRI): 80 CRI minimum.

.7 Minimum L70 lumen maintenance to occur at 50 000 hours in accordance with LM-80 testing data and TM-21 extrapolation.

2.10 LINEAR AMBIENT LUMINAIRES: INDIRECT

.1 Minimum Light Output: 500 lm per foot.

.2 Zonal lumen density:

.1 Minimum 50 per cent between 90 degrees and 150 degrees from nadir.

.3 Minimum luminaire efficacy: 85 lumens per watt.

.4 Correlated Colour Temperature (CCT): 3500 K

.5 Colour Rendition Index (CRI): 80 CRI minimum.

.6 Minimum L70 lumen maintenance to occur at 50 000 hours in accordance with LM-80 testing data and TM-21 extrapolation.

2.11 LINEAR AMBIENT LUMINAIRES: INDIRECT/DIRECT

.1 Minimum Light Output: 500 lm per foot.

.2 Zonal lumen density:

.1 Minimum 25 per cent between 0 degrees and 60 degrees from nadir.

.2 Minimum 50 per cent between 90 degrees and 150 degrees from nadir.

.3 Minimum luminaire efficacy: 85 lumens per watt.

.4 Correlated Colour Temperature (CCT): 3500 K

.5 Colour Rendition Index (CRI): 80 CRI minimum.

.6 Minimum L70 lumen maintenance to occur at 50 000 hours in accordance with LM-80 testing data and TM-21 extrapolation.

2.12 LINEAR AMBIENT LUMINAIRES: DIRECT/INDIRECT

.1 Minimum Light Output: 500 lm per foot.

.2 Zonal lumen density:

.1 Minimum 40 per cent between 0 degrees and 60 degrees from nadir.

.2 Minimum 35 per cent between 90 degrees and 150 degrees from nadir.

.3 Minimum luminaire efficacy: 85 lumens per watt.

.4 Correlated Colour Temperature (CCT): 3500 K

.5 Colour Rendition Index (CRI): 80 CRI minimum.

.6 Minimum L70 lumen maintenance to occur at 50 000 hours in accordance with LM-80 testing data and TM-21 extrapolation.

2.13 LINEAR AMBIENT LUMINAIRES: DIRECT

.1 Minimum Light Output: 375 lm per foot.

.2 Zonal lumen density:

.1 Minimum 40 per cent between 0 degrees and 60 degrees from nadir.

.3 Minimum luminaire efficacy: 85 lumens per watt.

.4 Correlated Colour Temperature (CCT): 3500 K

.5 Colour Rendition Index (CRI): 80 CRI minimum.

.6 Minimum L70 lumen maintenance to occur at 50 000 hours in accordance with LM-80 testing data and TM-21 extrapolation.

2.14 HIGH-BAY LUMINAIRES FOR COMMERCIAL AND INDUSTRIAL BUILDINGS

.1 Minimum Light Output: 10 000 lm.

.2 Zonal lumen density:

.1 Minimum 30 per cent between 20 degrees and 50 degrees from nadir.

.3 Minimum luminaire efficacy: 80 lumens per watt.

.4 Correlated Colour Temperature (CCT): 4000 K

.5 Colour Rendition Index (CRI): 70 CRI minimum.

.6 Minimum L70 lumen maintenance to occur at 35 000 hours in accordance with LM-80 testing data and TM-21 extrapolation.

2.15 LOW-BAY LUMINAIRES FOR COMMERCIAL AND INDUSTRIAL BUILDINGS

.1 Minimum Light Output: 5 000 lm.

.2 Zonal lumen density:

.1 Minimum 30 per cent between 20 degrees and 50 degrees from nadir.

.3 Minimum luminaire efficacy: 80 lumens per watt.

.4 Correlated Colour Temperature (CCT): 4000 K

.5 Colour Rendition Index (CRI): 70 CRI minimum.

.6 Minimum L70 lumen maintenance to occur at 35 000 hours in accordance with LM-80 testing data and TM-21 extrapolation.

2.16 HIGH-BAY AISLE LUMINAIRES

.1 Minimum Light Output: 10 000 lm.

.2 Zonal lumen density:

.1 Minimum 30 per cent between 0 degrees and 20 degrees from nadir.

.2 Minimum 50 per cent between 20 degrees and 50 degrees from nadir.

.3 Minimum luminaire efficacy: 80 lumens per watt.

.4 Correlated Colour Temperature (CCT): 4000 K

.5 Colour Rendition Index (CRI): 70 CRI minimum.

.6 Minimum L70 lumen maintenance to occur at 35 000 hours in accordance with LM-80 testing data and TM-21 extrapolation.

PART 3 - EXECUTION

3.1 VERIFICATION OF CONDITIONS

.1 Coordinate the lighting system installation with the relevant trades so as to eliminate interferences with hangers, mechanical ducts, sprinklers, piping, steel, etc.

3.2 INSTALLATION

.1 Install lighting equipment, including but not limited to luminaires, controls, auxiliary devices and the integration of same in strict conformance with all manufacturers' recommendations and instructions the securing of which shall be the responsibility of the Contractor.

.2 Integrate luminaires with controls in accordance with respective luminaire manufacturers' and controls manufacturers' recommendations and instructions and to provide a complete, trouble-free operation without compromising safety, code and CSA requirements.

.3 Seal all luminaires for wet locations (i.e. all knock-outs, all pipe and wire entrances, etc.) as is standard industry practice to prevent water from entering luminaires.

.4 Luminaire Alignment:

.1 Locate recessed ceiling luminaires as indicated on reflected ceiling plan. Install recessed luminaires to permit removal from below. Include accessories and materials to meet applicable codes and regulatory requirements.

.2 Align luminaires mounted in continuous rows to form straight uninterrupted line.

.3 Align luminaires mounted individually parallel or perpendicular to building grid lines.

.4 Install surface mounted luminaires plumb and adjust to align with building lines and with each other. Secure to prevent movement.

.5 Locate and install luminaires as indicated. Mounting heights and configuration of the luminaires shall be as specified in the Luminaire Schedule portion of the Specification or indicated on the drawings, and where conflicts exist, as approved by the Consultant.

.6 Installed all luminaires plumb and true and level as viewed from all directions unless specifically identified otherwise in the Lighting Fixture Schedule. Luminaires shall remain plumb and true without continual adjustment or visibly obvious means beyond what is shown on luminaire submittal drawings.

.7 For installation in suspended ceilings, ensure that the luminaires are supported such that there is no resultant bowing or deflection of the ceiling system greater than 1/360 of the length of the total span of the ceiling member.

.5 Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.

.6 Whenever a luminaire or its hanger canopy is installed directly to a surface mounted junction box, use a finishing ring painted to match the ceiling to conceal the junction box.

.7 Suspended Luminaires:

.1 Install suspended luminaires and exit signs using pendants supported from swivel hangers. Provide pendant length required to suspend luminaire at indicated height.

.2 Suspended luminaires shall be installed plumb and true and level unless specifically identified otherwise in the Luminaire Schedule portion of this Specification and at a height from finished floor as specified on the drawings, details and Luminaire Schedule. In cases where this is impractical, refer to the Consultant for a decision. All appurtenances shall be consistently organized for a neat, uniform appearance.

.8 Install wall mounted luminaires at height as indicated.

.9 Accessories:

.1 Reflector cones, louvers, baffles, lenses, trims and other decorative elements shall be installed after completion of ceiling tile installation, plastering, painting and general cleanup.

.2 Install accessories provided with each luminaire.

.3 All accessories shall be properly installed and adjusted by Contractor in accordance with specification and installation instructions. Any spare items shall be clearly labeled (indicate type of accessory and associated luminaire types).

3.3 TESTING AND ADJUSTMENT

.1 As required, all adjustable luminaires shall be aimed, focused, locked, etc., by the Contractor under the observation of the Consultant. As aiming and adjusting is completed, locking setscrews and bolts and nuts shall be tightened securely by the Contractor.

.2 For luminaires with field selectable lumen output and/or CCT, ensure the correct setting matches the intended set points.

.3 All ladders, scaffolds, lifts, etc. required for aiming and adjusting luminaires shall be furnished by the Contractor.

.4 Where possible, units shall be focused during the normal working day. However, where daylight interferes with seeing lighting effects, aiming shall be accomplished at night.

3.4 LUMINAIRE SUPPORTS

.1 Provide adequate support to suit ceiling system.

.2 Support luminaires independently of ceiling framing, unless ceiling is certified by the manufacturer to support weight of installed devices. Confirm if T-bar ceilings are metric or imperial and provide luminaires to suit ceiling dimensions.

.3 Provide chain hangers for new and existing luminaires.

.4 Install clips to secure recessed grid-supported luminaires in place.

.5 Fixtures supported by suspended ceiling systems shall be securely fastened to the ceiling framing member by mechanical means, such as bolts, screws, or rivets. Ceiling framing members must be securely attached to each other and to the building structure as required by all applicable codes and standards. Use of integral clips is not acceptable.

3.5 WIRING

.1 Use SPC90 conductors for final connections to luminaires (including 0-10 V dimming conductors for applicable luminaires).

.2 Install luminaire disconnect plugs on all new luminaires not provided as such from the manufacturer.

.3 Connect luminaires to branch circuit outlets provided under Section 26 05 33.13 using flexible conduit.

.4 Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.

.5 Bond products and metal accessories to branch circuit equipment grounding conductor.

3.6 FIELD QUALITY CONTROL

.1 Operate each luminaire after installation and connection. Inspect for proper connection and operation.

.2 Make wiring connections to the branch circuit using building wire with insulation suitable for temperature conditions within luminaire.

.3 Occupancy Sensors.

.1 Locate and aim sensors in the correct location required for complete and proper volumetric coverage within the range of coverage(s) of controlled areas.

.2 Rooms shall have 90 per cent to 100 per cent coverage to completely cover the controlled area to accommodate all occupancy habits of single or multiple occupants at any location within the room.

.3 Exercise proper judgment in executing the work to ensure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference of structural components.

3.7 CLEANING

.1 Thoroughly clean all luminaires and accessories after installation. All fingerprints, dirt, tar, smudges, drywall mud, dust, etc. shall be removed by the Contractor from the luminaire bodies, reflectors, trims, and lens or louvers prior to final acceptance. All reflectors shall be free of paint other than factory-applied, if any. All reflectors, cones and lenses shall be cleaned only according to manufacturers' instructions.

.2 Clean electrical parts to remove conductive and deleterious materials.

.3 Remove dirt and debris from enclosures.

.4 Clean photometric control surfaces as recommended by manufacturer.

.5 Clean finishes and touch up damage.

.6 Luminaire finishes which are disturbed in any way during construction shall be touched up or refinished in a manner satisfactory to the Consultant.

3.8 COMMISSIONING

.1 In accordance with Section 26 08 50.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Emergency lighting units with battery back-up for emergency illumination of remote emergency fixtures and internally illuminated exit signs.

.2 Remote emergency fixtures.

1.2 RELATED REQUIREMENTS

.1 Section 26 51 19 – LED Interior Lighting.

.2 Section 26 52 13.16 – Exit Signs.

1.3 REFERENCES

.1 CSA Group:

.1 CSA C22.2 No. 141-15 (R2020), Emergency lighting equipment.

.2 CSA C22.1:21, Canadian Electrical Code, Part 1 (25th Edition), Safety Standard for Electrical Installations.

.3 Ontario Electrical Safety Code (28th edition/2021).

.2 Ontario Building Code.

.3 National Building Code of Canada.

.4 Underwriters Laboratories, Inc. (UL):

.1 UL 924 – Standard for Safety of Emergency Lighting and Power Equipment.

1.4 SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for emergency lighting and include product characteristics, performance criteria, physical size, finish, and limitations.

1.5 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00.

.2 Operation and Maintenance Data: submit operation and maintenance data for emergency lighting for incorporation into manual.

1.6 EXTRA MATERIALS

.1 Allow the cost for material and for installation of the following to be installed as directed by the Consultant during construction:

.1 An additional five dual head emergency remote units.

.2 An additional one battery unit, based on the maximum battery capacity as specified.

1.7 QUALITY ASSURANCE

.1 Manufacturer Qualifications: Products shall be free of defects in material and workmanship.

.2 Furnished products are listed and/or certified by third party agencies as suitable for the intended purpose.

.3 All units will be certified that they have been tested prior to shipping.

1.8 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store, and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect emergency lighting from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 00.

1.9 WARRANTY

.1 Product is warranted free of defects in material and workmanship.

.2 Product is warranted to perform the intended function within design limits.

.3 For batteries in this Section, 12 month warranty period is extended to 24 months.

PART 2 - PRODUCTS

2.1 EMERGENCY BATTERY UNITS

.1 Manufacturers:

.1 Lumacell RG12S series.

.2 Aimlite.

.3 BeLuce (formerly Beghelli).

.4 Emergi-Lite.

.5 Lithonia (Acuity Brands Lighting).

.6 Stanpro.

.2 Battery Unit Features:

.1 Self-contained unit equipment for LED emergency lighting shall be manufactured and labeled as certified to meet CSA C22.2 No 141.

.2 Housing: Constructed of formed and welded 18 gauge cold rolled steel with knockouts for conduit, finished in baked white enamel. Cabinet suitable for direct or shelf mounting to wall. Removable or hinged front panel for easy access to batteries.

.3 Charger:

.1 Solid-state micro-controller PCB, Pulse-Guard charger, features include; auto-equalized, temperature compensated, current limited, short circuit and reverse polarity protected.

.2 Recharges battery within 24 hours in accordance with CSA requirements.

.4 Transfer: Upon failure of the power supply, or voltage dip below 75 per cent of nominal, a sealed relay automatically and instantaneously connects the battery to the emergency lighting load and disconnects when battery discharge reaches 87.5 per cent expectancy.

.5 Batteries: seal lead calcium, maintenance free, and 10 year pro-rated service life.

.6 Auto-test: Unit to perform self-test for 1 minute ever 30 days, 10 minutes on the 6th month, and 30 minutes every 12 months.

.3 Battery Electrical Features:

.1 Input Voltage:120-347 VAC universal input:

.1 Provided with plug and receptacle when connected to 120 volt source panelboard.

.2 direct connected to 347 volt source panelboard.

.2 Output Voltage: 12 VDC; balance loads to battery unit terminals.

.1 Normally "Off" output: wattage capacity as indicated for emergency remotes and internally illuminated exit signs.

.2 Battery Run Time at full load: must meet OBC minimum, 60 minutes.

.3 Voltage regulation: ± 5 per cent of nominal maximum.

.3 Signal lights: solid state, for 'AC Power ON' and 'High Charge'.

.4 Lamp heads:

.1 Integral on unit, 345 degrees horizontal and 180 degrees vertical adjustment.

.2 Lamp type:

.1 Two 12 V, 6 W MR16 LED lamps mounted on top of the battery cabinet, shall be injection molded thermoplastic, white finish.

.2 Average lamp lumens: 170 lm.

.3 Centre Beam Candlepower: 440 cd.

.4 Beam angle: 30 degrees.

.5 Lamp efficacy: 42.5 lm/W.

.5 Auxiliary equipment:

.1 Ammeter.

.2 Voltmeter.

.3 Test switch.

.4 Time delay relay.

.5 Battery disconnect device.

.6 AC input and DC output terminal blocks inside cabinet.

.7 Shelf Bracket.

.8 Cord and single twist-lock plug connection for AC.

.9 RFI suppressors.

.10 Voltage Sensing Relay:

.1 Up to six inputs for line voltage detection from different normal lighting zone. The wire connection from each zone circuit shall be made with terminal blocks.

.2 Operation Sequence: In the case of power failure of one or several circuits feeding normal lighting, the output circuit will open and transfer the battery unit(s) in emergency lighting mode.

.3 Provide “push to test” push button and a pilot light for each zone circuit for manual testing and service.

2.2 VOLTAGE SENSING RELAY (VSR) ZONE CONTROL STAND-ALONE EXTENSION MODULE

.1 Manufacturers: Lumacell VSR series (basis of design).

.2 The equipment shall have an adequate quantity of inputs (up to 24 inputs) for line voltage detection from different building zones. The wire connection from each zone circuit shall be made with terminal blocks. The output circuit shall be a dry-contact relay, normally closed and shall be accessible for connection on a terminal block. The output circuit shall be connected at installation in series with the AC line supplying the battery unit equipment.

.3 Operation Sequence: In the case of power failure of one or several circuits feeding normal lighting, the output circuit will open and transfer the battery unit(s) in emergency lighting mode.

.4 Include a “push to test” push button and a pilot light for each zone circuit for manual testing and service.

2.3 EMERGENCY LIGHTING EMERGENCY REMOTE HEADS

.1 Refer to drawings and lighting schedule.

.2 One or two lamps, shall be injection molded thermoplastic, white finish, lamps shall be MR16 LED 12 V, 540 lumen, 25 degree beam angle, 6 watt.

.3 Remote heads to be mounted not less than 2100 mm (6’-10") AFF.

.4 LED MR16 lamps:

.1 Lumacell MQM-x-12V4W-LD10 series.

.2 Equal by Emergi-Lite.

.3 Equal by Stanpro.

.4 Equal by Beluce (formerly Beghelli).

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections are acceptable for emergency lighting installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Owner.

.2 Inform Owner of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Owner.

3.2 INSTALLATION

.1 Install emergency lighting in compliance with local inspection authorities.

.2 Wiring:

.1 Connect battery input to source panelboard. Balance the emergency lighting loads connected to battery output terminal blocks. Provide and connect remote fixtures and internally illuminated exit signs as specified and as required for system performance in compliance with OBC minimum egress illumination requirements. Install remotes in locations as shown on the drawings. Connect all remotes to normally "Off" output from battery units.

.2 Contractor is responsible for revisions to system, including relocations, aiming and additional remote heads as determined by testing results. All wiring shall be in accordance with manufacturer's recommendations.

.3 Use minimum #10 gauge or heavier if needed to provide a maximum voltage drop of 5 per cent. Consult manufacturer's table for sizing the minimum gage and length of wire runs permitted for connected loads to ensure a maximum voltage drop of 5 per cent from the battery unit to the farthest emergency remote, in accordance with OBC and local inspection authorities.

.3 Mounting: Suitable for wall mounting, complete with bracket from manufacturer lighting heads, test switch and diagnostic LED indicator shall be visible.

.4 Provide Voltage Sensing Relays internal or external to battery units to meet the intent of OESC Rule 46-304 (4). Unit equipment shall be installed in such a manner that it will be automatically actuated upon failure of the power supply to the normal lighting in the area covered by that unit equipment.

3.3 TESTING AND COMMISSIONING

.1 When installation of emergency lighting equipment is complete, contractor shall commission and test the entire system and adjust if necessary.

.2 Contractor is responsible for arranging and cost of a verification test of emergency illumination levels by the manufacturer’s representative.

.1 Verification test shall be performed with a lux/footcandle meter at 1 m intervals along all paths of egress throughout the space, and record light level readings on floor plans provided by the consultant.

.2 The contractor shall also provide consultant with a letter stating the recorded emergency lighting levels meet the OBC requirements of 10 lx (1 fc) average with minimum readings not less than 1 lx (0.1 fc) on the path of egress.

.3 The manufacturer is to provide a letter of verification confirming testing and operation of all emergency lighting as well as installation to all applicable codes.

.3 Contractor is to indicate in the letter the duration of emergency lighting run time that was observed.

.4 Testing shall be performed during non-daylight hours. Contractor shall aim all remotes to optimise illumination on the floor and stair.

.5 Contractor shall certify in writing to the Consultant that the system is complete, installed per CSA C22.2 No. 141, has been tested, and operates for the specified battery run time.

.6 Contractor shall notify the Owner and the Consultant at least ten days prior to proposed testing date and schedule testing at time and date acceptable to the Owner.

.7 Installation shall be in accordance with the electrical code and manufacturer’s instructions.

.8 The Contractor is to submit a letter on Contractor's letterhead confirming the criteria specified above is met, including light levels, and run time, and include a copy of the plans with light levels recorded.

.9 Provide breaker lock on emergency lighting circuit at source panelboard.

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by emergency lighting installation.

3.5 TESTING, MAINTENANCE, AND WARRANTY SERVICE

.1 Provide complete instructions for the operation and care of the emergency power supply or unit equipment that shall specify testing at least once every month to ensure security of operation. Instructions to be framed under glass.

.2 OBC testing obligations: Owner's facility maintenance personnel are required to document one manual test of the battery units each month, and conduct one full discharge test once a year per OBC and CSA C22.2 No. 141 requirements.

.3 Annual Maintenance: The manufacturer recommends maintenance to be performed by a qualified service provider. Contact the manufacturer for any warranty service.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Internally illuminated “Running Man” exit sign units for ordinary location use.

1.2 RELATED REQUIREMENTS

.1 Section 26 52 13.13 – Emergency Lighting: Emergency Battery Units.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International):

.1 CSA C22.1:21, Canadian Electrical Code, Part 1 (25th Edition), Safety Standard for Electrical Installations.

.2 Ontario Electrical Safety Code (28th edition/2021).

.3 CSA C22.2 No. 141-15 (R2020), Emergency lighting equipment.

.4 CAN/CSA-C860-11 (R2020), Performance of Internally Lighted Exit Signs.

.2 International Organization for Standardization (ISO):

.1 ISO 7010:2011 – Graphical symbols – Safety colours and safety signs.

.2 ISO 3864-1:2011 – Graphical symbols -- Safety colours and safety signs -- Part 1: Design principles for safety signs and safety markings

.3 Ontario Building Code.

.4 Underwriters Laboratories of Canada (ULC):

.1 ULC/ORD-924-02, Standard for Emergency Lighting and Power Equipment.

.2 CAN/ULC-S572, First Edition Standard for Photoluminescent and Self-Luminous Exit Signs and Path Marking Systems.

1.4 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data: Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish, and limitations.

.3 Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, cleaning procedures and maintenance.

1.5 EXTRA STOCK MATERIALS

.1 Allow the cost for material and for installation of an additional five exit signs, single face or dual face, to be installed as directed by the Consultant during construction. Include 15.24 m (50 feet) of wire and conduit for AC and for DC circuits per exit sign.

1.6 QUALITY ASSURANCE

.1 Products ULC Listed and/or CSA Certified to CSA C22.2 No. 141 and CSA C860.

.2 Furnished products are listed and/or certified by third party agencies as suitable for the intended purpose.

.3 Manufacturer Qualifications: Products shall be free of defects in material and workmanship.

.4 All units will be certified that they have been tested prior to shipping.

1.7 DELIVERY, STORAGE, AND HANDLING

.1 In accordance with Section 01 61 00.

1.8 WARRANTY

.1 Product is warranted free of defects in material and workmanship for a minimum of one year from substantial completion.

PART 2 - PRODUCTS

2.1 EXIT SIGNS, GENERAL

.1 Manufacturers

.1 Aimlite.

.2 BeLuce (formerly Beghelli).

.3 Emergi-Lite.

.4 Lithonia (Acuity Brands Lighting).

.5 Lumacell.

.6 Stanpro.

.7 Other manufacturers as indicated in Section 26 52 13.13.

.2 Substitution Limitations:

.1 Manufacturer of exit signs to be the same as manufacturer of emergency lighting battery units and remote heads specified in Section 26 52 13.13.

.2 No manufacturer substitutions.

.3 Description:

.1 Green and White LED Pictogram “Running Man” exit sign.

.2 The pictogram sign shall be certified as CSA 22.2 No. 141, and meet ISO 3864-1 and ISO 7010.

.3 The pictogram legend shall have a minimum illuminated dimension of 5.9" high and 11.13" with ISO 3864-1 and ISO 7010 pictogram printed on a pure-acrylic panel.

.4 The sign shall include a standard single face with optional double-faceplate included.

.5 Not acceptable:

.1 Red LED EXIT signs.

.2 Externally illuminated photoluminescent, or non-electrical radioluminescent type of pictogram signs are unacceptable.

.4 Mounting

.1 Universal canopy to allow for wall, end, or ceiling mount.

.5 Electrical

.1 The LED light source shall be long-life white Light-Emitting Diodes and shall provide uniform illumination of the pictogram in normal and emergency operation.

.2 The sign shall operate with universal 2-wire AC input voltage of 120 to 347 Vac at less than 3 Watts, and universal 2-wire DC input voltage from 6 to 24 Vdc at less than 2.5 Watts for single and double face legends with a single arrow either left or right.

.3 If arrow left and arrow right is required for T intersection, the contractor shall supply and install two separate pictogram signs.

.4 The pictogram edge-lit exit sign where indicated on the plans in a self-powered configuration shall use a sealed Nickel-Cadmium battery of 2.4 V nominal voltage and shall stay illuminated during emergency operation for at least two hours upon AC failure.

2.2 ALL-PLASTIC PICTOGRAM EXIT SIGN, COMMERCIAL GRADE

.1 Manufacturers

.1 Lumacell LP Series

.2 Equivalent products from manufacturers as described in Article 2.01 of this section.

.2 Materials

.1 The sign shall come standard with a canopy and shall be suitable for wall, end, or ceiling mounting. The frame, faceplates, back plate and canopy shall each be constructed of a one-piece UV-stabilized thermoplastic material colored factory white.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install exit lights to manufacturer's recommendations, listing requirements, CSA standard and local regulatory requirements.

.2 Ensure exit signs are not obscured. Where an exit sign is to be installed in an area with no ceiling, provide a suitable pendant mount.

.3 Connect fixtures to exit light circuits normal power supply and emergency battery units specified in Section 26 52 13.13.

.4 Ensure that emergency lighting circuit breaker is locked in ON position.

.5 If arrow left and arrow right is required for T intersection, the contractor shall supply & install two separate pictogram signs.

3.2 FIELD TESTS AND INSPECTIONS

.1 When installation of emergency lighting equipment is complete, contractor shall commission and test the entire system and adjust if necessary.

.2 Certify in writing to the consultant that the system is complete, installed per CSA C22.2 No. 141, has been tested, and operates for the specified battery run time.

.3 Notify owner and consultant at least ten days prior to proposed testing date and schedule testing at time and date acceptable to the owner.

.4 Installation shall be in accordance to the electrical code and manufacturer’s instructions.

.5 Provide breaker lock on emergency lighting circuit at source panelboard.

3.3 CLEANING

.1 Proceed in accordance with Section 01 74 00.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

.3 Waste Management

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 00.

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by exit sign installation.

END OF SECTION

Added through ADD#15

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Materials and installation for steel lighting poles.

.2 Architectural concrete bases.

1.2 RELATED REQUIREMENTS

.1 Section 03 30 00 – Cast-in-Place Concrete.

.2 Section 26 27 26 – Wiring Devices: receptacles at pole bases.

.3 Section 26 56 19 – LED Exterior Lighting.

.4 Section 28 20 00 – Video Surveillance: CCTV camera brackets.

.5 Section 31 23 00 – Excavation and Fill.

1.3 REFERENCES

.1 CSA Group:

.1 CSA C22.2 No. 206-17, Lighting poles.

1.4 COORDINATION

.1 Ensure shop drawings are submitted promptly to ensure adequate time for the Consultant's review and to permit timely release of anchor bolts.

.2 Coordinate the installation of all light poles with the work of other trades. This includes but is not limited to placement of poles in conjunction with civil work such as sidewalks, roadways, parking lots, landscaping and building exteriors.

1.5 SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00.

.2 Product Data: For each pole, accessory, luminaire-supporting and lowering device, arranged as indicated on the plans and as required.

.1 Include data on construction details, profiles, effective projected area (EPA), cable entrances, materials, dimensions, weight, rated design load, and ultimate strength of individual components.

.2 Include finishes for lighting poles and luminaire-supporting devices.

.3 Anchor bolts.

.4 Manufactured pole foundations.

.5 Manufacturer cut sheets indicating pole catalog number selections with highlighted selections. Include pole designations that match the project designations if applicable.

.6 All distinct poles required on the project shall be submitted in one single submittal so all poles can be reviewed at one time.

.3 Shop Drawings:

.1 Anchor-bolt templates keyed to specific poles and certified by manufacturer.

.2 Include plans, elevations, sections, and mounting and attachment details.

.3 Include details of equipment assemblies, indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

.4 Detail fabrication and assembly of poles and pole accessories.

.5 Foundation construction details, including material descriptions, dimensions, anchor bolts, support devices, and calculations, signed and sealed by a professional engineer licensed in the jurisdiction of the project site.

.6 Method and procedure of pole installation. Include manufacturer's written installation instructions.

.4 Delegated Design Submittals:

.1 Soil test report prepared by a Geotechnical Engineer licensed in the jurisdiction of the project site.

.2 Provide pole base details using the submitted poles and luminaires, sealed by a Structural Engineer licensed in the jurisdiction of the project site.

.3 Contractor is responsible for hiring geotechnical and structural engineers as part of base bid.

1.6 CLOSEOUT SUBMITTALS

.1 In accordance with Section 01 78 00.

.2 Include soil reports and sealed base details in O&M manual.

.3 Reviewed shop drawings.

.4 Warranty documentation.

1.7 DELIVERY, STORAGE, AND HANDLING

.1 Protect products from moisture and dust by storing them in a clean, dry location remote from areas involved in construction operations. Provide additional protection in accordance with manufacturer's instructions.

.2 Store poles on decay-resistant skids at least 305 mm (12 in) above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.

.3 Retain factory-applied pole wrappings on metal poles until immediately before pole installation. Handle poles with web fabric straps.

.4 Protect pole finishes prior and during install by applying a strippable, temporary protective covering as required.

1.8 WARRANTY

.1 Special Warranty: Manufacturer agrees to repair or replace components of pole(s) that fail in materials or workmanship; that corrode; or that fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation within a specified warranty period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs from special warranty period.

.1 Warranty Period: Five (5) years from date of Substantial Completion.

.2 Warranty Period for Corrosion Resistance: Five (5) years from date of Substantial Completion.

.3 Warranty Period for Colour Retention: Five (5) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 ARCHITECTURAL CONCRETE BASES

.1 Manufacturers:

.1 Manufacturer list:

.1 ArtFORMS International Inc. (basis of design).
Tel: 905 642-3225, Fax: 905-642-3227,
Email: ArtFORMS@ArtFORMSConcreteBases.com.

.2 Substitution limitations:

.1 Equivalent architectural precast concrete luminaire pole base by Utility Structures Inc.

.2 Provide bases in styles, sizes, and profiles indicated. Depth of bases to be in accordance with Structural Engineer's detail.

.3 Cast-in-place architectural concrete base (basis of design):

.1 Use single-use Concrete Forms.

.2 Provide cast-in-place architectural concrete bases for lighting poles, bollards, floodlights, flagpoles, signs, columns fence posts, and other applications as noted.

.3 Self-locking, vandal-resistant, wraparound aluminum colour accent band around finished bases, where indicated.

2.2 PAINTED GALVANIZED STEEL POLES

.1 Galvanized steel poles: to CSA C22.2 No. 206 designed for underground wiring and:

.1 Suitable for mounting on concrete anchor base.

.2 Monotube style, minimum 3.0 mm thick, straight or tapered, round or square as indicated.

.3 Access handhole 300 mm (12 inches) above pole base for wiring connections, with welded-on reinforcing frame and bolted-on cover.

.4 Galvanized anchor bolts complete with galvanized double nuts and galvanized washers, and plastic bolt covers.

.5 Two lugs: one for grounding and one for bonding.

.6 Two-piece aluminium base cover to suit pole.

.7 Manufacturer's standard flat pole cap.

.8 For poles noted with other services including CCTV cameras or other extra low voltage equipment, provide a conduit or suitable voltage divider in the pole.

.9 Effective Projected Area (EPA) rating to meet or exceed the requirement of luminaires, mounting brackets, etc.

.10 Finishes:

.1 Polyester powder coat finish.

.11 Manufacturer's nameplate indicating manufacturer's name, model number of pole, and date of manufacture with a permanent, stamped/printed or engraved label.

.2 Manufacturers:

.1 Aluminous Lighting Products.

.2 Dynapole.

.3 LSI Industries.

.4 Lumec.

.5 Polefab.

.6 Spina.

.7 Valmont West Coast Engineering.

2.3 POLE ACCESSORIES

.1

.2 Duplex Receptacle: Only where required of particular project scope, a 120 V, 15 A, specification grade receptacle in a weatherproof assembly complying with Section 26 27 26, ground-fault circuit-interrupter type.

.1 Surface mounted, a minimum of 300 mm (12 inches) above finished grade, or at the height indicated on the plans.

.2 Nonmetallic polycarbonate, weatherproof, while-in-use cover.

.3 With cord opening allowing for use while the cover is pad locked.

2.4 LUMINAIRE MOUNTING BRACKETS

.1 Mounting brackets for specified luminaires:

.1 Single, twin, and quad brackets as indicated.

2.5 LUMINAIRES

.1 In accordance with Section 26 56 19.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

.2 Examine poles, luminaire-mounting devices, lowering devices, and pole accessories before installation. Components that are scratched, dented, marred, wet, moisture damaged, or visibly damaged are considered defective.

.3 Examine roughing-in for foundation and conduit to verify actual locations of installation.

.4 Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 BASE INSTALLATION

.1 Install specified below-grade fiber form, reinforcing steel, ducts, etc. to required grade.

.2 Place form on top of empty fiber form. Position vertical seams in desired direction.

.3 Pour specified concrete through open top of form into fiber form below. Avoid contact with inside surface. Bring concrete to top of formwork.

.4 Mechanically vibrate concrete with small vibrator, and vigorously hand tap outside surface of formwork.

.5 Place and centre anchor bolt assembly (or post, etc.) into concrete. Trowel-finish top surface of concrete.

.6 Reinforce bases with vertical steel reinforcing rods and horizontal steel reinforcing ties as noted on the drawings.

.7 Coordinate installation of conduit at bases for lighting poles, bollards, floodlights, and signs.

.8 Cast and cure bases in accordance with requirements of Section 03 30 00.

.9 Install self-locking, vandal-resistant, wraparound aluminum colour accent band around finished bases, where indicated.

.10 Base Stripping:

.1 Strip concrete form within 24 hours of pouring of base.

.2 Cut steel bands. Strip form in two halves. Pry open at the two vertical seams with flat-bladed hand-tool e.g. ice-scraper or square-nose shovel. Insert blade and separate form at top, middle, and bottom of first seam. Repeat for second seam.

.3 Wire brush any traces of form material remaining on finished concrete base.

.4 Use rubbing stone to make smooth any rough concrete edges around top of base and along vertical seams.

.5 If there is risk of damage by construction equipment to exposed base, protect base by tie-wiring or duct taping the two formwork halves back in place around base until safe to remove protection.

.6 Install colour accent band(s), where applicable, in horizontal reveal(s) around finished base.

3.3 POLE INSTALLATION

.1 Alignment: Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on the pole.

.2 Raise and set poles using web fabric slings (not chain or cable) at locations indicated by manufacturer.

.3 Install poles true and plumb, complete with brackets in accordance with manufacturer's instructions.

.4 Mount standards on bases plumb and true utilizing shims as required and then securely anchor standards to anchor bolts. Touch up all chips and scratches on poles upon completion.

.5 Provide label on each pole to allow for individual identification of each pole, minimum 125 mm (5 inch) text height of contrasting colour to that of pole finish, installed at approximately 3048 mm (10 feet) above finished grade.

.6 Install luminaires on pole.

.7 Check luminaire orientation, level, and tilt.

.8 Connect luminaires to lighting circuits.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Pole mounted, wall mounted, and canopy mounted solid state, light emitting diode (LED) source exterior luminaires.

1.2 RELATED REQUIREMENTS

.1 Division 04 – Masonry: brick grinding requirements for wall mounted luminaires.

.2 Section 26 09 23 – Lighting Control Devices: photocells, astronomical timers.

.3 Section 26 09 26 – Lighting Control Panelboards.

.4 Section 26 09 43.19 – Wireless Network Lighting Controls.

.5 Section 26 56 13 – Lighting Poles and Standards.

1.3 REFERENCES

.1 CSA Group:

.1 CSA C22.1:21, Canadian Electrical Code, Part 1 (25th Edition), Safety Standard for Electrical Installations.

.2 Ontario Electrical Safety Code (28th edition/2021).

.3 CSA C22.2 No. 9.0 – General Requirements for Luminaires.

.4 CSA C22.2 No. 250.0 – Luminaires (Bi-National Standard, with UL 1598).

.5 CAN/CSA-C22.2 No. 250.13 – Light Emitting Diode (LED) equipment for lighting applications.

.2 DesignLights Consortium (DLC):

.1 Solid-State Lighting Technical Requirements v5.1, or latest edition.

.2 Where the specifications do not explicitly call for DLC qualified LED luminaires, the technical criteria provided in the DLC Technical Requirements provide the basis of the requirements for this section of the Specification.

.3 Illuminating Engineering Society (IES):

.1 IES HB-10-11 – The Lighting Handbook, 10th Edition.

.2 IES LM-79-08 – Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products.

.3 IES LM-80-08 – IES Approved Method for Measuring Lumen Maintenance of LED Light Sources.

.4 IES TM-21-11 – IES Technical Memorandum on Projecting Long Term Lumen Maintenance of LED Light Sources.

.4 National Electrical Manufacturer's Association (NEMA):

.1 SSL-1-10 – Electronic Drivers for LED Devices, Arrays, or Systems.

.2 WD 6 - Wiring Devices - Dimensional Requirements.

.5 Underwriters Laboratories Inc. (UL):

.1 ANSI/UL 1449, (4th Edition), Standard for Safety, Surge Protective Devices.

1.4 ACTION SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00.

.2 Manufacturer reports: Provide a point-by-point photometric analysis of the site, in accordance with the procedures laid out in IES RP-8-18, for review by the Consultant. Include point-by-point calculation zones along the property line. The designer shall lay out a grid of points on the pavement at a maximum spacing of one-third the light fixture mounting height, commencing within one-half the grid spacing from the perimeter boundary.

.3 Product specification sheets or other documentation that includes the designed parameters as detailed in this specification. These parameters include (but are not limited to):

.1 Luminaire cut sheets.

.1 Highlight all parameters of the complete luminaire part number, including lumen package, correlated colour temperature, IES distribution type, and driver information.

.2 Highlight the input watts of the luminaire and the B-U-G rating.

.3 Cut sheet to document L70 lumen maintenance data, in hours, when extrapolated for the worse case operating temperature.

.4 Lighting Manufacturer's photometric analysis when requested by the Consultant during submittal review.

1.5 INFORMATIONAL SUBMITTALS

.1 Instructions for installation and maintenance.

1.6 CLOSEOUT SUBMITTALS

.1 Section 01 78 00: Submittals for project closeout.

.2 The Contractor shall be responsible for obtaining from the supplying lighting manufacturers, for each luminaire, a recommended maintenance manual including:

.1 Vendor and local representative's contact information.

.2 Tools required.

.3 Maintenance instructions.

.4 Types of cleaners to be used.

.5 Replacement parts identification lists.

.6 Equipment product data (high-quality reproducible copies).

.3 Complete warranty information including manufacturer's warranty conditions, including driver, luminaire, and accessories.

.4 Light level measurements demonstrating the installation is consistent with the photometric analysis.

1.7 QUALITY ASSURANCE

.1 Luminaires tested to IES LM-79.

.2 Design Qualification Testing performed by a National Voluntary Laboratory Accreditation Program (NVLAP) testing facility. Such testing may be performed by the manufacturer, or an independent testing lab hired by the manufacturer on new luminaire designs, and when a major design change has been implemented on an existing design. A major design change is defined as a design change (electrical or physical) which changes any of the performance characteristics of the luminaire,

results in a different circuit configuration for the power supply, or changes the layout of the individual LED's in the module.

.3 Products certified by a recognized testing agency accredited by the Standards Council of Canada, and bearing a certification mark from that agency. Certification shall include wet location rating.

1.8 WARRANTY

.1 Manufacturer Warranty against loss of performance and defects in materials and workmanship for the luminaires for a period of 5 years after acceptance of the luminaires. Warranty to cover all components comprising the luminaire.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 As noted on Lighting Fixture Schedule.

2.2 OUTDOOR LED LUMINAIRES, GENERAL

.1 Maximum nominal luminaire input wattage as specified for each luminaire type as indicated on the Luminaire schedule.

.2 Luminaires designed for ease of component replacement and end-of-life disassembly.

.3 Input Voltage:

.1 As indicated on Luminaire schedule.

.2 Driver to be compatible with system voltage without use of a step-down transformer. If the manufacturer’s standard product offering cannot achieve this, clearly indicate on the shop drawings and clearly indicate location of transformer.

.4 Surge Protection

.1 UL 1449 recognized surge protective device that is wired in front of the driver(s) and protects the luminaire to a minimum Category C Low (per ANSI/IEEE C62.41.2).

.5 Power Factor and Total Harmonic Distortion

.1 Power factor of greater than or equal to 0.9.

.2 THD of less than or equal to 20 per cent.

.6 0-10 V dimming, or as indicated on drawings.

.7 Driver rated for minimum 50 000 hours.

.8 Gasket: neoprene seal between refractor and housing.

.9 Light Distributions:

.1 Fixtures available with IES distribution types I, II, III, IV, V, and other distributions, as noted.

.2 Pole mounted luminaire shall have an available option for low-profile house-side shield.

.10 Self-locking latches of stainless steel and aluminum.

.11 Factory wired including integral driver, terminated at terminal block.

.12 Luminaires with cast aluminum weatherproof housing.

.13 Ingress protection: sealed against moisture and environmental contaminants to IP65 rating or better for both light engines/optics and overall luminaire.

.14 Finishes

.1 Housing and heat sink finished in polyester powder coat paint, minimum 2.5 mil nominal thickness.

.2 Standard finish colours to include black, bronze, grey, white, dark platinum, and graphite metallic.

.3 RAL and custom colour matches to be available as indicated on the luminaire schedule.

2.3 OUTDOOR POLE/ARM MOUNTED AREA AND ROADWAY LED LUMINAIRES

.1 Pole mounted luminaires suitable for the EPA rating of the pole.

.2 Pole finish colour to match that of luminaire.

.3 Source: Light Emitting Diode (LED).

.1 Zonal Lumen Density:

.1 100 per cent between 0 degrees and 90 degrees from nadir.

.2 Less than or equal to 10 per cent between 80 degrees and 90 degrees from nadir.

.2 Minimum luminaire efficacy: 105 lumens per watt.

.3 Correlated Colour Temperature (CCT): 3000 K.

.4 Colour Rendition Index (CRI): 70 CRI minimum.

.5 Minimum L70 lumen maintenance to occur at 50 000 hours in accordance with LM-80 testing data and TM-21 extrapolation. LM-80 testing is to utilize 10 000 hour testing data.

2.4 OUTDOOR WALL MOUNTED AREA LED LUMINAIRES

.1 Source: Light Emitting Diode (LED).

.1 Zonal Lumen Density:

.1 100 per cent between 0 degrees and 90 degrees from nadir.

.2 Less than or equal to 10 per cent between 80 degrees and 90 degrees from nadir.

.2 Minimum luminaire efficacy: 105 lumens per watt.

.3 Correlated Colour Temperature (CCT): 3000 K.

.4 Colour Rendition Index (CRI): 70 CRI minimum.

.5 Minimum L70 lumen maintenance to occur at 50 000 hours in accordance with LM-80 testing data and TM-21 extrapolation. LM-80 testing is to utilize 10 000 hour testing data.

2.5 FIXTURE MOUNTED CONTROLS PROVISION

.1 Provide NEMA 7-pin receptacle on all pole mounted luminaires, complete with shorting cap.

.1 Shorting Cap, Locking-Type Mounting: 3-prong locking-type plug connector. It is used with luminaries with a photocontrol receptacle to complete circuit when a photocontrol is not required.

.2 Basis of design: Intermatic K4500 series.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install lighting equipment, including but not limited to luminaires, controls, auxiliary devices and the integration of same in strict conformance with all manufacturers' recommendations and instructions the securing of which shall be the responsibility of the Contractor.

.2 Luminaires shall be integrated with controls in accordance with respective luminaire manufacturers' and controls manufacturers' recommendations and instructions and to provide a complete, trouble-free operation without compromising safety, code, and UL/CSA/NOM requirements.

.3 Contractor shall be responsible for sealing all outdoor luminaires for wet locations (i.e. all knock-outs, all pipe and wire entrances, etc.) as is standard industry practice to prevent water from entering luminaires.

.4 All luminaires shall be installed plumb and true and level as viewed from all directions unless specifically identified otherwise in the Luminaire Schedule. Luminaires shall remain plumb and true without continual adjustment or visibly obvious means beyond what is shown on luminaire submittal drawings.

.5 Luminaire finishes which are disturbed in any way during construction shall be touched up or refinished in a manner satisfactory to the Consultant.

.6 Whenever a luminaire or its hanger canopy is installed directly to a surface mounted junction box, a finishing ring painted to match the ceiling, shall be used to conceal the junction box.

.7 All accessories shall be properly installed and adjusted by Contractor in accordance with specification and installation instructions. Any spare items shall be clearly labeled (indicate type of accessory and associated luminaire types).

.8 Install luminaires on poles in accordance with Section 26 56 13.

.9 For wall mounted luminaires:

.1 Provide a smooth grinding of brick, including type such as split face, to ensure a flush contact between luminaire and wall in accordance with Division 04 requirements.

.2 Provide a silicone seal around the luminaire.

.10 Connect luminaire to lighting circuit.

3.2 SITE TESTS AND INSPECTIONS

.1 Perform lighting system commissioning in accordance with Section 26 08 50.

.2 Perform light meter testing at night and report values to the Consultant.

3.3 ADJUSTING

.1 As required, all adjustable luminaires shall be aimed, focused, locked, etc., by the Contractor under the observation of the Consultant. As aiming and adjusting is completed, locking setscrews and bolts and nuts shall be tightened securely by the Contractor.

.2 All ladders, scaffolds, lifts, etc. required for aiming and adjusting luminaires shall be furnished by the Contractor.

.3 Where possible, units shall be focused during the normal working day. However, where daylight interferes with seeing lighting effects, aiming shall be accomplished at night.

3.4 CLEANING

.1 All luminaires and accessories shall be thoroughly cleaned after being installed. All fingerprints, dirt, tar, smudges, drywall mud and dust, etc. shall be removed by the Contractor from the luminaire bodies, reflectors, trims, and lens or louvers prior to final acceptance. All reflectors shall be free of paint other than factory-applied, if any. All reflectors, cones and lenses shall be cleaned only according to manufacturers' instructions.

END OF SECTION

SEE ADD#4
Q#69

PART 1 - GENERAL

1.1 SUMMARY

.1 Provide a complete system of empty conduit, pull boxes, outlets, and sleeves for enclosure of communications cabling.

1.2 RELATED REQUIREMENTS

.1 Section 26 05 33.13 – Conduit for Electrical Systems.

.2 Section 26 05 33.16 – Boxes for Electrical Systems.

1.3 REFERENCES

.1 BISCI Telecommunications Distribution Methods Manual, 14th Edition.

1.4 CLOSEOUT SUBMITTALS

.1 Record documentation:

.1 Records of underground utility locates.

.2 Record as-constructed location of all underground conduits and telecommunications pathways on as-built drawings regardless of conduit size.

PART 2 - PRODUCTS

2.1 OUTLETS

.1 Wall outlets shall be 115 mm square boxes with plaster rings to suit single gang devices unless otherwise noted.

.2 Provide 53 mm conduit through walls as noted.

2.2 CONDUITS

.1 Conduit size shall be in accordance with recommended standard for conduits in Building as published by BICSI.

.2 Minimum conduit size shall be 21 mm diameter.

.3 Minimum space requirements in pull boxes for 90 degree pulls, shall be as follows:

Maximum conduit size	Size of pull boxes in millimetres			For each additional conduit size increase width by:
	Width	Length	Depth	
21 mm	150 mm	300 mm	100 mm	50 mm
27 mm	200 mm	400 mm	150 mm	75 mm
35 mm	250 mm	450 mm	200 mm	75 mm
41 mm	300 mm	600 mm	250 mm	100 mm
53 mm	350 mm	750 mm	300 mm	125 mm

.4 Plenum cables are permitted in accessible ceilings. Provide 'J' hooks in these locations [for later cable installation by others].

.5 Plywood backboards shall be minimum 1200 mm by 2400 mm, 19 mm thick, painted with 2 coats of fire retardant light grey enamel.

.6 Provide a minimum of two 5-15R duplex receptacles on separate circuits at each backboard.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Vertically mount outlet boxes, unless noted otherwise, 300 mm to centre above floor, or 150 mm above counter top where shown at counters or benches.

.2 Fish conduit, clear blockages and outlet and clean out pull boxes at completion of installation. Leave conduit free of water or excess moisture. Install No. 12 gauge galvanized soft iron pull wire, or 3.2 mm (1/8") nylon pull cord continuously from outlet to outlet, through conduit and fasten at each box.

.3 Conduit shall have a bending radius of not less than nine times conduit diameter. Ream out conduit and identify ends with green paint.

.4 Install additional steel pull boxes in such a manner that, throughout entire system, there shall be not more than two 90 degree or equivalent bends or more than 30 m in each run, so that wire or cables may be pulled in or withdrawn with reasonable ease. Minimum space requirements in pull boxes having one conduit each in opposite ends of the box, shall be as follows:

Maximum conduit size	Size of pull boxes in millimetres			For each additional conduit size increase width by:
	Width	Length	Depth	
21 mm	150 mm	300 mm	100 mm	50 mm
27 mm	200 mm	400 mm	150 mm	75 mm
35 mm	250 mm	450 mm	200 mm	75 mm
41 mm	300 mm	600 mm	250 mm	100 mm
53 mm	350 mm	750 mm	300 mm	125 mm

.5 Show as-installed conduit routing and location of all pull boxes on the record drawings, prior to project completion, for use by future installer to facilitate wiring and equipment installation. Include above noted information on final record drawings at project completion.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Flexible textile raceway, innerduct, or conduit.

.2 To allow for future communication upgrades, including transitioning from multi-pair copper cables to optical fiber media, a specific number of conduits shall be dedicated for that purpose. And to further that effort and achieve maximum conduit utilization, those conduits shall contain innerduct.

1.2 REFERENCES

.1 Innerduct definition per the American National Standards Institute (ANSI).

1.3 SUBMITTALS

.1 Product Data - Provide standard details and installation instructions.

PART 2 - PRODUCTS

2.1 GENERAL

.1 Materials and Equipment: Labeled and/or listed as acceptable to the authority having jurisdiction as suitable for the intended use.

.2 Flexible optical fiber/communication raceway.

.3 Provide wire management in a building for fiber optic and data and communications cabling.

.4 A non-metallic raceway, usually circular, placed within a larger raceway. (Sub duct).

2.2 MANUFACTURERS

.1 MaxCell Group/TVC Communications
600 Plum Creek Dr., Wadsworth, OH. 44281, Tel: 1-888-387-3828.

.2 Approved equal.

2.3 MATERIALS

.1 White Polyester and Nylon resin polymer.

2.4 TEXTILE INNERDUCT

.1 Standard Outdoor Textile Innerduct: Micro (33 mm), 2 inch, 3 inch, and 4 inch single or multi-cell polyester/nylon textile innerduct containing 1250 lb polyester flat woven pull tape.

.2 Detectable Outdoor Textile Innerduct: Micro (33mm), 2 inch, 3 inch, and 4 inch single or multi-cell polyester/nylon textile innerduct containing 1250 lb polyester flat woven pull tape, and a solid copper, polyvinyl color coated conductor (19 AWG minimum) for tracing and rated for a minimum of 6 amps and 600 volts. Conductor shall be placed in the sidewall edge fold of the textile sleeve.

.3 Indoor Textile Innerduct (Riser-listed): Micro (33 mm), 2-inch, 3-inch and 4-inch single or multi-cell nylon textile innerduct containing 1250 lb polyester flat woven pull tape which meets UL2024A for flame propagation and smoke density values for general applications.

.4 Plenum-Listed Textile Innerduct: Micro (33 mm), 2-inch and 3-inch single or multi-cell nylon textile innerduct containing 200 lb nylon-resin flat woven pull tape which meets UL2024A for flame propagation and smoke density values for use in air handling spaces.

2.5 TEXTILE INNERDUCT FITTINGS

.1 Conduit Plugs: Compression-type conduit plugs with locking nuts for sealing and securing one or more textile innerducts within a 4-inch inside diameter conduit, e.g. a. 4 inch plug with nine holes for cables in a 3 pack (9-cell) configuration.

.2 Termination Bags: Inflation-type bags for sealing and securing around one or more textile innerducts and cables within 2-inch outside diameter or larger conduit.

2.6 PULL TAPE

.1 Pull Tape: measuring and pulling tape constructed of synthetic fiber, printed with accurate sequential footage marks. Color-coded.

2.7 PENETRATION SEALING MATERIALS

.1 Duct Water Seal: products suitable for closing underground and entrance conduit openings where innerduct or cable is installed, to prevent entry of gases, liquids, or rodents into the structure.

PART 3 - EXECUTION

3.1 PROTECTION DURING CONSTRUCTION

.1 Protect products from the effects of moisture, UV exposure, corrosion and physical damage during construction.

3.2 TEXTILE INNERDUCT TYPE TO BE USED

.1 Aboveground, Exterior and Interior Conduit Installations: Outdoor textile innerduct (Standard or Detectable as desired).

.2 Interior Exposed Locations

.1 Non-plenum Areas: Indoor textile innerduct.

.2 Plenum Areas: Plenum-listed indoor innerduct.

.3 When installed in 4 in conduit, use two 3 in 3-Cell packs with an additional pull tape on the outside for future pulls in each conduit.

.4 Cable Tray: use standard outdoor or indoor textile innerduct.

3.3 TEXTILE INNERDUCT INSTALLATION

.1 Provide textile innerduct in conduit and wire ways, and place textile innerduct within and under cable trays using continuous unspliced lengths of textile innerduct between maintenance holes, pull boxes, and/or termination points as indicated on the drawings.

.2 Make a 2 in incision, approximately 18 in from the end of textile innerduct. Pull out and cut off approximately 2 feet of pull-tape. Thus allowing the pull tape ends to retract back into the cells.

.3 Using approximately 6 feet of pull tape, tie a non-slip knot to the incision. Then tie 3 to 6 half-hitch knots down to the end of textile innerduct. Apply black vinyl tape over all knots and the end of textile

innerduct. Using a Bow Line knot tie a swivel to the end of 3 feet pull tape. For multi-pack installations one swivel is sufficient, but stagger each textile innerduct.

.4 Using a Bow Line knot, attach the pull rope located in the rigid conduit to the other end of the swivel. Install textile innerduct – ensuring that no twist is introduced to the innerduct.

.5 Provide suitable textile innerduct slack in the maintenance holes, hand holes, pull boxes, and at turns to ensure there is no kinking or binding of the product.

.6 Textile Innerduct Mountings, Hangers and Attachments: When exposed indoors or in maintenance holes, hold firmly in place using independent support.

.1 Design and install hangers and other similar fittings adequate to support loads and so as to not damage innerduct.

.2 Do not fasten textile innerduct to steam, water, or other piping, ductwork, mechanical equipment, electrical equipment, electrical raceways, or wires.

.3 When appropriate, use the following cable ties to secure textile innerduct through previously created incisions:

.1 Plenum areas: plenum-rated plastic or stainless steel.

.2 Non plenum areas: Conventional flame-retardant nylon ties.

.3 Underground locations: Conventional plastic cable ties.

.7 Maintenance Hole and Hand Hole Installation:

.1 At locations where textile innerduct will be continuous through a manhole or hand hole, allow sufficient slack so that the innerduct may be secured to the side of the vault maintaining the minimum bend radius.

.2 At maintenance holes serving as the junction location, pull the exposed end of the innerduct to the far end of the vault, install termination bag, and secure to the vault.

.8 Cable Tray and Runway Installation: Cut incisions every 24 inches into the edge of the textile innerduct and cable wrap to one side of vertical ladder rack or horizontal ladder-type cable tray at each incision.

3.4 PENETRATIONS

.1 Seal all conduit and textile innerduct entering structures at the first box or outlet to prevent entrance into the structure of gases, liquids, or rodents.

.2 Inspect fire stopping installation by others between building structure and conduit, wire way, and cable tray to verify integrity of installation.

.3 Exposed Textile Innerduct Penetrations: Install conduit sleeves or fire barrier sealing systems in all openings where open and exposed textile innerduct passes through fire-rated walls and floors. After installation, install intumescent fire barrier penetration sealing material (Hilti system) between textile innerduct and sleeves or fire barrier system.

.4 Raceway Penetrations: After textile innerduct installation, install intumescent fire barrier penetration sealing material (Hilti system) between textile innerduct and conduit or wire way at all exposed penetration locations.

.5 Protect adjacent surfaces from damage during water seal or fire stop installation. Repair any damage.

.6 Document entire installation process for future referral.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

.1 Provide a complete system of empty conduits, terminal cabinets, plywood backboards, pull boxes and outlets for enclosure of wiring by Security Contractor under Cash Allowance.

1.2 RELATED REQUIREMENTS

.1 Section 26 05 33.13 – Conduit for Electrical Systems.

.2 Section 26 05 33.16 – Boxes for Electrical Systems.

PART 2 - PRODUCTS

2.1 OUTLETS

.1 Wall and door outlets shall be single boxes, or 115 mm square boxes with plaster rings to suit single gang devices unless otherwise noted. Coordinate with Security Contractor.

2.2 CONDUITS

.1 Provide conduit in all walls, exposed areas, and inaccessible ceilings. All conduit work shall be concealed.

.2 Minimum conduit size shall be 21 mm diameter.

.3 Provide J hooks in accessible ceilings for plenum rated wiring.

.4 Minimum space requirements in pull boxes for 90 degree pulls, shall be as follows:

Maximum conduit size	Size of pull boxes in millimetres			For each additional conduit size increase width by:
	Width	Length	Depth	
21 mm	150 mm	300 mm	100 mm	50 mm
27 mm	200 mm	400 mm	150 mm	75 mm
35 mm	250 mm	450 mm	200 mm	75 mm
41 mm	300 mm	600 mm	250 mm	100 mm
53 mm	350 mm	750 mm	300 mm	125 mm

.5 Plywood backboards shall be minimum 1200 x 2400 mm, 19 mm thick, painted with 2 coats of fire retardant light grey enamel.

.6 Provide a minimum of 2 duplex receptacles on separate circuits at each backboard.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Vertically mount outlet boxes, unless noted otherwise, 300 mm to centre above floor, or 150 mm above counter top where shown at counters or benches.

.2 Fish conduit, clear blockages and outlet and clean out pull boxes at completion of installation. Leave conduit free of water or excess moisture. Install No. 12 gauge galvanized soft iron pull wire, or 3.2 mm (1/8") nylon pull cord continuously from outlet to outlet, through conduit and fasten at each box.

.3 Conduit bonds shall have a bending radius of not less than nine times conduit diameter. Ream out conduit and identify ends with green paint.

.4 Install additional steel pull boxes in such a manner that, throughout entire system, there shall be not more than two 90 degree or equivalent bends or more than 30 m in each run, so that wire or cables may be pulled in or withdrawn with reasonable ease. Minimum space requirements in pull boxes having one conduit each in opposite ends of the box, shall be as follows:

Maximum conduit size	Size of pull boxes in millimetres			For each additional conduit size increase width by:
	Width	Length	Depth	
21 mm	150 mm	300 mm	100 mm	50 mm
27 mm	200 mm	400 mm	150 mm	75 mm
35 mm	250 mm	450 mm	200 mm	75 mm
41 mm	300 mm	600 mm	250 mm	100 mm
53 mm	350 mm	750 mm	300 mm	125 mm

.5 Show as-installed conduit routing and location of all pull boxes on the record drawings, prior to project completion, for use by Security installer to facilitate wiring and equipment installation. Include above noted information on final record drawings at project completion.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

.1 Provide a complete system of empty conduits, terminal cabinets, plywood backboards, pull boxes and outlet boxes for enclosure of cabling [by Owner] under a separate contract.

1.2 RELATED REQUIREMENTS

.1 Section 26 05 33.13 – Conduit for Electrical Systems.

.2 Section 26 05 33.16 – Boxes for Electrical Systems.

PART 2 - PRODUCTS

2.1 VIDEO SURVEILLANCE EQUIPMENT [BY OWNER]

.1 Video Surveillance equipment shall be based on IP cameras. Size conduits based on industry practices based on Category 6 communications cabling.

2.2 OUTLETS

.1 Wall and door outlets shall be single boxes, or 115 mm square boxes with plaster rings to suit single gang devices unless otherwise noted. Coordinate with Owner's video surveillance contractor.

2.3 CONDUITS

.1 Provide conduit in all walls, exposed areas, and inaccessible ceilings. All conduit work shall be concealed.

.2 Minimum conduit size shall be 21 mm diameter.

.3 Provide J hooks in accessible ceilings for plenum rated wiring.

.4 Minimum space requirements in pull boxes for 90 degree pulls, shall be as follows:

Maximum conduit size	Size of pull boxes in millimetres			For each additional conduit size increase width by:
	Width	Length	Depth	
21 mm	150 mm	300 mm	100 mm	50 mm
27 mm	200 mm	400 mm	150 mm	75 mm
35 mm	250 mm	450 mm	200 mm	75 mm
41 mm	300 mm	600 mm	250 mm	100 mm
53 mm	350 mm	750 mm	300 mm	125 mm

.5 Plywood backboards shall be minimum 1200 mm by 2400 mm, 19 mm thick, painted with 2 coats of fire retardant light grey enamel.

.6 Provide a minimum of two duplex receptacles on separate circuits at each backboard.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Vertically mount outlet boxes, unless noted otherwise, 300 mm to centre above floor, or 150 mm above counter top where shown at counters or benches.

.2 Fish conduit, clear blockages and outlet and clean out pull boxes at completion of installation. Leave conduit free of water or excess moisture. Install No. 12 gauge galvanized soft iron pull wire, or 3.2 mm (1/8") nylon pull cord continuously from outlet to outlet, through conduit and fasten at each box.

.3 Conduit bonds shall have a bending radius of not less than nine times conduit diameter. Ream out conduit and identify ends with green paint.

.4 Install additional steel pull boxes in such a manner that, throughout entire system, there shall be not more than two 90 degree or equivalent bends or more than 30 000 mm in each run, so that wire or cables may be pulled in or withdrawn with reasonable ease. Minimum space requirements in pull boxes having one conduit each in opposite ends of the box, shall be as follows:

Maximum conduit size	Size of pull boxes in millimetres			For each additional conduit size increase width by:
	Width	Length	Depth	
21 mm	150 mm	300 mm	100 mm	50 mm
27 mm	200 mm	400 mm	150 mm	75 mm
35 mm	250 mm	450 mm	200 mm	75 mm
41 mm	300 mm	600 mm	250 mm	100 mm
53 mm	350 mm	750 mm	300 mm	125 mm

.5 Show as-installed conduit routing and location of all pull boxes on the record drawings, prior to project completion, for use by Security installer to facilitate wiring and equipment installation. Include above noted information on final record drawings at project completion.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Cable trays, including ladder rack, wire mesh, optical fibre trough, and accessories.

1.2 RELATED REQUIREMENTS

.1 Section 26 05 26 – Grounding and Bonding for Electrical Systems.

.2 Section 26 05 29 – Hangers and Supports for Electrical Systems.

1.3 REFERENCES

.1 CSA C22.1:21, Canadian Electrical Code, Part 1 (25th Edition), Safety Standard for Electrical Installations.

.2 Ontario Electrical Safety Code (28th edition/2021).

.3 CSA C22.2 No. 126.1-17 (CSA/NEMA) - Metal Cable Tray Systems (Binational standard with NEMA VE 1-2017).

1.4 ACTION SUBMITTALS

.1 Product Data: Provide data for fittings and accessories.

.2 Shop Drawings: Indicate tray type, dimensions, support points, and finishes.

1.5 INFORMATIONAL SUBMITTALS

.1 Manufacturer's Instructions:

.1 Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements.

.2 Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.6 CLOSEOUT SUBMITTALS

.1 Project Record Documents: Record actual routing of cable tray and locations of supports.

1.7 REGULATORY REQUIREMENTS

.1 Products: Listed and classified by CSA (Canadian Standards Association as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.1 LADDER RACK-TYPE CABLE TRAY

.1 Description: CSA 22.2 No. 126.1, Class ladder type tray.

.2 Material: Aluminum.

.3 Inside width: As indicated.

.4 Inside depth: As indicated.

.5 Straight section rung spacing: 152 mm (6 in) on centre.

.6 Inside Radius of Fittings: As indicated.

.7 Unless otherwise noted, provide manufacturer's standard clamps, hangers, brackets, splice plates, reducer plates, blind ends, barrier strips, connectors, and grounding straps.

.8 Refer to drawings for details.

.9 Manufacturers:

.1 Hubbell Nextframe Ladder Rack.

.2 Canadian Electrical Raceways “Telecom Cable Rack”.

.3 Approved equal.

2.2 WIRE BASKET CABLE TRAY

.1 Description: CSA 22.2 No. 126.1, Class Basket type tray.

.2 Material: Carbon Steel, Hot Dipped Galvanized to ASTM A 123.

.3 Inside Width: As indicated.

.4 Inside Depth: As indicated.

.5 Straight Section Rung Spacing: refer to drawings.

.6 Inside Radius of Fittings: As indicated.

.7 Unless otherwise noted, provide manufacturer's standard clamps, hangers, brackets, splice plates, reducer plates, blind ends, barrier strips, connectors, and grounding straps.

.8 Refer to drawings for details.

.9 Rung spacing 152 mm (6 in).

.10 Radius for tees 305 mm (12 in) minimum. Exact size to be verified on site.

.11 Do not employ tray elbows. Use Tees to permit future extension of tray.

.12 Radius for the dropouts 125 mm (5 in) minimum. Exact size to be verified on site.

.13 Manufacturers:

.1 Cablofil.

.2 Canadian Electrical Raceways Inc.

.3 Hubbell.

.4 Thomas & Betts.

2.3 OPTICAL FIBRE ROUTING SYSTEM (FIBRE TRAY)

.1 The optical fiber routing system shall be used to route, segregate, and protect fiber optic communication cabling.

.2 ULC Listed (UL2024A)

.3 Size:

.1 100 mm x 100 mm (4 in x 4 in).

.2 As otherwise indicated on drawings.

.4 50 mm (2”) minimum bend radius through-out pathway.

.5 Impact resistant and flame-retardant material (UL94-V0 Flammability).

.6 Color: Black.

.7 Will include all mounting hardware, waterfalls, directional fittings, and other accessories required for installation.

.8 Manufacturers:

.1 Panduit Fiberrunner series.

.2 ADC FiberGuide series.

.3 Commscope SpeedPRO series.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Trays to be sized to 40 per cent maximum capacity.

.2 Install metallic cable tray to CSA C22.1 SB-02 and C22.2 No. 126.1.

.3 Install fibreglass cable tray to CSA C22.1 SB-02 and C22.2 No. 126.2.

.4 Support trays to Section 26 05 29. Provide supports at each connection point, at the end of each run, and at other points to maintain spacing between supports.

.5 Use expansion connectors where required.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Firestopping through penetrations in fire rated assemblies.

1.2 RELATED REQUIREMENTS

.1 Section 07 84 00 – Firestopping.

1.3 REFERENCES

.1 ASTM E 84, “Surface Burning Characteristics of Building Materials”.

.2 ASTM E 119, “Fire Tests of Building Construction and Materials”.

.3 ASTM E 814, “Fire Tests of Penetration Firestop Systems”.

.4 ANSI/UL263, “Fire Tests of Building Construction and Materials”.

.5 ANSI/UL723, “Surface Burning Characteristics of Building Materials”.

.6 ANSI/UL1479, “Fire Tests of Through Penetration Firestops”.

.7 Underwriters Laboratories Inc. (UL) – Fire Resistance Directory

1.4 PERFORMANCE REQUIREMENTS

.1 Fire rated pathway devices shall be the preferred product and shall be installed in all locations where frequent cable moves, add-ons and changes will occur, such devices shall:

.1 Meet the hourly rating of the floor or wall penetrated.

.2 Permit the allowable cable load to range from 0% to 100% visual fill thereby eliminating the need to calculate allowable fill ratios.

.3 Not require any additional action on the part of the installer to open or close the pathway device or activate the internal smoke and fire seal, such as, but not limited to:

.1 Opening or closing of doors.

.2 Twisting an inner liner.

.3 Removal or replacement of any material such as, but not limited to, sealant, caulk, putty, pillows, bags, foam plugs, foam blocks, or any other material.

.4 Permit multiple devices to be ganged together to increase overall cable capacity.

.5 Allow for retrofit to install around existing cables.

.6 Include an optional means to lengthen the device to facilitate installation in thicker barriers without degrading fire or smoke sealing properties or inhibiting ability of device to permit cable moves, add-ons, or changes.

.2 Where single cables (up to 7 mm (0.27 in) diameter) penetrate gypsum board/stud wall assemblies, a fire-rated cable grommet may be substituted. Acceptable products shall be molded from plenum-grade polymer and conform to the outer diameter of the cable forming a tight seal for fire and smoke. Additionally, acceptable products shall lock into the barrier to secure cable penetration.

.3 Where non- mechanical products are utilized, provide products that upon curing do no re-emulsify, dissolve, leach, breakdown or otherwise deteriorate over time from exposure to atmospheric

moisture, sweating pipes, ponding water, or other forms of moisture characteristic during or after construction.

.4 Where it is not practical to use a mechanical device, openings within floors and walls designed to accommodate telecommunications and data cabling shall be provided with re-enterable products that do not cure or dry.

.5 Cable trays shall terminate at each barrier and resume on the opposite side such that cables pass independently through fire-rated pathway devices. Cable tray shall be rigidly supported independent from fire-rated pathway devices on each side of barrier.

1.5 SUBMITTALS

.1 Submit under provisions of Section 01 33 00.

.2 Product Data: Provide manufacturer's standard catalog data for specified products demonstrating compliance with referenced standards and listing numbers of systems in which each product is to be used.

.3 Shop Drawings: Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance ratings.

.4 Certificates: Product certificates signed by firestop system manufacturer certifying material compliance with applicable code and specified performance characteristics.

.5 Installation Instructions: Submit manufacturer's printed installation instructions.

1.6 QUALITY ASSURANCE

.1 Products/Systems: Provide firestopping systems that comply with the following requirements:

.1 Firestopping tests are performed by a qualified, testing and inspection agency. A qualified testing and inspection agency is UL, or another agency performing testing and follow-up inspection services for firestop system acceptable to authorities having jurisdiction.

.2 Firestopping products bear the classification marking of qualified testing and inspection agency.

.2 Installer Qualifications: Experience in performing work of this section who is qualified by the firestopping manufacturer as having been provided the necessary training to install firestop products in accordance with specified requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

.1 Delivery:

.1 Manufacturer's original, unopened, undamaged containers, identification labels intact identifying product and manufacturer, date of manufacture; lot number; shelf life, if applicable; qualified testing and inspection agency's classification marking; and mixing instruction for multicomponent products.

.2 Handle and store products according to manufacturer's recommendations published in technical materials. Leave products wrapped or otherwise protected and under clean and dry storage conditions until required for installation.

.2 Storage and Protection:

.1 Store materials protected from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.

1.8 PROJECT CONDITIONS

.1 Do not install firestopping products when ambient or substrate temperatures are outside limitations recommended by manufacturer.

.2 Do not install firestopping products when substrates are wet due to rain, frost, condensation, or other causes.

.3 Maintain minimum temperature before, during, and for a minimum 3 days after installation of materials.

.4 Do not use materials that contain flammable solvents.

.5 Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.

.6 Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.

.7 Schedule installation of firestopping after completion of penetrating item installation but prior to covering or concealing of openings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Specified Technologies Inc.
200 Evans Way, Somerville, NJ 08876. Tel: (800) 992-1180, Fax: (908) 526-9623, Email: specseal@stifirestop.com, Website: www.stifirestop.com.

.2 Substitutions: as approved by the Consultant prior to tender closing.

.3 Single Source: Obtain firestop systems for each type of penetration and construction condition indicated only from a single manufacturer.

2.2 MATERIALS

.1 General: Use only firestopping products that have been tested for specific fire resistance rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire rating involved for each separate instance.

2.3 FIRE RATED CABLE PATHWAYS

.1 Steel raceway with intumescent foam pads allowing 0 to 100 percent cable fill, the following products are acceptable:

.1 Specified Technologies Inc. (STI) EZ-PATH Fire Rated Pathway.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Before beginning installation, verify that substrate conditions previously installed under other sections are acceptable for installation of firestopping in accordance with manufacturer’s installation instructions and technical information.

.2 Surfaces shall be free of dirt, grease, oil, scale, laitance, rust, release agents, water repellants, and any other substances that may inhibit optimum adhesion.

.3 Provide masking and temporary covering to protect adjacent surfaces.

.4 Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

.1 General: Install through-penetration firestop systems in accordance with Performance Criteria and in accordance with the conditions of testing and classification as specified in the published design.

.2 Manufacturer's Instructions: Comply with manufacturer's instructions for installation of firestopping products.

3.3 FIELD QUALITY CONTROL

.1 Inspections: Engage qualified independent inspection agency to inspect through-penetration firestop systems.

.2 Keep areas of work accessible until inspection by authorities having jurisdiction.

.3 Where deficiencies are found, repair firestopping products so they comply with requirements.

3.4 ADJUSTING AND CLEANING

.1 Remove equipment, materials, and debris, leaving area in undamaged, clean condition.

.2 Clean all surfaces adjacent to sealed openings to be free of excess firestopping materials and soiling as work progresses.

END OF SECTION

Updated through ADD#14

PART 1 - GENERAL

1.1 SUMMARY

.1 Provide commissioning of fire alarm and interconnected systems to verify that installations are in accordance with project requirements, and to ensure proper system operation.

1.2 RELATED REQUIREMENTS

.1 Section 01 91 13 – General Commissioning Requirements.

.1 Section 01 91 26.13 – Integrated Systems Testing of Fire Protection and Life Safety Systems.

1.3 REFERENCES

.1 CAN/ULC-S1001-11 – Integrated Systems Testing of Fire Protection and Life Safety Systems.

1.4 SUBMITTALS

.1 Commissioning plan.

1.5 CLOSEOUT SUBMITTALS

.1 Final commissioning and functional test report.

1.6 QUALIFICATIONS

.1 Commissioning Organizations:

.1 Certified member of Electrical Contractors Association of Ontario (ECAO) or Canadian Fire Alarm Association (CFAA).

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 SITE TESTS AND INSPECTIONS

.1 Perform testing of integrated systems in accordance with CAN/ULC-S1001.

.2 Follow manufacturer's recommendations for testing.

.3 Inspect wiring connections to all devices comprising the system.

.4 Verify supervision of wiring at every device connection to a supervised circuit.

.5 Test operation of every device on a system to verify its function.

.6 Examine equipment for any apparent damage or tampering that may interfere with its intended operation.

.7 Test equipment with capabilities for field adjustment to establish that it functions as intended under the conditions prevailing at its point of installation.

.8 Examine devices for evidence of damage or obstructions which may interfere with their operating mechanisms.

.9 Test automatic devices by simulating an operating condition.

.10 Wiring:

.1 Inspect every device and test to demonstrate that disconnection of the device from the circuit or malfunction of the equipment or wiring activates the required supervisory signals. Inspection shall include verification that:

.1 Supervisory signals operate in response to open circuits, short circuits, ground faults and disconnection of plug-in components;

.2 Terminations of conductors entering and leaving equipment have been made;

.3 Circuit polarities are in accordance with the system design, where applicable.

.2 In addition, test to establish that the power supplied to any device is within its recommended operating range and that the required voltage levels are maintained and that the fusing is correct.

.11 Initiating Devices - Manual:

.1 Inspect manual alarm stations in consideration of the following:

.1 The device shall be mounted with sufficient clearance to facilitate ease of access and proper operation;

.2 Operate each manual alarm station, toggle switch and key switch to verify proper functions.

.12 Automatic heat detectors:

.1 Use a heat source reproducible in its intensity, as recommended by the manufacturer of the device, to initiate an alarm.

.2 Test equipment - Heat lamp or Air heater. DO NOT USE AN OPEN FLAME HEAT SOURCE.

.3 Apply heat source as to not damage or operate fusible disc parts.

.13 Automatic heat detectors - non-resettable:

.1 Test by simulating its electrical operation by jumpering the wiring points (creating a short) adjacent to its operating mechanism.

.14 Automatic smoke detectors - area type:

.1 Test by introducing smoke into its detecting chamber. This may consist of actual smoke from burning materials or artificially generated smoke aerosol spray as recommended by the manufacturer. The sensitivity should be noted and adjusted if necessary.

.15 Automatic smoke detectors:

.1 Examine the air sampling arrangements of the detectors under actual conditions of balanced air circulation by conducting a check of the field sensitivity and a check of the air velocity in accordance with the manufacturers' recommendations.

.2 Test gas to be used similar to Automatic Smoke Detector.

.16 Alarm signals - audible:

.1 Test on main power supply and standby power supply with the maximum expected load on the system.

.2 The audible signalling appliances shall function as intended and shall be audible throughout the building over the background noise present.

.3 Decibel recordings in each area covering 100 sq. metres shall be taken.

.4 The level of sound should usually be 15 dB above ambient noise level.

.17 Alarm signals - visual:

.1 The visual signal appliances shall function as intended and shall be clearly visible.

.18 Fire suppression supervision:

.1 Coordinate with the requirements of Section 21 12 00, and Section 21 13 00.

.2 Sprinkler and standpipe trade to active each sprinkler and standpipe supervisory and alarm device by operating valves and producing flows as required in conjunction with fire alarm technician to observe activation of flow switches, pressure switches, supervised valves, etc.

.19 Annunciators, printers, and workstations:

.1 Inspect and operate to establish that their operation in conjunction with the control equipment and other system components, is as intended. The equipment shall be inspected to ensure:

.1 The zone of each alarm initiating device is properly indicated;

.2 The legend is clearly visible;

.3 Adequate voltage under local conditions is present;

.4 Wiring connections have been made in a workmanlike manner.

.5 Proper care must be taken to establish that each item is complete and satisfactory.

.20 Standby power supplies - batteries:

.1 Examine batteries for possible damage and consideration of the following:

.1 The charging system functions as intended;

.2 The installation has not resulted in the bypassing of a fuse or a similar protective device;

.3 The installation protects the batteries from accidental or mechanical damage.

.4 The batteries must be able to operate the fire alarm system with the charger input disconnected for one rated load cycle.

.21 Control equipment and transponders:

.1 Test to establish that they function as intended. The following examinations and tests shall be performed:

.1 A visual and physical inspection of all cables, plug interconnections, plug-in circuit components, lamps, sockets and controls to establish that their mechanical and electrical connections and mounting are as required for intended function and, where applicable, to confirm electrical supervision;

.2 Verification that all field wiring is terminated in a workman-like manner;

.3 All lamps and indicators shall be tested for operation and intended function;

.4 All keypad functions shall be tested for operation and intended function;

.5 All control unit functions shall be operated to verify appropriate response including all software routines and programme functions are simulated;

.6 Simulation of open circuits, short circuits and ground faults on all relevant internal circuits in order to confirm the appropriate supervisory response;

.2 Commissioning Report:

.1 Provide in accordance with requirements of Section 01 91 13, supplemented as specified herein.

.2 Report to include relevant information of the system including:

.3 Each system part described.

.4 How the system is operated.

.5 What functions the system performs.

.6 Requirements for tests and service.

.7 Itemization of all devices connected on the system, their general location.

.8 The date of the performed tests.

.9 All pertinent details of the report sheets requested.

.3 Verification:

.1 The Commissioning Report to be submitted to the Commissioning Manager upon completion of commissioning and will be subject to verification by the Commissioning Manager.

3.2 SIMULATIONS OF INTERCONNECTED SYSTEMS

.1 Provide simulations of all interconnected systems in accordance with CAN/ULC-S1001.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 [Single stage] [Two-stage] [Modified Two-Stage] addressable fire alarm systems.

.2 System testing and verification.

.3 Work to be done under this Section shall include furnishing of labour, materials, and equipment required for installation, testing, and putting into proper operation a complete Fire Alarm System as shown, as specified, and as otherwise required. Complete system shall be left ready for continuous and efficient satisfactory operation.

1.2 RELATED REQUIREMENTS

.1 Section 08 71 00 – Door Hardware: additional requirements for access control devices, magnetic door holders, etc.

.2 Section 21 12 00 – Fire-Suppression Standpipes.

.3 Section 21 13 00 – Fire-Suppression Sprinkler Systems.

.4 Section 26 05 00 – Common Work Results for Electrical.

1.3 UNIT PRICES

.1 Refer to Document 00 43 00.26.

.2 Submit with Tender unit prices to provide the following. Include installation and verification in the unit price:

.1 Section 28 46 31:

.1 Fire detector (heat detector or smoke detector) complete with wiring and conduit, based on 10 metre distance.

.2 Duct type smoke detector complete with wiring and conduit on a separate zone, based on 30 metre distance.

.2 Section 28 46 31.31:

.1 Manual pull station, complete with wiring and conduit based on 10 metre distance.

.3 Section 28 46 31.41:

.1 Zone Addressable Module (ZAM).

.4 Section 28 46 41:

.1 Fire alarm horn complete with wiring and conduit, based on 10 metre distance.

.2 Combination Fire alarm horn/strobe complete with wiring and conduit, based on 10 metre distance.

[OR]

.3 Speaker complete with wiring and conduit, based on 10 metre distance.

.4 Combination speaker/strobe complete with wiring and conduit, based on 10 metre distance.

.5 Unit cost of additional conduit and wire for the above items.

.6 Wire guard for any fire alarm device.

1.4 REFERENCES

.1 Definitions

.1 FACP: Fire Alarm Control Panel. This is the central component of a fire alarm/detection/communication system and consists of a control panel(s) and contains the system power supply, system CPU, circuit terminations, and system annunciation functions.

.2 INITIATION DEVICE: Examples are smoke detectors, heat detectors, water flow switches, valve tamper switches, and manual pull stations. These are devices which initiate a signal and send it to the FACP telling it that an abnormal event has taken place. Data Centre extinguishing systems, kitchen hood extinguishing systems, and other special extinguishing system control panels are additional examples of initiating devices.

.3 NOTIFICATION DEVICE: Examples are alarm horns, alarm speakers, and strobe lights. These devices are used to indicate through visual and audible means the existence of an abnormal event throughout all areas of the protected premises.

.4 CONTROL DEVICE: Examples are electronic relays or solenoids. These devices allow the FACP to automatically take certain actions during an abnormal event. For example, the FACP may energize a relay which, in turn, shuts down an air handling unit.

.5 CENTRAL PROCESSING UNIT (CPU): The central computer of a multiplex fire alarm system.

.6 CONCEALED: Where used in connection with installation of piping or conduit and accessories shall mean "hidden from sight" as in shafts, furred spaces, soffits or above suspended ceilings.

.7 EXPOSED: Where used in connection with installation of piping or conduit and accessories shall mean "visible" or "not concealed."

.8 AHJ: Authority Having Jurisdiction.

.9 LISTED: Materials or equipment included in a list published by a nationally recognized laboratory that maintains periodic inspection of production of listed equipment and materials, and whose listing states either that the equipment or material meets nationally recognized standards or has been tested and found suitable for use in a specified manner.

.10 NFPA: National Fire Protection Association.

.11 CLASS A: Applies to wiring from transponder to central processing unit. The CPU will detect circuit trouble and transponder will retain the ability to transit alarm upon a single fault condition.

.12 CLASS B: Applies to wiring from initiating device to transponder. A trouble signal will be transmitted to the panel upon a single fault condition.

.13 TRANSPONDER: Single or multiple zone/point data collection panel used within a multiplex system.

.14 UL, and ULC: Underwriters Laboratories, Inc., and Underwriters Laboratories of Canada, Inc.

.15 ULC Listed: Materials or equipment listed by Underwriters Laboratories of Canada and included in the most recent edition of the UL and ULC Fire Protection Equipment Directory.

.16 AHU: Air Handling Unit.

.17 FM: Factory Mutual Research Corporation/Factory Mutual Engineering Association.

.2 Reference Standards

.1 The publications listed below form a part of this specification. The publications are referenced in text by the basic designation only. The equipment and installation shall comply with the latest edition/amendment referenced code, standard, or publication.

.1 CSA Group:

.1 CSA C22.1:21, Canadian Electrical Code, Part 1 (25th edition), Safety Standard for Electrical Installations.

.2 Ontario Electrical Safety Code (28th edition/2021).

.3 CSA C22.2 No. 208-14 - Fire Alarm and Signal Cable.

.2 Ontario Regulations:

.1 2012 Ontario Building Code.

.2 2007 Ontario Fire Code.

.3 Underwriters Laboratories of Canada:

.1 [CAN/ULC-S524-14] [CAN/ULC-S524:2019], Standard for Installation of Fire Alarm Systems.

.2 CAN/ULC-S525 – Audible Signal Appliances for Fire Alarm Systems.

.3 CAN/ULC-S526 – Visual Signal Appliances for Fire Alarm Systems.

.4 CAN/ULC-S527 – Control Units for Fire Alarm Systems.

.5 CAN/ULC-S528 – Manual Pull Stations for Fire Alarm Systems.

.6 CAN/ULC-S529 – Smoke Detectors for Fire Alarm Systems.

.7 CAN/ULC-S530 – Heat Detectors for Fire Alarm Systems.

.8 CAN/ULC-S533 – Egress Door Securing and Releasing Devices.

.9 CAN/ULC-S536 – Inspection and Testing of Fire Alarm Systems.

.10 CAN/ULC-S537 – Verification of Fire Alarm Systems.

.11 CAN/ULC-S548 – Alarm Initiating and Supervisory Devices for Water Type Extinguishing Systems.

.12 CAN/ULC-S561-13 – Standard for Installation and Services for Fire Signal Receiving Centres and Systems.

.13 CAN/ULC-S1001-11 (R2018) – Integrated Systems Testing of Fire Protection and Life Safety Systems.

.4 All requirements of the Authority Having Jurisdiction (AHJ).

.2 In the case of any discrepancy between these specifications, the project drawings, and any applicable local codes, the installed Fire Alarm / Life Safety System shall comply with the most stringent requirement.

1.5 ACTION SUBMITTALS

.1 In accordance with Section 01 33 00.

.2 Product Data: Provide electrical characteristics and connection requirements.

.3 Submit drawings to municipal Fire Department if required, showing annunciation devices, manual pull stations, complete wiring diagrams and annunciator details and obtain their approval.

.4 Shop Drawings:

.1 Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.

.2 Include manufacturer's name(s), model numbers, ratings, power requirements, equipment layout, and device arrangement, and clearly showing ULC certification of all components.

.3 Show annunciator layout and main control panel module layout, configurations and terminations.

.4 Floor plan layouts showing all devices.

.5 Complete riser diagram, and auxiliary functions.

.6 The supplier of the system shall prepare a complete zoning schedule and artwork layout for passive graphic to be included with submittal package.

.7 Sequence of Operation narrative and zone chart.

1.6 INFORMATIONAL SUBMITTALS

.1 Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of products.

1.7 CLOSEOUT SUBMITTALS

.1 Maintenance Contracts

.1 [Provide service and maintenance of fire alarm system for one year from Date of Substantial Completion.]

.2 Operation and Maintenance Data

.1 Operation Data: Operating instructions.

.2 Maintenance Data: Maintenance and repair procedures.

.3 Record Documentation

.1 Record actual locations of initiating devices, signaling appliances, and end-of-line devices.

.2 Electrical Safety Authority (ESA) inspection certificate.

.3 Fire alarm verification report.

.4 Audibility test.

.5 CAN/ULC-S1001 functional test report.

.4 Manuals

.1 Submit complete operating and maintenance manuals listing the manufacturer's name(s) including technical data sheets (with model numbers to be used indicated).

.2 Wiring diagrams shall indicate terminals and the interconnections between the items of equipment.

.3 Provide a clear and concise description of operation which gives, in detail, the information required to properly operate the equipment.

1.8 SPARE PARTS

.1 Supply the following additional equipment as spare parts in a proper metal enclosure sized to accept the equipment as listed herein. Label the enclosure fire alarm spare parts. Enclosure shall be placed in the same room as the FACP.

.1 Supply [six] keys of each type.

.2 Supply [three] of each type of addressable detector base, smoke detector, heat detector, and fire alarm pull station.

.3 Supply [three] of each type of other installed initiating, notification, or controlling devices.

.4 Supply [three] of each type of any special tools required for system use and maintenance.

.5 Supply [three] of each type of signalling device used on the project.

.2 Provide (supply and install) an additional [five] of each of the following devices as directed during construction. Turn over unused surplus in addition to those devices listed above:

.1 Section 28 46 31:

.1 [Heat detectors].

.2 Smoke detectors.

.3 Duct smoke detectors.

.2 Section 28 46 41:

.1 Fire alarm horns.

.2 Combination Horn/Strobes.

[OR]

.3 Section 28 46 41:

.1 Fire alarm speakers.

.2 Combination speaker/strobes.

.4 Door hold open devices.

1.9 QUALITY ASSURANCE

.1 Manufacturer shall examine drawings and specifications prior to award of contract to ensure that detectors, control panels and miscellaneous devices being supplied will provide a satisfactory working installation.

.2 Each and all items of the fire alarm system shall be listed as the products of a single manufacturer under the appropriate category by Underwriters Laboratories of Canada and shall bear the “ULC” label.

.3 The fire alarm control, panel shall meet the modular listing requirements of ULC. Each subassembly of the FACP, including all printed circuit boards, shall include the appropriate ULC modular label.

.4 Each and all items of the fire alarm system shall be covered by a one-year parts and labour warranty covering defects resulting from faulty workmanship and materials. The warranty shall be deemed to begin on the date the system is accepted by the Project Manager on issuance of the substantial performance certificate for the project.

.5 Regulatory Requirements

.1 Provide products listed and classified by ULC as suitable for purpose specified and indicated.

.6 Qualifications of Manufacturer

.1 Equipment and materials shall be provided by an experienced reputable manufacturer to ensure proper specification adherence, final connection, test, turnover, warranty compliance, and service.

.2 The manufacturer is required to have been in the fire alarm industry (service and installation) for a minimum of ten years.

.3 The manufacturer shall have in-house engineering and project management capability consistent with the requirements of this project. Qualified and approved representatives of the system manufacturer shall perform the detailed engineering design of central and remote control equipment.

.4 International Standards Organization. The system and all components will be manufactured to ISO 9001 international Quality Management and Quality Assurance Standards.

.5 Manufacturer must have service facilities within a 50 km radius of the installation location.

.7 Qualifications of Installers

.1 All work performed to comply with this specification shall be carried out by and/or managed by a competent firm regularly engaged in the installation and testing of fire alarm systems for commercial buildings. Equipment manufacturer shall also be competent firms which are regularly engaged in the design, installation, testing, and servicing of fire alarm systems for this type of building.

.2 Review of cut-sheets, shop drawings, calculations and other materials submitted by the contractor shall not relieve the contractor's responsibility for full compliance with the design drawings and specification unless written approval is requested by the contractor and obtained from the Consultant for each non-complying feature. Finalized agreements for all equipment deviations from the drawings and specification shall be completed prior to award of the installation contract.

.3 For those instances where the contractor cannot conform to the drawings and specification, a proposed variance shall be submitted in writing to the Consultant at least five working days prior to the bidding date. The Consultant will respond to all proposed variances within two working days of receipt.

.4 All questions concerning interpretation of the design drawings and specification shall be submitted to the Consultant in writing no later than three working days prior to the bidding date. Requests for interpretations received after this date will not be answered. The Consultant will respond to all requests for interpretations in writing and will provide a summary of each request and the response to all bidding contractors. The Consultant will respond to all requests for interpretations within two working days of receipt.

.5 The contractor shall utilize the services of a fire alarm equipment distributor who is a factory authorized representative and a full line stocking distributor of the equipment manufacturer and shall maintain a constant inventory of the parts typical of those used in the system installation covered under this specification.

.6 The contractor and the fire alarm equipment manufacturer or distributor shall each have a minimum of 7 years of continuous experience in the design and/or installation of fire alarm systems and shall have completed a minimum of five projects of similar scope and complexity which were completed using addressable/analog systems. It is intended that these projects incorporated the same equipment, manufacturer, and model number, as is being proposed for this project. To verify the qualifications, the contractor and the fire alarm equipment distributor shall submit a brief design narrative which covers at least five fire alarm systems selected for references. This narrative shall indicate the project location, approximate contract value, system size by device counts, and a functional overview. These narratives shall provide an end-user contact name and telephone number for each referenced system. Where a fire alarm equipment distributor is a branch office of a fire alarm manufacturer, the references shall be chosen from projects in which the branch office completed both the design implementation and the installation.

.7 The Owner reserves the right to request documentation from the contractor with respect to any pending litigation against the contractor or any subcontractor. Further, the Owner reserves the

right to review an audited financial statement of the contractor or any subcontractor for the most recently completed fiscal year.

.8 The Owner reserves the right to disqualify any contractor who does not comply with all requirements of the Contractor Performance Standard of this specification.

.9 Installer must be certified by the Province of Ontario as a fire alarm installer.

1.10 DELIVERY, STORAGE, AND HANDLING

.1 In accordance with Section 01 61 00.

1.11 WARRANTY

.1 All work performed and all material and equipment furnished under this contract shall be free from defects and shall remain so for a period of at least one year from the date of Substantial Performance.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 All references to manufacturer's model numbers and other pertinent information herein is intended to establish minimum standards of performance, function and quality.

.1 [Autocall 4100ES series.]

.2 Edwards; EST4 series.

.3 Notifier by Honeywell; Onyx [NFS2-640C] [NFS2-3030] series.

.4 Mircom; FX-4000 series.

.5 Siemens; Desigo series.

.6 SimplexGrinnell by Tyco Integrated Fire & Security; 4100ES series.

.2 All equipment and components shall be the manufacturer's current model.

.3 The materials, appliances, equipment, and devices shall be tested and listed by a nationally recognized approvals agency for use as part of a protected premises protective signaling (fire alarm) system.

.4 The authorized representative of the manufacturer of the major equipment, such as control panels, shall be responsible for the satisfactory installation of the complete system.

.5 The contractor shall provide, from the acceptable manufacturer's current product lines, equipment, and components, which comply, with the requirements of these specifications.

.6 Manufacturer is to support a 20 year product.

2.2 CONDUIT AND WIRE FOR FIRE ALARM SYSTEM

.1 Conduit:

.1 In accordance with Section 26 05 33.13.

.2 Conduit shall be in accordance with the Electrical Safety Authority (ESA), local and provincial requirements.

.3 All wiring shall be installed in conduit or raceway.

.2 Terminal Boxes, Junction Boxes and Cabinets:

.1 All boxes and cabinets shall be listed for their purpose and use.

.3 Fire Alarm Cable

.1 To Section 27 15 01.19.

[OR]

.2 Wiring shall be in accordance with local, provincial and national codes and as recommended by the manufacturer of the fire alarm system. Number and size of conductors shall be as outlined in the Ontario Electrical Safety Code and as recommended by the fire alarm system manufacturer.

.3 All wire and cable shall be listed and/or approved by a recognized testing agency for use with a protective signalling system, as outlined in the Ontario Electrical Safety Code.

.4 Conductors: 300 V rated multiconductor, insulated, colour coded, copper conductor, minimum size to be 16 AWG for device loops and 14 AWG for signal circuits.

.5 Certified by CSA as fire alarm and signal cable type FAS 105 to CSA C22.2 No. 208.

.6 Non-Fire rated cable:

.1 Insulation: 105°C flame retardant PVC

.2 Outer Jacket: 105°C flame retardant PVC Red.

.3 Armour: Interlocking aluminum without overall jacket. For drops to devices in suspended ceilings from conduit system.

.7 Fire rated fire alarm cable:

.1 Pentair Pyrotenax 1850 series mineral insulated (MI) cable with 2 hour fire rating to ULC S139 and to meet 2012 Ontario Building Code rule 3.2.7.10.

.2 Substitution: VITALink MC Brand Type MC, manufactured by Marmon Wire & Cable Inc. (listed by ULC under ULC category code ‘FHJRC’, dated 19 May 2015).

2.3 ADDRESSABLE FIRE ALARM SYSTEM

.1 The system to be electrically supervised, non-coded, annunciated, [single] [two]-stage, addressable fire alarm system using addressable devices.

[OR]

.2 The system to be electrically supervised, non-coded, annunciated, [single] [two] [modified two] stage, complete with voice communication, addressable fire alarm system using addressable devices.

.3 The Central Processing Unit (CPU) uses multiplex communication techniques to receive data from and transmit data to transponders remotely located throughout facility to minimize wiring costs, simplify design, to allow economical expansion and easy retrofit.

.4 Make provisions during detailed design for future expansion of the system.

.5 System to be complete with a minimum of three data loops per node.

.6 The CPU is microprocessor-based to increase system reliability, speed response to alarm conditions, and reduce cost. CPU response time to alarm conditions to be no more than four seconds, regardless of system size.

.7 Fire alarm system will be zoned as required plus 20 per cent spares.

.8 Basic Performance:

.1 Alarm signals arriving at the main FACP shall not be lost following a power failure (or outage) until the alarm signal is processed and recorded.

.2 Provided with an emergency power supply, i.e. batteries capable of providing supervisory power for not less than 24 hours, and immediately following, emergency power under full load for not less than two hours.

2.4 FIRE ALARM ANNUNCIATOR PANEL (FAAP) AND GRAPHIC

.1 To Section 28 46 21.22.

2.5 ULC MONITORING TRANSMITTER

.1 To Section 28 46 21.24.

2.6 FIRE ALARM SYSTEM ACCESSORIES

.1 To Section 28 46 25.

2.7 FIRE ALARM INITIATION DEVICES

.1 Automatic Initiating Devices to Section 28 46 31.

.2 Manual Pull Stations to Section 28 46 31 31.

.3 Supervisory Signal devices and Sprinkler Flow Switch alarms to Section 28 46 31.41.

2.8 FIRE-ALARM SUPERVISED INTERFACE HARDWARE

.1 Door Hardware Fire Alarm Integration to Section 28 46 51.08.

.2 HVAC Integration to Section 28 46 51.23.

.3 [Data Centre Aisle Containment to Section 28 46 51.28.]

2.9 SIGNALLING DEVICES

.1 [Bells] [Horns] [Speakers] and visual signal devices (strobes) to Section 28 46 41.

.1 Strobe Frequency: maximum 5 Hz.

.2 Programmable Electronic Sounders:

.1 Shall be flush mounted as required.

.3 Audible/Visual Combination Devices:

.1 Shall meet the applicable requirements listed above for audibility.

.2 Shall have a built in strobe, 75 candela.

.4 Strobe Synchronizing Modules:

.1 Synchronize strobes at 1 Hz and horns at temporal over single wire pan.

2.10 OPERATION SEQUENCE

.1 To Section 28 46 15.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 The entire system shall be installed in accordance with the edition of CAN/ULC-S524 as adopted by the applicable legislation, and the manufacturer's manuals and wiring diagrams.

.2 The contractor shall furnish all labour, conduit, wiring, outlet boxes, junction boxes, cabinets, and similar devices necessary for a complete, functional life safety fire alarm system.

.3 Provide all necessary power supply, interconnecting and remote signal wire in dedicated conduit throughout and installed in accordance with the manufacturer's wiring diagrams and the requirements of the Canadian Electrical Code and the Inspection Authority.

.4 All penetration of floor slabs and fire walls shall be fire stopped in accordance with all local fire codes.

.5 Power supply:

- .1 Connect fire alarm system power supply to a dedicated circuit.
- .2 Circuit breaker(s) feeding fire alarm system to be coloured red, clearly labelled, and be locked in the ON position.

.6 Wiring:

- .1 Install all wiring in metal raceways.
- .2 Provide wiring suitable for fire alarm circuits.
  - .1 Class "A" wiring for initiating circuits.
  - .2 Class "A" wiring for signalling circuits unless noted otherwise.
- .3 Provide fire rated cables for fire alarm circuits as required by applicable codes and standards.
- .4 Provide separate signalling circuits for audible and visual devices.
- .5 End-of-line resistors shall be furnished as required for mounting as directed by the manufacturer on Class B circuits.
  - .1 Install EOL resistors maximum 1800 mm above finished floor in interior spaces.

.7 Install manual pull stations at 1200 mm above finished floor.

.8 [Install factory wire guards in gymnasium on pull stations, fire detectors, strobes, and fire alarm horns.]

.9 Identification

- .1 Provide lamacoid label (white text on red background) for all supporting field devices indicating function of the device.

3.2 FIELD QUALITY CONTROL

.1 The installing contractor shall provide a qualified project superintendent for the overall management and supervision of the work.

.2 The project superintendent shall assure that adequate supervision is provided during all periods of installation of the fire alarm system. The project superintendent and all job site supervisors shall have a minimum of five years of continuous experience in the installation of fire alarm systems of similar scope and complexity.

.3 Upon completion of the installation, the installing contractor shall test all alarm initiating devices, supervisory devices, control devices and notification devices for proper response and effectiveness.

Operation of all annunciating devices including the FACP, printer and remote LCD panel shall be verified. Testing shall include thorough sound level measurements of audible notification devices. These tests shall be fully documented. All testing up to the point of conducting the final acceptance tests shall be recorded using a temporary printer. The permanent printer of the system, where such has been provided, shall not be installed prior to the final acceptance tests.

.4 All smoke detectors shall be suitably protected against contamination up to the time of the final acceptance tests.

.5 An itemized test report in accordance with CAN/ULC-S524, CAN/ULC-S536, and CAN/ULC-S537 shall be submitted to the Consultant. This report shall provide complete details of the testing completed for all devices as well as circuit testing parameters. Data shall be submitted indicating the sensitivity level of all system smoke detectors.

.6 Following completion of a 100 per cent system functional test, the contractor shall perform a thorough acceptance test of the system at the direction of and to the satisfaction of the Owner and Consultant. This test shall not be carried out until at least 15 days after completion of all contractor's testing, modification and repairs following the original contractor's functional test and submittal of the functional testing documentation to the Consultant. The 15 day interval is also intended to be a system "burn-in" period. Any false activations of the system which occur within the burn-in period which are determined to be the result of a system fault shall result in the restart of the 15 day period.

.7 In the event that the acceptance test of the system results in the need for system repair or modification, the contractor shall demonstrate the operability of the system to the full satisfaction of the Owner and Consultant following the completion of repairs or modification.

.8 In the event that the AHJ requires a separate demonstration of the operability of the system for acceptance purposes, these additional tests shall be carried out by the Contractor without expense to the Owner.

.9 The contractor shall conduct an independent quality assurance review of all developed "record" drawings to assure accuracy and completeness of these drawings. Any discrepancies shall be brought to the attention of the Consultant prior to construction start.

.10 Only directly prior to verification, remove smoke detector protectors, and clean smoke detectors thoroughly.

.11 Inspect and check each individual device in entire system for proper connection, supervision, and function in accordance with CAN/ULC-S537. Identify detectors, manual pull stations and signal appliances not installed within requirements of CAN/ULC-S524 in remarks column of verification report.

.12 Obtain verification certificate and verification report from manufacturer showing each device checked, and that work has been carried out. Utilize standard verification forms similar to Canadian Fire Alarm Association (CFAA) forms.

3.3 ADJUSTING

.1 Contractor to verify programming of room names prior to fire alarm system programming, and allow for a revision to the fire alarm system programming should the Owner or AHJ wish to revise the room names.

3.4 MONITORING

.1 Fire alarm control panel to be located as indicated. Coordinate third party CUL Listed monitoring with Owner.

3.5 MANUFACTURER SERVICES

.1 At the final inspection a factory trained representative of the manufacturer of the major equipment shall demonstrate that the systems function properly in every respect.

.2 The manufacturer's representative shall perform an inspection of the fire alarm equipment, including those components necessary to the direct operation of the system such as manual stations, thermal and smoke actuated detectors and controls, whether or not manufactured by the manufacturer. The inspection shall comprise an examination and test of such equipment for the following:

.1 That the type of equipment installed is that designated by the specifications.

.2 That the wiring connections to all equipment components show that the installer undertook to have observed ULC requirements. That all products of combustion (smoke) detectors have been properly calibrated, and adjustments set correctly.

.3 That the representative's equipment has been installed in accordance with the manufacturer's recommendations.

.4 That the supervisory wiring of all devices connected to a supervised circuit is operating and that the wiring, having been met to the satisfaction of the inspecting officials.

.3 Testing to be done in the presence of the local building inspector, and the local fire inspector.

.4 The manufacturer(s) of the fire alarm shall make a complete inspection of all components installed for system(s), such as manual stations, horns, and annunciators and sprinkler and standpipe valves and smoke detectors to ensure the following:

.1 That the system is complete in accordance with Specifications.

.2 That the system is connected according to ULC requirements.

.3 That the system is connected in accordance with the manufacturer's recommendations.

.4 That the regulations concerning the supervision of components have been adhered to (e.g. stations, detectors, supervised valves, bells), and are properly wired and supervised.

.5 That all valves are properly connected and displayed correctly on each annunciator.

.6 That any subsequent changes necessary to conform to the above will be carried out with technical advice supplied by the Manufacturer.

.7 That all thermal detectors, smoke detectors and manual pull stations have been operated and are in good working order.

.8 That all sprinkler system and standpipe system valves have been operated and are in good working order.

.9 That all annunciators correctly pin-pint the origin of any fire alarm.

.10 That actual smoke concentration of sufficient density, have been applied to each smoke detector to cause the detector to be set off and that the sensitivity of each smoke detector has been set.

.11 That all devices are in good working order. Include for replacing any defective/damaged devices at no extra cost to Owner.

.12 That signal audibility is acceptable in all areas. Submit audibility readings for every Room.

3.6 SITE TESTS AND INSPECTIONS

.1 Provide the service of a competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment to technically supervise and participate during all of the adjustments and tests for the system.

.2 All initial testing shall be in accordance with the latest issue of ULC-S537 Verification of Fire Alarm Systems standard.

.3 Provided integrated testing of life safety systems in accordance with Section 28 08 46.

.4 A representative of the electrical contractor shall be present to participate and assist the manufacturer representative during the course of the verification. The electrical contractor shall make good any deficiencies discovered during the verification. Verify all devices. The electrical contractor shall provide one person for assistance with the verification.

.5 The verification report shall be submitted for approval to the Consultant.

.1 Ensure verification report uses room numbers and space descriptions that are consistent with the drawings.

.6 On completion of the inspection the manufacturer shall supply a certificate, together with detailed inspection record sheets showing location of each device and certifying the test results per unit, confirming that the system is installed, supervised, and operate in accordance with Article "System Verification".

.7 Audibility Test:

.1 Provide audibility test of signalling devices after other systems have been commissioned to verify operation at ambient sound levels.

.2 Provide audibility test report to the Consultant.

.3 Implement varied tone to suit audibility requirements.

3.7 CLOSEOUT ACTIVITIES

.1 The System Supplier shall schedule and present documented formalized instruction for the building owner, detailing the proper operation and maintenance of the installed System.

.2 The instruction shall be presented in an organized and professional manner by a person factory trained in the operation and maintenance of the equipment and who is also thoroughly familiar with the installation.

.3 The instruction shall cover the schedule of maintenance required by ULC and any additional maintenance recommended by the system manufacturer.

.4 Instruction shall be made available to the Local Municipal Fire Department if requested by the Local Authority Having Jurisdiction.

.5 The contractor shall provide for a minimum of three training sessions of two hours in length. At least one of these training sessions shall be carried out for key personnel prior to the system being initially placed on-line for the beginning of the burn-in period.

.6 Three bound copies which summarize the training instruction shall be submitted to the Owner for future reference.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 [Single stage] addressable fire alarm system Sequence of Operation.

1.2 RELATED REQUIREMENTS

.1 Section 28 46 13 – Fire-Alarm Systems.

1.3 CLOSEOUT SUBMITTALS

.1 Manuals

.1 Provide a clear and concise description of operation which gives, in detail, the information required to properly operate the equipment.

PART 2 - PRODUCTS

2.1 GENERAL

.1 The sequence listed below is representative sequence of operation, based on typical buildings.

.2 The Contractor shall submit a project specific sequence of operation, as part of the submittal process.

2.2 OPERATION SEQUENCES

.1 An alarm is caused by actuation of any one of the following devices:

.1 Pulling a manual station.

.2 Operation of an automatic fire alarm detector.

.3 Operation of a sprinkler flow switch.

.4 Operation of a smoke detector.

.2 If, in any area of the building, an alarm is caused by actuation of the aforementioned devices, the following shall occur:

.1 Signals in the building shall sound.

.2 Annunciators shall indicate exact zone where alarm originated.

.3 The activation of a manual pull station, automatic fire detector, automatic smoke detector, or sprinkler flow switch shall initiate the following sequence of operation:

.1 Sound an alarm signal throughout building.

.2 Control panel and remote annunciators shall indicate exact location of alarm via a zoned RED LED.

.3 Fans shall be automatically turned off.

.4 Initiate alarm origin on CPU and at graphic annunciator.

.5 Display the alarm event on all annunciator panels.

.6 Actuate CPU causes evacuation signal to sound and strobes to operate.

.7 The internal audible device shall sound at the control panel.

.8 Signal transmission to external systems:

.1 Transmit signal to monitoring station.

.2 Central station shall be automatically alerted via telephone lines connected for fire alarm system.

.3 Transmit signal to Building Automation System.

.4 Transmit signal to Access Control System.

.9 Door Releases:

.1 All stairwell/exit doors shall unlock throughout the building.

.2 All self-closing fire/smoke doors held open shall be released.

.10 HVAC Shutdowns:

.1 [Shut down air supply and return air fans.]

.2 Activate smoke dampers.

.11 CPU indicates trouble when any fault occurs within the system.

.4 Alarm:

.1 Actuate CPU causes evacuation signal to sound and strobes to operate.

.2 The internal audible device shall sound at the control panel.

.3 Signal transmission to external systems:

.1 Transmit signal to monitoring station.

.2 Transmit signal to Building Automation System.

.3 Transmit signal to Access Control System.

.4 Door Releases:

.1 All stairwell/exit doors shall unlock throughout the building.

.2 All self-closing fire/smoke doors held open shall be released.

.3 Site entrance and exit gates open.

.5 HVAC Shutdowns:

.1 Shut down air supply and return air fans.

.2 Activate smoke dampers.

.5 Supervisory

.1 If, in any area of the building, supervised valves of the sprinkler, systems are operated or exhibit short or open circuits, the following shall occur:

.1 The annunciator shall identify, as a separate zone, the item causing the trouble signal.

.2 The trouble buzzer on the annunciator(s) shall sound.

.3 The signals in the building shall not be sounded.

.2 The activation of a sprinkler supervised valve or pressure switch shall initiate the following sequence of operation:

.1 The control panel and remote annunciator shall indicate exact location of activity via a zoned AMBER LED

.2 Activate an audible tone on the control panel and remote annunciator.

.3 The signals in the building shall not be sounded.

.6 Trouble

.1 A short, ground fault or open circuit to any fire alarm conductor, the tamper or removal of any field device or the loss of primary or standby power to any control equipment will result in the following trouble sequence of operation:

.1 The control panel and remote annunciator shall indicate exact location of activity via a zoned YELLOW LED.

.2 Activate an audible tone on the control panel and remote annunciator.

.3 The signals in the building shall not be sounded.

PART 3 - EXECUTION – NOT USED

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

.1 Section Includes

.1 Fire Alarm Control Panel.

.2 [Fire alarm transponders, Data Gathering Panels.]

.3 Fire alarm power supplies and batteries.

1.2 RELATED REQUIREMENTS

.1 Section 28 46 21.22 – Fire-Alarm Remote Annunciators.

.2 Section 28 46 21.24 – Supervising Station Alarm Systems Communications Equipment.

1.3 REFERENCES

.1 Design, manufacture, install and test fire alarm system in accordance with good industry practice and in accordance with the following Codes and Standards:

.1 CAN/ULC-S524-14 – Standard for the Installation of Fire Alarm Systems.

.2 CAN/ULC-S536-13 – Standard for the Inspection and Testing of Fire Alarm Systems.

.3 CAN/ULC-S537-13 – Standard for the Verification of Fire Alarm Systems.

.4 CAN/ULC-S527-11 – Control Units for Fire Alarm Systems.

.2 If any of the requirements of the above Codes and Standards is in conflict with the Drawings or Specifications, the Code or Standard requirements shall govern, but in no instance shall the standards established by these Drawings and Specifications be reduced by any of the Codes and Standards listed above.

1.4 ACTION SUBMITTALS

.1 Submit shop drawings in accordance with Section 01 33 00 and items noted below. Documentation to be project specific.

.1 Generic documentation and/or alternate or as-equal products are unacceptable.

.2 Product data for each type of system component including list of materials and Underwriters' Laboratories of Canada (ULC) listing. Product data to include technical documentation features, and/or functions, and parts list.

.3 Dimensioned drawings illustrating minimum clearances and any required access space.

.4 Point to point wiring diagrams of the entire installed system differentiating clearly between factory and field installed wiring. Identify all terminals and interconnections including conductor numbering.

1.5 INFORMATIONAL SUBMITTALS

.1 Dimensional elevation of fire alarm control panel and mounting instructions.

1.6 CLOSEOUT SUBMITTALS

.1 In accordance with Section 01 78 00.

.1 Operation and Maintenance Manuals: Data on each product type including all features and operating sequences for both automatic and manual operations including trouble shooting and maintenance instructions, schematic and wiring diagrams, final reviewed shop drawings, manufacturer's warranty and verification test report.

.2 Final device address list and application program listing for the system as installed at the time of acceptance.

.3 A list of all input and output points in the system with a label indicating location or use of initiating device circuit, notification appliance circuit, relay, sensor, and auxiliary control circuits.

.4 System power and battery charts with performance graphs and voltage drop calculations to assure that the system will operate per the prescribed backup time periods and under all voltage conditions per ULC standards.

.5 Operating instructions for control panel.

.6 Installation and programming manuals covering the installed system.

.7 All final and certified documentation.

.8 Drawings in PDF format.

.2 Operations and Maintenance Manuals: Submit such manuals in accordance with Division 01, and prior to completion of project, in triplicate, containing following:

.1 Actual system functional description, and sequence of operation of completed installation.

.2 Detailed maintenance instructions for control equipment and each device type, maintenance schedule in accordance with CAN/ULC-S536. Trouble shooting guide for control panels and devices.

.3 Pictorial drawing of control equipment layout, showing location of components, modules and parts, indicating catalogue numbers.

.4 Schematic diagrams of control equipment, except modules which can be exchanged as unit and internal interconnecting cables and wires.

.5 Copy of verification certificate, verification report and warranty certificates such as for fire alarm system, batteries, ancillary devices, including battery suppliers date coding for batteries.

.6 Name, address and telephone number of service representative of manufacturer to be contacted during warranty period.

.7 Name, address and telephone number of representative responsible for future software programming changes.

1.7 MAINTENANCE MATERIAL SUBMITTALS

.1 Keys.

1.8 QUALITY ASSURANCE

.1 Testing Personnel Qualifications: In addition to the requirements specified in [Division 01 Section "Quality Control"], provide persons currently certified by the Canadian Fire Alarm Association (CFAA) for fire alarm system testing and verification, to supervise on-site testing and verification as specified in Part 3.

.2 Installer Qualifications: Engage an experienced factory-authorized installer to supervise work of this Section.

.3 Single-Source Responsibility: Obtain fire alarm components from a single source who assumes responsibility for compatibility of system components.

.4 Compliance with Local Requirements: Comply with the applicable building code, local ordinances, and regulations, and the requirements of the authorities having jurisdiction.

.5 Listing and Labelling: Provide fire alarm systems and components specified in this Section that are listed and labelled by ULC.

1.9 TESTING AND COMMISSIONING

.1 Perform testing and commissioning services described herein, after fire alarm, visual and audible signalling system has been installed and pretested.

1.10 WARRANTY

.1 Provide a warranty for materials and workmanship, including microprocessor components and software, to be free of defects for period from date of acceptance of system by Owner in accordance with the General Conditions.

.2 Repair response times for problems defined as routine to be addressed and corrected within twenty-four (24) hours, excepting statutory holidays and weekends.

.3 Repair response times for problems defined as major to be addressed and corrected within four (4) hours, excepting statutory holidays and weekends.

.4 Contractor to provide a recommended list of spare components and devices.

.5 Manufacturers of the major components to provide written confirmation of full warranty, extended warranty and service back-up in case of the failure to perform or insolvency of the successful supplier.

.6 Maintain maintenance records for each system supplied, and must submit a monthly report containing a time and date record of all reported or detected problems, detail of corrective action taken and the cause of the problem.

.7 [At end of warranty period, perform tests described above, and in accordance to CAN/ULC-S536 annual inspection and produce a final inspection report.]

PART 2 - PRODUCTS

2.1 GENERAL

.1 The Central Processing Unit (CPU) to use multiplex communication techniques to receive data from and transmit data to transponders remotely located throughout the facility to minimize wiring costs, simplify design, to allow economical expansion and easy retrofit.

.2 Make provisions during detailed design for future expansion of the system.

.3 The CPU is microprocessor-based to increase system reliability, speed response to alarm conditions, and reduce cost. CPU response time to alarm conditions to be no more than four seconds, regardless of system size.

.4 Fire alarm system will be zoned as required plus 20 per cent spares.

2.2 FIRE ALARM CONTROL PANEL

.1 Fire Alarm Control Panel (FACP) complete with Central Processing Unit (CPU) shall be housed in a surface wall mounted cabinet with baked enamel finish, full viewing window, and hinged front door cover complete with lock and [two] keys.

.1 Opening cabinet door shall provide access to all operating controls, but will not expose live electrical connections.

.2 Cabinet provided with sufficient capacity to allow maximum system expansion and to house alphanumeric display.

.2 [Modules: concentrated in single central location in modular central control panel.]

[OR]

.3 [CPU shall be designed for use with transponders.]

.4 Control panel, with number of zones as identified on fire alarm schedule plus 20% spare capacity, shall contain the following:

.1 Reset button, LED test button, alarm signal silencing push button, ground fault indicator light, system trouble indicating light, trouble signal silencing button and annunciator trouble indicating light.

.2 Relays and control modules as required for door releases, fan shut-down, extinguishing system release, and audible alarms.

.3 Alarm receiving modules for number of zones as indicated on drawings plus provision for 20% spares. Zone modules shall be capable of handling any type of device including pull stations, smoke detectors, and heat detectors to allow for future changing of devices without changing modules. Each module to contain a trouble alarm indicator.

.4 Power supply modules as required.

.5 Signal control modules as required.

.6 All modules shall have visual supervision against removal.

.5 Ancillary functions:

.1 Each ancillary function of the fire alarm system shall have its own independent bypass switch, (i.e. fans, door holders, security locks, bells, elevator homing, BMS, monitoring, etc.). Each switch is to be clearly labeled with LED annunciation of its normal and active positions.

.2 The panel shall contain enough bypass switches with a least 3 spares to provide each special system and/or ancillary system with bypass capability.

.6 Power supply: self-contained unit, with integral power supply, battery charger, and standby batteries. Short circuit, over voltage, and brown-out monitoring to protect powered components by automatically switching to standby batteries whenever trouble condition exists in power supply.

.7 [Communication between FACP and remote DGP's to be supervised, DCLC style. Communications failure between FACP and remote units, audible and visual trouble to be indicated at FACP.]

.1 [Communication between nodes in networked system to be supervised, DCLC style. Communication failure between any 2 nodes, other nodes on loop to continue to communicate with each other and programmed functions on communicating nodes to continue operating.]

.8 As a result of alarm conditions received at the FACP, the system shall have ability to automatically operate specified control points such as CAN/ULC-S561 monitoring, or stopping exhaust fans, air conditioning units, and releasing magnetically held doors or other Fire Alarm related devices.

2.3 [TRANSPONDERS (DATA GATHERING PANELS)]

.1 Transponders to be remotely located throughout the facility to minimize wiring costs, simplify design, to allow economical expansion, and to allow easy retrofit.

.2 Distributed throughout the building as shown on drawings in separately enclosed units (DGP'S) and interconnected to central control unit utilizing multiplex data transmission techniques.

.3 Transponders shall have the capability to interface with all specified peripheral devices, such as smoke and thermal detectors, door holders, horns, firefighter phones. Communication between CPU and transponders shall be one twisted shielded pair.

.4 The Data Gathering Panels (DGPs) (referred to as Transponders in CAN/ULC-S524) shall have standalone capabilities in the event that communication is lost between the central fire alarm panel and the DGPs. The DGPs shall be capable of receiving and processing alarms and all other functions for their respective areas in the event of a communication loss with the fire alarm control panel.

.5 Transponder provided with the following features which are active when in stand-alone mode:

.1 Signal silence, reset, and trouble silence switches with visual indicators, and stand-alone capability indicators.

.2 In event of loss of communication with the CPU, the DGP shall be capable of operating in stand-alone mode to ensure survivability of the system.

.6 System to be complete with a minimum of three data loops per DGP.

.7 Power supply: self-contained unit, with integral power supply, battery charger, and standby batteries. Short circuit, over voltage, and brown-out monitoring to protect powered components by automatically switching to standby batteries whenever trouble condition exists in power supply.

.8 The area served by a transponder shall cover the same area for both inputs and outputs.

2.4 POWER SUPPLIES

.1 The system shall be provided with sufficient battery capacity to operate the entire system upon loss of normal AC power in a normal supervisory mode for a period of 24 hours with [2 hours] of alarm operation at the end of this period. The system shall automatically transfer to battery standby upon power failure. All battery charging and recharging operations shall be automatic.

.2 All circuits requiring system-operating power shall be 24 VDC and shall be individually fused at the control unit or transponder.

.3 The incoming power to the system shall be supervised so that any power failure will be indicated at the control unit. A green "power on" LED shall be displayed continuously while incoming power is present.

.4 The system batteries shall be supervised so that a low battery or depleted battery condition or disconnection of the battery shall be indicated at the control unit and displayed for the specific fault type.

.5 The system shall support 100% of addressable devices in alarm, or operated at the same time, under both primary (AC) and secondary (battery) power conditions.

.6 Loss of primary power shall annunciate a trouble signal at the FACP. FACP shall indicate when the system is operating on an alternate power supply.

.7 120 V, 60 Hz as primary source of power for system.

.1 Provide [one][four] 120 V circuits to each [DGP or] FACP, or as directed by fire alarm system manufacturer.

.8 Standby batteries: sealed, maintenance free, lead calcium sealed batteries.

.1 The batteries shall be sealed maintenance free type with expected life of ten years.

.2 Batteries shall be enclosed in a steel housing, or within the fire alarm control unit.

.3 A fully automatic battery charger shall be provided which shall be capable of restoring a dead battery’s capacity per ULC standards.

.9 Alarm signals arriving at the main FACP shall not be lost following a power failure (or outage) until the alarm signal is processed and recorded.

2.5 PASSIVE GRAPHIC DISPLAY

.1 [ ].

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install to CAN/ULC-S524.

.2 Control Panel mounting height: arranged such that visual displays and operating controls are not less than 600 mm and not more than 1800 mm above the finished floor level.

.3 Power to be provided by 120 VAC [emergency] circuit.

.4 Label batteries with the in-service date.

.5 Install Fire Alarm System components as follows:

.1 Install fire alarm control panel [and DGPs] where shown on drawings.

.2 [Provide DCLC loop with 1 hour fire rated conductors between FACP and DGPs. Maintain minimum spacing of the loop per CAN/ULC-S524 figure 1.1.]

3.2 FIELD QUALITY CONTROL

.1 Verification in accordance with Section 28 46 13.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Fire alarm annunciator panels.

.1 Main annunicator panel and remote LCD annunicator panels.

.2 Firefighter entrances.

.3 Passive graphics.

1.2 RELATED REQUIREMENTS

.1 Section 21 12 00 – Fire-Suppression Standpipes.

.2 Section 21 13 00 – Fire-Suppression Sprinkler Systems.

.3 Section 26 05 00 – Common Work Results for Electrical.

.4 Section 28 46 13 – Fire-Alarm Systems.

1.3 REFERENCE STANDARDS

.1 The publications listed below form a part of this specification. The publications are referenced in text by the basic designation only. Comply with the latest edition/amendment referenced code, standard, or publication.

.1 Ontario Regulations

.1 Ontario Building Code.

.2 Ontario Fire Code.

.2 Underwriters Laboratories of Canada

.1 CAN/ULC-S524 – Installation of Fire Alarm Systems.

.2 CAN/ULC-S525 – Audible Signal Appliances for Fire Alarm Systems.

.3 CAN/ULC-S526 – Visual Signal Appliances for Fire Alarm Systems.

.4 CAN/ULC-S527 – Control Units for Fire Alarm Systems.

.5 CAN/ULC-S528 – Manual Pull Stations for Fire Alarm Systems.

.6 CAN/ULC-S529 – Smoke Detectors for Fire Alarm Systems.

.7 CAN/ULC-S530 – Heat Detectors for Fire Alarm Systems.

.8 CAN/ULC-S533 – Egress Door Securing and Releasing Devices.

.9 CAN/ULC-S536 – Inspection and Testing of Fire Alarm Systems.

.10 CAN/ULC-S537 – Verification of Fire Alarm Systems.

.11 CAN/ULC-S548 – Alarm Initiating and Supervisory Devices for Water Type Extinguishing Systems.

.12 ULC/ORD 693 – Central Station Fire Protective Signaling.

.3 All requirements of the Authority Having Jurisdiction (AHJ).

.2 In the case of any discrepancy between these specifications, the project drawings, and any applicable local codes, comply with the most stringent requirement.

1.4 COORDINATION

.1 Coordinate between all trades for inclusion of information to be included on passive graphic.

1.5 ACTION SUBMITTALS

.1 In accordance with Section 01 33 00, and Section 28 46 13.

.2 Shop Drawings:

.1 Annunciator:

.1 Provide annunciator layout and system wiring diagram showing each device and wiring connection required.

.2 Show annunciator layout and main control panel module layout, configurations, and terminations.

.2 Passive Graphic:

.1 Prepare a complete zoning schedule and artwork layout for each passive graphic to be included with submittal package.

.2 Submit colour PDF (electronic submittal) using the identical colours as will be used in a temporary graphic for use during occupancy review by municipal fire inspector.

.3 After occupancy review, incorporate comments from municipal fire inspector, and submit colour PDF (electronic submittal) using the identical colours as will be used in the final production graphic.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 In accordance with Section 01 61 00.

1.7 WARRANTY

.1 All work performed and all material and equipment furnished to be warranted as free from defects and for a period of at least one year from the date of acceptance.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 In accordance with Section 28 46 13.

2.2 FIRE ALARM ANNUNCIATOR PANEL (FAAP)

.1 Annunciator panels will have an alphanumeric display for each detection device, and will identify the detection device initiating an alarm.

.2 Annunciator panel located at the firefighter’s entrance will have separate zone indication for each zone.

.3 Install panel in a [recessed] [floor mounted] enclosure with brushed aluminum finish [to suit the construction of the vestibule]. Coordinate exact location and dimensions with Architectural drawings.

.4 Identify emergency exit door numbers/identifiers, and on the control panel/annunciator panel LED labels in order to identify the manual pull stations adjacent to said doors when being activated when cross referenced with the passive graphic.

.1 Coordinate with architectural plans indicating door IDs.

2.3 PASSIVE GRAPHIC DISPLAYS

.1 Provide passive colour graphic display to be mounted adjacent to the fire alarm control panel and each annunciator panel as indicated on the drawings.

.1 Provides building and zone layout while defining zone boundaries.

.2 Visual reference of user’s location within the building.

.2 Multicoloured Passive Graphics:

.1 Plastic laminate type, on white background, framed and under plexiglass, 600 mm by 600 mm (24 inch by 24 inch) minimum size.

.2 Different brilliant colours used to distinguish the various fire alarm zones and building outline from one another, silk-screened with durable acrylic-based inks on a white matte 3 mm (1/8 inch) thick acrylic sheet. Use UV protected inks to protect against fading or colour changes for life.

.3 Provide a minimum of six different colours.

.4 Uppercase text, minimum height of 4 mm (0.15 in).

.5 Graphical display will indicate the following at minimum. Coordinate between all trades for inclusion of this information.

.1 "YOU ARE HERE" indicated in red (unique to each passive graphic location), and properly oriented to the viewer when standing in front of the graphic.

.2 Zone colours to clearly indicate the extents of all fire alarm zones.

.1 Define all egress corridors in a distinctive (dot) black hatch pattern.

.2 All enclosed stairs and elevators to be coloured yellow.

.3 Indicate the extents of zones served by air handling units with shut downs.

.4 Indicate the location of the fire alarm control panel, all annunciators, and network panels/nodes.

.5 Indicate the location of the ULC monitoring transmitter.

.6 Indicate the location and designation of sprinkler and standpipe monitoring devices.

.7 Indicate the location of Sprinkler Room(s), and all supervised fire protection devices. Coordinate with the fire protection trade(s) for exact locations of devices.

.8 Emergency exit doors with door numbers shown. These will be needed to cross reference with the annunciator panel labels for pull stations that are activated next to these doors.

.9 Label all Stair Letters. Designations to match Architectural drawings.

.10 Main gas shut off location.

.3 Frame

.1 [Stainless steel] [Extruded aluminum] frame with concealed mounting hardware and concealed screws

.2 Brushed silver finish.

.3 Concealed security mounting hardware.

.4 Frame to permit future replacement of graphic if the building or zone layouts change in future.

.4 Allow for other requirements per the Authorities Having Jurisdiction, including the Municipal Building Inspector, and Municipal Fire Inspector.

2.4 [FIRE ALARM REMOTE LCD ANNUNCIATORS (FARA)]

.1 Description: Remote Control and Annunciation provided using back-lit, alphanumeric display. Information is presented including:

.1 Point Status (alarm, trouble, etc.);

.2 Alarm Type (smoke detector, manual station, etc.);

.3 Number of System Alarms, Supervisory Conditions, and Trouble Conditions.

.2 Features:

.1 Display:

.1 LCD Display with two lines of 40 characters each.

.2 LED status indicators.

.2 Controls:

.1 Switches for system acknowledge, alarm silence, and system reset.

.2 Four programmable control switches.

.3 Lamp/LCD test

.3 Finish: brushed stainless steel trim.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Installation in accordance with Section 28 46 13.

.2 Install annunciators and passive graphics with the top no greater than 1800 mm (70 in) above finished floor.

.3 Install main annunciators with temporary passive graphics in the following locations:

.1 Ground floor lobby (firefighter’s entrance).

.2 [CACF room.]

.3 [Main Electrical Room.]

.4 Other locations as noted on drawings.

.4 Install temporary passive graphic at fire alarm control panel.

.5 Install remote annunciators with temporary passive graphics in the following locations:

.1 [Nurse's stations].

3.2 SITE TESTS AND INSPECTIONS

.1 Review passive graphics and annunciators with municipal fire inspector on site during occupancy review. Incorporate any comments and resubmit to the Consultant for review.

.2 Include reprogramming of zone nomenclature by system manufacturer to suit municipal review comments.

.3 After review by the Consultant, fabricate final passive graphics, and replace temporary graphics on site.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 End-of-Line Devices.

.2 Fault Isolators.

.3 Wire Guards.

.4 [Illuminated Signs.]

1.2 RELATED REQUIREMENTS

.1 Section 28 46 13 – Fire-Alarm Systems.

.2 Section 28 46 31.31 – Fire-Alarm Manual Initiating Devices: manual pull station covers.

1.3 REFERENCES

.1 CAN/ULC-S524-14 – Installation Standard for Fire Alarm Systems.

1.4 UNIT PRICES

.1 Refer to Document 00 43 00.26.

.2 Unit price to supply and install wire guard for any fire alarm device.

1.5 CLOSEOUT DOCUMENTS

.1 As-Built Drawings: include location and zone of all End-of-Line devices.

1.6 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Stock Materials

.1 Provide (supply and install) an additional [five] of each of the following devices as directed during construction. Turn over unused surplus in addition to those devices listed above:

.1 Fault Isolators.

.2 End-of-Line devices.

.3 Wire guard.

.2 Spare Parts

.1 Supply the following additional equipment as spare parts in a proper metal enclosure sized to accept the equipment as listed herein. Label the enclosure fire alarm spare parts. Enclosure shall be placed in the same room as the FACP.

.1 Supply three of each type of other installed initiating, notification, or controlling devices.

.3 Tools

.1 Supply three of each type of any special tools required for system use and maintenance.

PART 2 - PRODUCTS

2.1 END OF LINE DEVICES

.1 One watt type resistors mounted within outlet boxes separate from those for other devices at the locations indicated. Provide on the cover plate for each such device on approved nameplate, engraved "END-OF-LINE RESISTOR" or with an approved symbol. Provide red lamacoid plate with white 6 mm letters identifying zone.

.2 [Finish of end of line device cover plates to be priced based on stainless steel finish; confirm exact finish with the Consultant during submittal review process.]

2.2 FAULT ISOLATORS

.1 Module shall detect and isolate a short-circuited segment of a fault-tolerant loop whilst allowing the rest of the addressing circuit to function normally.

2.3 DEVICE GUARDS

.1 Description: Welded wire mesh of size and shape for the initiation, signaling, or other device requiring protection.

.1 Factory fabricated and furnished by manufacturer of device.

.2 Finish: Paint of colour to match the protected device.

.2 Pull station covers: as described in Section 28 46 31.31.

2.4 [ILLUMINATED “FIRE DO NOT ENTER” SIGNS]

.1 Internally illuminated sign with red LED illuminating text.

.2 Lettering within the sign not visible unless the sign is illuminated.

.3 Display text:

.1 FIRE DO NOT ENTER

.2 Other custom text where specified on drawing.

.4 Designed for 24 VAC/DC with integrated supervisory function.

.5 Manufacturers:

.1 Geographics

.1 GEO-LIS series (indoor use).

.2 GEO-LIS-WP series (outdoor use).

.2 Fire alarm system manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Installation to Section 28 46 13 and CAN/ULC-S524.

.2 End-of-Line devices:

.1 Provide End-of-Line devices as directed by the manufacturer on Class B circuits.

.2 Install 1800 mm above finished floor in interior spaces and provide a label indicating the zone service.

.3 Installation of End-of-Line devices within other field devices: not permitted.

.4 Provide a permanent mark to identify the zone or circuit served by the End-of-Line device.

.3 Fault Isolators:

.1 Provide fault isolators in accordance with CAN/ULC-S524.

.4 Illuminated “Fire Do Not Enter” Signs

.1 Feed illuminated signs from the fire alarm system and provide electrically supervised output circuits.

3.2 FIELD TESTS AND INSPECTIONS

.1 Testing and inspection to Section 28 46 13.

.2 Verification to Section 28 46 13.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Spot Heat Detectors.

.2 Spot Smoke Detectors.

.3 Duct mounted smoke detectors.

.4 Accessories.

1.2 RELATED REQUIREMENTS

.1 Section 28 01 80.71 – Revisions and Upgrades of Fire Detection and Alarm.

.2 Section 28 46 31.18 – Carbon Monoxide Detection Sensors.

1.3 UNIT PRICES

.1 Refer to Document 00 43 00.26.

.2 Submit with Tender unit prices to provide the following. Include installation and verification in the unit price:

.1 Fire detector (heat detector or smoke detector) complete with wiring and conduit, based on 10 metre distance.

.2 Duct type smoke detector complete with wiring and conduit on a separate zone, based on 30 metre distance.

.3 Unit cost of additional conduit and wire for the above items.

1.4 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Stock Materials:

.1 Provide (supply and install) an additional [five] of each of the following devices as directed during construction. Turn over unused surplus in addition to those devices listed above:

.1 [Heat detectors.]

.2 Smoke detectors.

.3 Duct smoke detectors.

.2 Spare Parts:

.1 Supply the following additional equipment as spare parts in a proper metal enclosure sized to accept the equipment as listed herein. Label the enclosure fire alarm spare parts. Enclosure shall be placed in the same room as the FACP.

.1 Supply three of each type of addressable detector base, smoke detector, heat detector, and fire alarm pull station.

.2 Supply three of each type of other installed initiating, notification, or controlling devices.

.3 Tools:

.1 Supply three of each type of any special tools required for system use and maintenance.

PART 2 - PRODUCTS

2.1 AUTOMATIC CONVENTIONAL HEAT DETECTORS

.1 Automatic heat detectors shall have a combination rate of rise and fixed temperature rated at 57.2 degrees C (135 degrees F) for areas where ambient temperatures do not exceed 37.7 degrees C (100 degrees F), and 93.33 degrees C (200 degrees F) for areas where the temperature does not exceed 65.5 degrees C (150 degrees F).

.2 Automatic heat detectors shall be a low profile, ceiling mount type with positive indication of activation.

.3 The rate of rise element shall consist of an air chamber, a flexible metal diaphragm, and a factory calibrated, moisture-proof, trouble free vent, and shall operate when the rate of temperature rise exceeds 9.4 degrees C (15 degrees F) per minute.

.4 The fixed temperature element shall consist of a fusible alloy retainer and actuator shaft.

.5 Automatic heat detectors shall have a smooth ceiling rating of 232 square metres (2500 square feet).

.6 Style of detectors shall match existing system.

2.2 FIXED TEMPERATURE HEAT DETECTORS

.1 Manufacturers:

.1 Basis of design: Potter CF series.

.2 Features:

.1 Low profile design

.2 White plastic housing

.3 Up to 70’ inter detector spacing

.4 Open or closed contact versions.

.5 Product includes a 5 year warranty.

2.3 COMBINATION RATE-OF-RISE AND FIXED TEMPERATURE HEAT DETECTORS

.1 Manufacturers:

.1 Basis of design: Potter CR series.

.2 Features:

.1 Low profile design

.2 White plastic housing

.3 Up to 70’ inter detector spacing

.4 Open or closed contact versions.

.5 Product includes a 5 year warranty.

2.4 CONVENTIONAL PHOTOELECTRIC AREA SMOKE DETECTORS

.1 Smoke detector shall be a System Sensor i3 Series, listed to ULC.

.2 The detector shall be a photoelectric type (model C2W-BA for 2-wire, model C4W-BA for 4-wire).

.3 The detector shall include a mounting base for mounting to 3½-inch and 4-inch octagonal, single gang, and 4-inch square back boxes with a plaster ring, or direct mount to the ceiling using drywall anchors.

.4 Wiring connections shall be made by means of SEMS screws. The detector shall allow pre-wiring of the base and the head shall be a plug-in type.

.5 The detector shall have a nominal sensitivity of 2.5 percent-per-foot nominal as measured in the ULC smoke box. The detector shall be capable of automatically adjusting its sensitivity by means of drift compensation and smoothing algorithms. The detector shall provide dual color LED indication which blinks to indicate power up, normal standby, out of sensitivity, alarm, and freeze trouble (Model C2WT-BA, C4WT-BA) conditions.

.6 When used in conjunction with the C2W-MOD2A module, 2-wire models shall include a maintenance signal to indicate the need for maintenance at the alarm control panel, and shall provide a loop testing capability to verify the circuit without testing each detector individually.

.7 The CSENS-RDRA, a wireless device, displays the sensitivity of i3 detectors in terms of percent per-foot-obscuration.

.1 Supply one CSENS-RDRA in project for each project site.

2.5 CONVENTIONAL DUCT SMOKE DETECTORS

.1 Duct smoke detectors shall be a 24 VDC type with visual alarm indicator, visual power indicator, and a reset switch. Each detector shall be installed upon the composite supply/return air ducts(s), with properly sized air sampling tubes.

2.6 CONVENTIONAL MANUAL PULL STATIONS

.1 General Requirements for Manual Fire-Alarm Boxes: Comply with CAN/ULC-S528. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.

.2 Description: Conventional [single-] [double-]action type, red LEXAN. Station shall mechanically latch upon operation and remain so until manually reset by opening with a key common with the control units. Station shall be pull-lever type; with integral terminal strip to accommodate wiring connections to fire-alarm control unit Initiating Device Circuit. Where double-action stations are provided, the mechanism shall require two actions [break front glass] [push top activation door] to initiate an alarm.

.3 Indoor Protective Shield: Where required, or as indicated on the drawings, provide a factory-fabricated, tamperproof, clear LEXAN enclosure shield and red frame that easily fits over manual pull stations which shall be hinged at the top to permit lifting for access to initiate a local alarm. Unit shall be ULC listed. [Lifting the cover shall actuate an integral battery-powered audible horn intended to discourage false-alarm operation. The horn shall be silenced by lowering and realigning the shield. The horn shall provide 85 dB at 10 feet and shall be powered by a 9 VDC battery.] [none]

.4 Barrier Free Path of Travel: Where required, manual station shall be operable using a closed fist and with a force of not more than 22.2 N. Provides a more easily operated manual station compared to standard stations.

.5 Weatherproof Protective Shield: Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm.

[OR]

.6 Basis of Design: Mircom MS-401.

.7 Manual fire alarm stations shall be non-coded, non-breakable glass type.

.8 Stations must be designed such that after an actual activation, they cannot be restored to normal without the use of a special tool.

.9 An operated station shall automatically condition itself so as to be visually detected, as operated, at a minimum distance of 30.5 m (100 feet) front or side.

.10 Manual stations shall be constructed of metal, with operating instructions provided on the cover. The word FIRE shall appear on the manual station in letters 12.7 mm (0.5 inch) in size or larger.

.11 Provide polycarbonate vandal resistant covers for new manual pull stations.

.12 Style of new manual pull stations to match existing system

2.7 ACCESSORIES

.1 Relay Base.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Installation to Section 28 46 13.

.2 [Provide wire guards for heat detectors in gymnasiums.]

3.2 RESIDENTIAL SMOKE ALARM INSTALLATION

.1 Install in accordance with manufacturer’s instructions.

.2 Circuit from same breaker as the washroom lighting.

3.3 IDENTIFICATION

.1 Provide an engraved phenolic nameplate, red text on red background at the ceiling location below any concealed duct mounted smoke detectors indicating “Smoke Detector Above – DSD-1” where DSD-1 is the identification of the detector. Locate on lay-in ceiling grid or access hatch where located.

3.4 FIELD TESTS AND INSPECTIONS

.1 Testing, and inspection to Section 28 46 13.

.2 Verification to Section 28 46 13.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Sensors for the detection of Carbon Monoxide (CO) gas.

1.2 RELATED REQUIREMENTS

.1 Section 28 46 13 – Fire-Alarm Systems.

1.3 REFERENCES

.1 Ontario Building Code.

.2 CAN/ULC-S529:2016 – Smoke Detectors for Fire Alarm Systems.

1.4 CERTIFICATIONS

.1 The CO detector shall be ULC-S529 and CSA 6.19 as Carbon Monoxide alarm device.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Edwards signature series “SIGA2” devices.

.2 S-Tech.

.3 CO detectors shall be compatible with the system in Section 28 46 13.

2.2 CARBON MONOXIDE SENSORS

.1 The CO element shall be modular and can be replaced when the CO detector reaches end of life, so that the whole detector does not need to be replaced. Detectors that require the complete device to be replaced are not acceptable.

.2 The CO detector element shall have an integral count-down timer that counts down from 6 years (expected life span of the CO detector component). The detector’s processor shall monitor the CO detector component to ensure that if the CO device is out of tolerance before the 6-year time frame, the device will register a trouble condition and identify itself to the control panel.

.3 Devices include, SIGA2-COS, carbon monoxide detector, SIGA2-PCOS, combination Photoelectric/CO detector, SIGA2-PHCOS combination Photo/Thermal/ CO detector as well as SIGA2-HCOS combination Heat/CO detector. The combination devices shall only utilize one detector address and have the ability to separate the device types to a maximum of two different inputs from each addressable detector. It shall be possible to have the smoke detector activate the sounder base only like a smoke alarm and have the heat detector activate the general alarm condition. And if the CO sensor activates, the sounder base must sound the ISO Temporal 4 CO alarm code.

.4 The CO sensor in a sounder base shall be listed as a Carbon Monoxide Alarm to CSA-6.19. Addressable Carbon Monoxide (CO) Detector, EST model SIGA2-COS with audible sounder base. Provide intelligent addressable Carbon Monoxide Detector with Temporal 4 Audible Base.

.5 The CO detection element shall indicate a trouble condition at the FACP signaling end of life and the CO element of the detector shall be field replaceable. It shall be programmed at the main control panel as a supervisory indication and transmit a separate supervisory signal to the central station.

.6 Alternate product for mechanical rooms: S-Tech STCH-1000HW (hard wired alarm, wall mount), and STCH-100HWR (hard wired alarm with relay).

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Installation to Section 28 46 13.

.2 Install CO detectors in accordance with 2012 Ontario Building Code, section 6.2.12, and as indicated on the drawings.

.1 [Mechanical rooms.]

.2 [Generator rooms.]

3.2 SITE TESTS AND INSPECTIONS

.1 Testing, and inspection to Section 28 46 13.

.2 Verification to Section 28 46 13.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Intelligent Modules.

.2 Fire Alarm Pull Stations for Single Stage Fire Alarm Systems.

1.2 RELATED REQUIREMENTS

.1 Section 21 12 00 – Fire-Suppression Standpipes.

.2 Section 21 13 00 – Fire-Suppression Sprinkler Systems.

.3 Section 26 05 00 – Common Work Results for Electrical.

.4 Section 28 46 13 – Fire-Alarm Systems.

1.3 REFERENCES

.1 CAN/ULC-S528, Manual Stations for Fire Alarm Systems.

1.4 UNIT PRICES

.1 Refer to Document 00 43 00.26.

.2 Submit with Tender unit prices to provide the following. Include installation and verification in the unit price:

.1 Manual pull station, complete with wiring and conduit based on 10 metre distance.

.2 Unit cost of additional conduit and wire for the above items.

.3 Unit cost for supply and installation of pull station cover.

1.5 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Stock Materials

.1 Provide (supply and install) an additional [five] of each manual pull station to be used as directed on site during construction.

.2 Turn over unused surplus in addition to those devices listed below.

.2 Spare Parts

.1 Supply the following additional equipment as spare parts in a proper metal enclosure sized to accept the equipment as listed herein. Label the enclosure fire alarm spare parts. Enclosure shall be placed in the same room as the FACP.

.1 Supply 6 keys of each type.

.2 Supply 3 of each type of fire alarm pull station.

.3 Supply 10 manual pull station break-glass rods.

.3 Tools:

.1 Supply three of each type of any special tools required for system use and maintenance.

PART 2 - PRODUCTS

2.1 MICROPROCESSOR BASED INTELLIGENT MODULES

.1 General

.1 Zone Addressable Modules (ZAM) shall be used for the monitoring of water flow, valve tamper, fire suppression control panels, non-addressable detectors, and for control of fans or dampers that require shutdown or manual control in an alarm condition.

.2 Monitor ZAM's shall monitor any N/O contact device and be capable of powering 2-wire smoke detectors. The ZAM will communicate the zone's status (normal, alarm, trouble) to the transponder. The ZAM's zone address shall be set at the time of installation via a dip switch package.

.3 Control ZAM's shall be able to provide supervised or non-supervised control of any control function. The ZAM will communicate the zone's status (normal, trouble) to the transponder. Each control ZAM shall provide a double pole double throw relay for switching loads of up to 120 VAC. Each common leg of the relay shall be equipped with a replaceable 2 Amp fuse. The ZAM's zone address shall be set at the time of installation via a dip switch package.

.4 Fire Alarm / Life Safety System shall incorporate microprocessor-based addressable modules for the monitoring and control of system Input and Output functions over a 2-wire electronic communications loop, using both broadcast and serial polling protocols. All modules shall display communications and alarm status via LED indicators. The function of each connected module shall be determined by the module type, and shall be defined in the system software through the application of a personality code. All addressing of the Microprocessor-based Addressable Modules shall be done electronically, and the electrical location of each module shall be automatically reported to the Fire Alarm Control Panel, where it may be downloaded into a PC, or printed out. The addressing of the modules will not be dependent on their electrical location on the circuit. All field wiring to the Microprocessor-based Addressable Modules shall be supervised for opens and ground faults and shall be location identified to the module of incidence. Diagnostic circuitry, and their associated indicators, with reviewable Trouble Codes, shall be integral to the Microprocessor-based Addressable Modules to assist in troubleshooting system faults. Each module shall be suitable for operation in the following environment:

.1 Temperature: 0°C to 49°C (32°F to 120°F).

.2 Humidity: 0-93% RH, non-condensing.

.2 Single Input Module:

.1 Microprocessor-based Addressable Modules shall be used to provide one (1) supervised Class A input circuit capable of latching operation for use with contact devices, non-damped Waterflow Switches, non-latching supervisory sprinkler switches.

.3 Dual Input Module:

.1 Microprocessor-based Addressable Modules shall be used to provide two (2) independent supervised Class A input circuits capable of operation with contact devices. Both of the input circuits shall be terminated to, and operated from, the same microprocessor-based addressable module.

.2 Modules configured for water flow operation shall have an automatic delay of 15 seconds before reporting the water flow alarm condition to the Fire Alarm Control Panel. The module shall monitor sprinkler supervisory switches and shall automatically report the supervisory function to the Fire Alarm Control Panel each time the associated dry contact closes.

.4 Monitor Module:

.1 The Microprocessor-based Addressable Monitor Module shall be factory set to support one (1) supervised Class A Normally-Open Active Non-Latching Monitor circuit. The module shall automatically report the monitor function to the Fire Alarm Control Panel each time the associated dry contact closes.

.5 Control Relay Module:

.1 Microprocessor-based Addressable Control Relay Modules shall provide one form “C” dry relay contact rated at 2 amps at 24 VDC or 0.5 amps at 120 VAC to, control external appliances or equipment processes. The control relay module shall be rated for pilot duty applications. The position of the relay contact shall be confirmed by the system firmware.

2.2 MICROPROCESSOR BASED ADDRESSABLE MANUAL PULL STATIONS

.1 Addressable manual fire alarm boxes shall, on command from the control panel, send data to the panel representing the state of the manual switch and the addressable communication module status. They shall use a key operated test-reset lock, and shall be designed so that after actual emergency operation, they cannot be restored to normal use except by the use of a key.

.2 Stations must be designed such that after an actual activation, they cannot be restored to normal without the use of a special tool.

.3 All operated stations shall have a positive, visual indication of operation and utilize a key type reset.

.4 Manual fire alarm boxes shall be constructed of Lexan with clearly visible operating instructions provided on the cover. The word FIRE shall appear on the front of the stations in raised letters, 44 mm (1.75 in) or larger.

.5 All addressing of the Manual Pull Stations shall be done electronically, and the electrical location of each station shall be automatically reported to the Fire Alarm Control Panel, where it may be downloaded into a PC, or printed out. The addressing of the Manual Pull Station will not be dependent on their electrical location on the circuit.

.6 The manual station shall be suitable for mounting on a North American 38 mm (1-1/2 inch) deep, 100 mm (4 inch) square electrical box with 13 mm (1/2 inch) raised cover.

.7 All Manual Fire Alarm station shall be suitable for operation in the following environment:

.1 Temperature: 0 degrees C to 49 degrees C (32 degrees F to 120 degrees F).

.2 Humidity: 0-93 per cent RH, non-condensing.

.8 Pull Station Cover

.1 All Manual Fire Alarm pull stations shall be provided with a clear, tamperproof, polycarbonate shield and frame that fits over manual pull stations. When lifted to gain access to the actual alarm, it shall sound a 95 dB or 105 dB warning horn.

.2 The cover is connected to the frame by a cable. When the cover is lifted, it hangs off of the frame and the horn will sound until the cover is snapped back onto the frame (or for the life of the battery).

.3 Battery shall be provided for each cover.

.1 Tamper or protecting covers for manual stations shall comply with CAN/ULC-S528, Including Accessories.

.2 Red surface backbox

.1 Similar to Mircom BB-300, or Notifier BB series.

.9 Pull stations shall be addressable, single action, non-coded, single stage, semi-flush mounted type.

.10 Provide contacts for connection to magnetic locking devices power supply such that upon activation of the local pull station or first stage fire alarm signal the magnetic locks release.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Installation to Section 28 46 13.

.2 Provide manual pull stations at the following locations:

.1 Near the principal entrance to the building.

.2 Near every required exit.

.3 At doors equipped with electromagnetic locks, locate on the wall not more than 600 mm from the door.

.4 Other locations as described in the Building Code.

.3 Install manual pull stations at 1200 mm above finished floor.

.4 Where possible, install the manual station on the latch side of a single door at a maximum lateral distance of 1500 mm (59 in) from the door opening.

.5 Install manual pull stations on both sides of a series of doors exceeding 12 m (39 feet) in total width, and within 1500 mm (59 in) of each side of the opening.

.6 When installing manual pull station on a glass partition mullion, provide red surface backbox for pull station, and fish armoured flexible cables through mullion of door frame.

3.2 SITE TESTS AND INSPECTIONS

.1 Testing, and inspection to Section 28 46 13.

.2 Verification to Section 28 46 13.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Intelligent modules.

.2 Sprinkler room temperature sensors.

1.2 RELATED REQUIREMENTS

.1 Section 21 05 33 – Heat Tracing for Fire Suppression Piping.

.2 Section 21 12 00 – Fire-Suppression Standpipes.

.3 Section 21 13 00 – Fire-Suppression Sprinkler Systems.

.4 Section 21 31 00 – Centrifugal Fire Pumps.

.5 Section 23 38 13 – Commercial-Kitchen Hoods.

.6 Section 26 05 00 – Common Work Results for Electrical.

.7 Section 26 05 26.13 – High-Resistance Grounding Systems.

.8 Section 28 46 13 – Fire-Alarm Systems.

.9 Section 32 17 43 – Pavement Snow Melting Systems.

1.3 UNIT PRICES

.1 To Section 28 46 13.

1.4 REFERENCES

.1 [CAN/ULC-S524-14] [CAN/ULC-S524:2019], Standard for Installation of Fire Alarm Systems.

.2 CAN/ULC-S548-15 (R2020), Standard for devices and accessories for water type extinguishing systems.

.3 CAN/ULC-S573:2018, Standard for Installation of Ancillary Devices Connected to Fire Alarm Systems.

.4 CAN/ULC-S1001-11, Standard for Integrated Systems Testing of Fire Protection and Life Safety Systems.

.5 NFPA 13, Standard for the Installation of Sprinkler Systems.

1.5 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Stock Materials

.1 Provide (supply and install) an additional [five] of each of the following fire alarm devices as directed during construction. Turn over unused surplus in addition to those devices listed below:

.1 Zone Addressable Modules (ZAMs).

.2 Spare Parts

.1 Supply the following additional equipment as spare parts in a proper metal enclosure sized to accept the equipment as listed herein. Label the enclosure fire alarm spare parts. Enclosure shall be placed in the same room as the FACP.

.1 Supply three of each type of other installed initiating, notification, or controlling devices.

.3 Tools

.1 Supply three of each type of any special tools required for system use and maintenance.

PART 2 - PRODUCTS

2.1 MICROPROCESSOR BASED INTELLIGENT MODULES

.1 General

.1 Zone Addressable Modules (ZAM) shall be used for the monitoring of water flow, valve tamper, fire suppression control panels, non-addressable detectors, and for control of fans or dampers that require shutdown or manual control in an alarm condition.

.2 Monitor ZAM's shall monitor any N/O contact device and be capable of powering 2-wire smoke detectors. The ZAM will communicate the zone's status (normal, alarm, trouble) to the transponder. The ZAM's zone address shall be set at the time of installation via a dip switch package.

.3 Control ZAM's shall be able to provide supervised or non-supervised control of any control function. The ZAM will communicate the zone's status (normal, trouble) to the transponder. Each control ZAM shall provide a double pole double throw relay for switching loads of up to 120 VAC. Each common leg of the relay shall be equipped with a replaceable 2 Amp fuse. The ZAM's zone address shall be set at the time of installation via a dip switch package.

.4 Fire Alarm / Life Safety System shall incorporate microprocessor-based addressable modules for the monitoring and control of system Input and Output functions over a 2-wire electronic communications loop, using both broadcast and serial polling protocols. All modules shall display communications and alarm status via LED indicators. The function of each connected module shall be determined by the module type, and shall be defined in the system software through the application of a personality code. All addressing of the Microprocessor-based Addressable Modules shall be done electronically, and the electrical location of each module shall be automatically reported to the Fire Alarm Control Panel, where it may be downloaded into a PC, or printed out. The addressing of the modules will not be dependent on their electrical location on the circuit. All field wiring to the Microprocessor-based Addressable Modules shall be supervised for opens and ground faults and shall be location identified to the module of incidence. Diagnostic circuitry, and their associated indicators, with reviewable Trouble Codes, shall be integral to the Microprocessor-based Addressable Modules to assist in troubleshooting system faults. Each module shall be suitable for operation in the following environment:

.1 Temperature: 0°C to 49°C (32°F to 120°F)

.2 Humidity: 0-93% RH, non-condensing

.2 Single Input Module:

.1 Microprocessor-based Addressable Modules shall be used to provide one (1) supervised Class A input circuit capable of latching operation for use with contact devices, non-damped Waterflow Switches, non-latching supervisory sprinkler switches.

.3 Dual Input Module:

.1 Microprocessor-based Addressable Modules shall be used to provide two (2) independent supervised Class A input circuits capable of operation with contact devices. Both of the input circuits shall be terminated to, and operated from, the same microprocessor-based addressable module.

.2 Modules configured for water flow operation shall have an automatic delay of 15 seconds before reporting the water flow alarm condition to the Fire Alarm Control Panel. The module shall

monitor sprinkler supervisory switches and shall automatically report the supervisory function to the Fire Alarm Control Panel each time the associated dry contact closes.

.4 Monitor Module:

.1 The Microprocessor-based Addressable Monitor Module shall be factory set to support one (1) supervised Class A Normally-Open active non-latching monitor circuit. The module shall automatically report the monitor function to the Fire Alarm Control Panel each time the associated dry contact closes.

.5 Control Relay Module:

.1 Microprocessor-based Addressable Control Relay Modules shall provide one form “C” dry relay contact rated at 2 amps @ 24 VDC or 0.5 amps at 120 VAC to, control external appliances or equipment processes. The control relay module shall be rated for pilot duty applications. The position of the relay contact shall be confirmed by the system firmware.

2.2 TEMPERATURE SWITCHES

.1 To sense a temperature approaching the freezing point in any dry pipe valve enclosure or water storage container used for firefighting purposes.

.2 Basis of design: Potter RTS series.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Installation to Section 28 46 13.

.2 Provide temperature sensor in any room containing a dry pipe valve and connect to fire alarm system to indicate a supervisory signal on the building fire alarm system annunciator for a temperature approaching the freezing point in any dry pipe valve enclosure or water storage container used for firefighting purposes.

3.2 SITE TESTS AND INSPECTIONS

.1 Testing, and inspection to Section 28 46 13.

.2 Verification to Section 28 46 13.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Fire Alarm Horns.

.2 Fire Alarm Strobes.

.3 Combination Horn/Strobes.

.4 Boosters.

1.2 RELATED REQUIREMENTS

.1 Section 26 05 00 – Common Work Results for Electrical.

.2 Section 28 46 13 – Fire-Alarm Systems.

1.3 UNIT PRICES

.1 Refer to Document 00 43 00.26.

.2 Submit with Tender unit prices to provide the following. Include installation and verification in the unit price:

.1 Fire alarm horn complete with wiring and conduit, based on 10 metre distance.

.2 Fire alarm strobe complete with wiring and conduit, based on 10 metre distance.

.3 Combination fire alarm horn/strobe complete with wiring and conduit, based on 10 metre distance.

.4 Unit cost of additional conduit and wire for the above items.

1.4 REFERENCES

.1 CAN/ULC-S525:2016, Audible signaling devices for fire alarm and signaling systems, including accessories.

.2 CAN/ULC-S526:2016, Visible signaling devices for fire alarm and signaling systems, including accessories.

1.5 SUBMITTALS

.1 Booster battery calculations, booster power supply voltage drop calculations.

1.6 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Stock Materials

.1 Supply the following additional equipment as spare parts in a proper metal enclosure sized to accept the equipment as listed herein. Label the enclosure fire alarm spare parts. Enclosure shall be placed in the same room as the FACP.

.1 Supply three of each type of signalling device used on the project.

.2 Spare Parts

.1 Provide (supply and install) an additional [five] of each of the following devices as directed during construction. Turn over unused surplus in addition to those devices listed above:

.1 Fire alarm horn.

.2 Fire alarm strobes.

.3 Combination horn/strobes.

.3 Tools

.1 Supply three of each type of any special tools required for system use and maintenance.

1.7 CERTIFICATIONS

.1 All appliances which are supplied for the requirements of this specification shall be ULC listed.

.2 All appliances of the same manufacturer as the Fire Alarm Control Panel specified to ensure absolute compatibility between the appliances and the control panels, and to ensure that the application of the appliances are performed in accordance with the single manufacturer's instructions.

.3 Any appliances that do not meet the above requirements, and are submitted for use must show written proof of their compatibility for the purpose intended. Such proof shall be in the form of documentation from all manufacturers that clearly states that their equipment (as submitted) is 100% compatible with each other for the purpose intended.

PART 2 - PRODUCTS

2.1 HORNS

.1 Vibrating horn: semi-flush mounted, 24 VDC, selectable 94 dBA or 98 dBA, suitable for installation in a standard electrical box.

.2 Red enamel typical, or white enamel as indicated on the drawings[, and as confirmed by the Owner].

2.2 MINI HORNS

.1 Vibrating horn: semi-flush mounted, 24 VDC, 91 dBA, suitable for installation in a standard electrical box.

.2 Red enamel typical, or white enamel as indicated on the drawings, and as confirmed by the Owner.

2.3 HORN-STROBES

.1 Vibrating horn: semi-flush mounted, 24 VDC, selectable 94 dBA or 98 dBA, suitable for installation in a standard electrical box.

.2 Red enamel typical, or white enamel as indicated on the drawings[, and as confirmed by the Owner].

.3 Provide horn-strobes where shown on plans and drawings. Strobe output shall be determined as required by its specific location and application from a family of 15/75 cd, 30 cd, and 110 cd devices. Strobes shall provide a synchronized flash.

.4 Strobes shall be 24 VDC and ULC listed.

.5 Strobe circuits shall be coordinated with audible circuits such that activation of an audible circuit results in activation of the companion strobe circuit. The strobe circuits shall be capable of being arranged such that they continue to operate in the event that the audible circuits have been silenced

and remain operating until the FACP has been reset. Strobe circuits should also be coordinated with the audible circuits such that they are zoned in the same manner as the audible circuits.

.6 All strobes and combination horn strobes shall be mounted such that the bottom of the device is mounted 2000 mm (79 in) above the finished floor or 150 mm (6 in) below the ceiling, whichever is lower.

2.4 STROBES

.1 Strobes shall be supplied where shown on plans and drawings. Strobe output shall be determined as required by its specific location and application from a family of 15/75 cd, 30 cd, and 110 cd devices. Strobes shall provide a synchronized flash.

.2 Size strobe power supplies based on all strobes set at 75 cd with exact setting determined in the field to provide adequate visual signals in accordance with CAN/ULC-S524.

1.02 REMOTE BOOSTER POWER SUPPLIES

.1 Power supply booster designed to extend power available to notification appliance circuits.

.2 Enclosure: Steel, with lockable front panel allowing access to all interior components, surface mounted.

.3 Functions: Contains circuits to monitor and charge batteries, control, and supervise four Class B appliance circuits, and monitor two controlling inputs from external sources.

.1 Configurable to operate at any one of three signaling rates, or to follow the main panel's notification appliance circuit.

.2 Trouble contact with 16-second delay.

.4 Batteries: Two, sized for 24 hours of standby followed by 15 minutes of alarm.

.5 Indicators: LEDs, one for each circuit, one for battery supervision, one for ground fault, and one for power.

.6 Input: 120 volt circuit.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Installation to Section 28 46 13.

.2 Strobe light output (candela) in accordance with CAN/ULC-S524-14:

.1 Table 5 – Light Output for Wall-Mounted Strobe Lights for Various Room Sizes:

Maximum Area of Coverage (m)	Minimum Light Output, Candela (Effective Luminous Intensity)		
	One Light per Area	Two Lights per Area	Four Lights per Area
6.10 x 6.10	15	Not allowable	Not allowable
8.53 x 8.53	30	15	Not allowable
9.14 x 9.14	34	15	Not allowable
12.2 x 12.2	60	30	15
13.7 x 13.7	75	60	30
15.2 x 15.2	94	60	30
16.5 x 16.5	110	60	30
18.3 x 18.3	135	95	30
21.3 x 21.3	184	95	60
24.4 x 24.4	240	135	60
27.4 x 27.4	304	185	95
30.5 x 30.5	375	240	95
33.5 x 33.5	455	240	135
36.6 x 36.6	540	305	135
39.9 x 39.9	635	375	135

.2 Table 6 – Light Output for Ceiling-Mounted Strobe Lights for Various Room Sizes:

Maximum Area of Coverage (m)	Minimum Light Output, Candela (Effective Luminous Intensity)	
	Maximum Mounting Height (m)	One Light
6.10 x 6.10	3	15
9.14 x 9.14	3	30
12.2 x 12.2	3	60
15.2 x 15.2	3	95
6.10 x 6.10	6	30
9.14 x 9.14	6	45
12.2 x 12.2	6	80
15.2 x 15.2	6	115
6.10 x 6.10	9	55
9.14 x 9.14	9	75
12.2 x 12.2	9	115
15.2 x 15.2	9	150

.3 Table 7 – Corridor Spacing Allocation for Ceiling or Wall-Mounted Strobe Lights:

Corridor Length (m)	Minimum Number of 15 cd Strobe Lights
0 – 9	1
10 – 40	2
41 – 70	3
71 – 100	4
101 – 130	5
131 - 160	6

3.2 SITE TESTS AND INSPECTIONS

.1 Testing, and inspection to Section 28 46.21 11.

.2 Verification to Section 28 46 13.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Fire alarm interfaces to other systems.

1.2 RELATED REQUIREMENTS

.1 Section 26 32 13.13 – Diesel-Engine-Driven Generator Sets.

.2 Section 26 32 13.16 – Gas-Engine-Driven Generator Sets.

.3 Section 26 09 23 – Lighting Control Devices.

.4 Section 27 41 00 – Audio-Video Systems.

.5 Section 27 51 16 – Public Address Systems.

.6 Section 27 51 19 – Sound Masking Systems.

1.3 REFERENCES

.1 Ontario Building Code.

.2 CSA C282:19, Emergency Power Supply for Buildings.

.3 [CAN/ULC-S524-14] [CAN/ULC-S524:2019], Standard for Installation of Fire Alarm Systems.

.4 CAN/ULC-S573:2018, Standard for Installation of Ancillary Devices Connected to Fire Alarm Systems.

.5 CAN/ULC-S1001-11, Standard for Integrated Systems Testing of Fire Protection and Life Safety Systems.

1.4 SUBMITTALS

.1 Submit under provisions of Section 01 33 00.

.2 Product Data: Manufacturer's data sheets on each product to be used, including:

.1 Preparation instructions and recommendations.

.2 Storage and handling requirements and recommendations.

.3 Installation methods.

.3 Operating and Maintenance Data: Include operating, troubleshooting, maintenance, and repair instructions for each item, with lists of spare parts, if any, and name, address, and phone number of local stocking distributors.

1.5 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Stock Materials:

.1 Provide (supply and install) an additional [five] of each door hold open device as directed during construction.

.2 Turn over unused surplus in addition as spare parts.

.2 Tools:

.1 Supply three of each type of any special tools required for system use and maintenance.

1.6 QUALITY ASSURANCE

.1 Installer Qualifications: experienced door hardware installer.

1.7 DELIVERY, STORAGE, AND HANDLING

.1 Store products in manufacturer's unopened packaging until ready for installation.

1.8 WARRANTY

.1 Provide manufacturer's standard warranties:

.1 Magnets: Lifetime warranty.

PART 2 - PRODUCTS

2.1 SYSTEM INTERFACES

.1 Emergency Power Systems:

.1 Provide a Supervisory input for Emergency Power Supply supervisory contacts as follows:

.1 [Generator] Common Alarm.

.2 [Automatic Transfer Switch] “Not in Auto”.

.2 Provide a monitoring input for Emergency Power supply contacts as follows that provides status indication but does not cause an audible alert, and automatically resets:

.1 [Generator] running.

.2 Provide relays to interface with the following systems upon fire alarm signal:

.1 [Lighting Controls]: activate [all] emergency lighting upon alarm.

.2 [Audio-Video Systems] [Sound Masking] [Public Address]: deactivate sound systems upon fire alarm.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Do not begin installation until substrates have been properly prepared.

.2 If substrate preparation is the responsibility of another installer, notify Consultant of unsatisfactory preparation before proceeding.

3.2 PREPARATION

.1 Clean surfaces thoroughly prior to installation.

.2 Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

.1 Install in accordance with manufacturer's instructions.

.2 Test for proper operation with building power energized; coordinate with start-up procedures of other installers.

3.4 SITE TESTS AND INSPECTIONS

.1 Perform functional test in accordance with CAN/ULC-S1001 and Section 28 08 46 to confirm that systems operate as described. Perform test in the presence of the Contractor, sub-trades, Consultant, and applicable vendors.

3.5 PROTECTION

.1 Protect installed products until completion of project.

.2 Repair or replace damaged products before Substantial Performance.

.3 Three bound copies which summarize the training instruction shall be submitted to the Owner for future reference.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Electromagnetic door holders (“hold opens”).

.2 Electromagnetic locks.

.3 [Door operators for bottom of stair OBC SB-4 Measure A.]

.4 Transformers, power supplies, and accessories.

1.2 RELATED REQUIREMENTS

.1 Section 08 06 71 – Door Hardware Schedule.

.2 Section 08 71 00 – Door Hardware: Locksets, exit devices, and other door hardware.

.3 Section 28 15 15 – Electrified Locking Devices and Accessories: electromagnetic locks.

.4 Section 28 46 13 – Fire-Alarm Systems.

.5 Section 28 46 31 – Fire-Alarm Initiating Devices: smoke detectors.

.6 Section 28 46 31.31 – Fire-Alarm Manual Initiating Devices: manual pull stations for doors with electromagnetic locks.

1.3 REFERENCES

.1 Ontario Building Code.

.2 Ontario Building Code – Supplementary Standard SB-4.

.3 [CAN/ULC-S524-14] [CAN/ULC-S524:2019], Standard for Installation of Fire Alarm Systems.

.4 CAN/ULC-S573:2018, Standard for Installation of Ancillary Devices Connected to Fire Alarm Systems.

.5 CAN/ULC-S533-15, Standard for egress door securing and releasing devices.

.6 CAN/ULC-S567, Door closers and electromagnetic door holders.

.7 CAN/ULC-S1001-11, Standard for Integrated Systems Testing of Fire Protection and Life Safety Systems.

.8 NFPA 80-13, Standard for Fire Doors and Other Opening Protectives.

1.4 SUBMITTALS

.1 Submit under provisions of Section 01 33 00.

.2 Product Data: Manufacturer's data sheets on each product to be used, including:

.1 Preparation instructions and recommendations.

.2 Storage and handling requirements and recommendations.

.3 Installation methods.

.3 Shop Drawings: Door Schedule showing each item of hardware to be installed on each door.

.1 Use door numbers on door schedule.

.2 Schedule may be combined with submittals required in other door hardware sections.

.4 Operating and Maintenance Data: Include operating, troubleshooting, maintenance, and repair instructions for each item, with lists of spare parts, if any, and name, address, and phone number of local stocking distributors.

1.5 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Stock Materials:

.1 Provide (supply and install) an additional [five] of each door hold open device as directed during construction.

.2 Turn over unused surplus in addition as spare parts.

.2 Tools:

.1 Supply three of each type of any special tools required for system use and maintenance.

1.6 QUALITY ASSURANCE

.1 Installer Qualifications: experienced door hardware installer.

1.7 DELIVERY, STORAGE, AND HANDLING

.1 Store products in manufacturer's unopened packaging until ready for installation.

1.8 WARRANTY

.1 Provide manufacturer's standard warranties:

.1 Magnets: Lifetime warranty.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 General Requirements: Provide devices suitable for door type, lock type, frame type, dimensions, and overall operation.

.1 Coordinate with doors, frames, and hardware specified in other sections.

.2 Provide all brackets, spacers, shims, lip extensions, strike boxes, and other accessory parts necessary to complete the installation.

.3 Power Supplies or Transformers: Provide all necessary components to supply power to devices from building power distribution system.

2.2 ELECTROMAGNETIC DOOR HOLD OPEN DEVICES

.1 Manufacturers

.1 Allegion/LCN.

.2 SimplexGrinnell.

.3 Fire alarm system manufacturers as noted in Section 28 46 13.

.4 [Substitutions: Not permitted.]

.5 [Requests for substitutions will be considered in accordance with provisions of Section 01 61 00.]

.2 Coordinate with Section 08 71 00.

.3 Provide auxiliary relay to disconnect door holders upon fire alarm.

.4 Description: Units shall be listed under ULC Fire Door Holders Certified for Canada (GTPR7) for wall or floor mounting as indicated and are complete with matching door plate. Unit shall operate from a 120 VAC, a 24 VAC or a 24 VDC source, and develop a minimum of 11.4 kg (25 lbs) of holding force.

.5 Material and Finish: Match door hardware.

.6 Furnish and install where shown on the drawings, magnetic door holders designed for positive release to secure openings as indicated for limiting smoke spread. The units furnished shall be brushed aluminum finish, compatible with the doors as listed in the door schedule as follows:

.1 120 Vac concealed wiring with 11.4 kg (25 lbs) holding force.

.2 120 Vac surface wiring with 11.4 kg (25 lbs) holding force.

.3 120 Vac recessed door with 11.4 kg (25 lbs) holding force.

.4 120 Vac floor mounting, single door with 11.4 kg (25 lbs) holding force.

.5 120 Vac floor mounting, double door with 11.4 kg (25 lbs) holding force.

.6 120 Vac sliding door with 54.4 kg (120 lbs) holding force, grey hammer-tone finish.

.7 120 Vac overhead door with 54.4 kg (120 lbs) holding force, grey hammer-tone finish.

.7 Smoke detectors shall be provided on both sides of doors with hold open devices. Smoke detectors shall be complete with auxiliary relay bases, connected to release the respective hold open device.

.8 Accessories: Provide extension and misalignment rods (various lengths) enabling parallelism between door and wall at distances greater than 300 mm (12 inches) and misalignment over 100 mm (4 inches).

.9 Operation Sequence

.1 Upon detection of smoke at any smoke detector located within 1500 mm (59 in) of the electromagnetically held door, release the door holder. Mechanical closer on the door will close the door to maintain required fire separation.

2.3 ELECTROMAGNETIC LOCKS

.1 Locks to Section 28 15 15.

.2 Manual pull stations:

.1 Provide manual pull station maximum 600 mm horizontally from the door.

.2 Provide auxiliary contact on pull station to deactivate power local electromagnetic lock.

.3 Operation Sequence:

.1 The locking device, and all similar devices in the access to exit leading to the exit door, are installed as ancillary devices to the fire alarm system and release immediately upon activation of:

.1 The alarm signal where a single stage fire alarm system is installed,

.2 The alert signal where a two-stage fire alarm system is installed, or

.3 The alarm signal of a two-stage fire alarm system installed in a care, care and treatment or detention occupancy or in a retirement home,

.2 The locking device releases immediately upon loss of power to the fire alarm control panel or loss of power controlling the electromagnetic locking mechanism and its associated auxiliary controls.

.3 The locking device releases immediately upon actuation of a manually operated switch readily accessible only to authorized personnel and located near the main entrance of the building.

[OR]

.4 The locking device releases immediately upon actuation of a manually operated switch readily accessible only to authorized personnel and located in the Central Alarm and Control Facility.

.5 The locking device releases immediately upon a fault being detected in the electrical circuit between the fire alarm control panel and the controller of the locking device.

.6 The locking device releases immediately upon the operation of a manual pull station for the fire alarm system located on the wall not more than 600 mm from the door.

.7 Provide a bypass for the ancillary relay on the fire alarm system. The operation of any bypass switch, where provided for testing of the fire alarm system, causes an audible signal and a visual signal to be indicated at the fire alarm annunciator panel and at the monitoring station.

2.4 POWERED DOOR OPERATORS IN FIRE SEPARATIONS

.1 References: 2012 OBC 3.1.8.5.(2)(a), NFPA 80.

.2 Sequence of operation: Power-operated fire doors shall be equipped with a releasing device that shall automatically disconnect the power operator at the time of fire, allowing a self-closing or automatic device to close the door regardless of power failure or manual operation.

.3 Provide fire alarm relay to disable each power door operator as noted.

2.5 [SMOKE CONTROL DOOR OPERATORS FOR EXIT STAIR DOORS OPENING TO EXTERIOR (OBC SB-4 MEASURE A)]

.1 Door Operators:

.1 To Section 08 71 00.

.2 Door operator to be complete with Form C dry contact indicating when door is fully open.

.2 Operation Sequence

.1 Door to open upon alarm signal from fire alarm control panel. Door operator complete with dry contact when fully open, dry connected to fire alarm system. Fire alarm panel to annunciate supervisory condition if door is not open while in alarm.

[OR]

.2 Door to open upon signal from fire alarm control panel 2nd stage alarm. Door operator complete with dry contact when fully open, dry connected to fire alarm system. Fire alarm panel to annunciate supervisory condition if door is not open while in 2nd stage alarm.

.3 Refer to 2012 OBC rule 3.2.6.2.(3) and accompanying commentary in MMAH supplementary Standard SB-4, measure A.

.3 Provide manual initiation control and bypass on fire alarm control panel for each stair door operator in the CACF room.

.4 Connect door operator “fully open” door contact to fire alarm system as a supervisory alarm.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Do not begin installation until substrates have been properly prepared.

.2 If substrate preparation is the responsibility of another installer, notify the Consultant of unsatisfactory preparation before proceeding.

3.2 PREPARATION

.1 Clean surfaces thoroughly prior to installation.

.2 Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

.1 Install in accordance with manufacturer's instructions.

.2 Coordinate with installers of other door hardware.

.3 Adjust installed items to operate properly without interfering with operation of door and other hardware.

.4 Test for proper operation with building power energized; coordinate with start-up procedures of other installers.

3.4 INTERFACE WITH OTHER WORK

.1 Connect hold opens to fire alarm system described in Section 28 46 13.

.2 Provide spot smoke detectors to Section 28 46 31.

3.5 SITE TESTS AND INSPECTIONS

.1 Perform functional test in accordance with CAN/ULC-S1001 and Section 28 08 46 to confirm that held doors and fire shutters release and close upon smoke detection with the presence of the Contractor, sub-trades, Consultant, and the door hardware vendor.

3.6 PROTECTION

.1 Protect installed products until completion of project.

.2 Repair or replace damaged products before Substantial Performance.

.3 Three bound copies which summarize the training instruction shall be submitted to the Owner for future reference.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Shutdown relays.

.2 Smoke Control.

1.2 RELATED REQUIREMENTS

.1 Section 23 30 00 – HVAC Air Distribution.

.2 Section 23 34 00 – HVAC Fans.

.3 Section 23 70 00 – Centralized HVAC Equipment.

.4 Section 23 75 00 – Custom Air Handling Units.

.5 Section 28 46 13 – Fire-Alarm Systems.

.6 Section 28 46 31 – Fire-Alarm Initiating Devices: duct mounted smoke detectors.

1.01 REFERENCES

.7 Ontario Building Code.

.8 [CAN/ULC-S524-14] [CAN/ULC-S524:2019], Standard for Installation of Fire Alarm Systems.

.9 CAN/ULC-S573:2018, Standard for Installation of Ancillary Devices Connected to Fire Alarm Systems.

.10 CAN/ULC-S1001-11, Standard for Integrated Systems Testing of Fire Protection and Life Safety Systems.

1.3 SUBMITTALS

.1 Submit under provisions of Section 01 33 00.

.2 Product Data: Manufacturer's data sheets on each product to be used, including:

.1 Preparation instructions and recommendations.

.2 Storage and handling requirements and recommendations.

.3 Installation methods.

.3 Shop Drawings: Door Schedule showing each item of hardware to be installed on each door.

.1 Use door numbers on door schedule.

.2 Schedule may be combined with submittals required in other door hardware sections.

.4 Operating and Maintenance Data: Include operating, troubleshooting, maintenance, and repair instructions for each item, with lists of spare parts, if any, and name, address, and phone number of local stocking distributors.

1.4 QUALITY ASSURANCE

.1 Installer Qualifications: experienced door hardware installer.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Store products in manufacturer's unopened packaging until ready for installation.

1.6 WARRANTY

.1 Provide manufacturer's standard warranties:

.1 Magnets: Lifetime warranty.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 General Requirements: Provide devices suitable for door type, lock type, frame type, dimensions, and overall operation.

.1 Coordinate with doors, frames, and hardware specified in other sections.

.2 Provide all brackets, spacers, shims, lip extensions, strike boxes, and other accessory parts necessary to complete the installation.

.3 Power Supplies or Transformers: Provide all necessary components to supply power to devices from building power distribution system.

2.2 AIR HANDLING UNIT SHUTDOWN RELAYS

.1 Provide duct smoke detectors in the supply air duct of air handling units feeding more than one storey, or more than one suite in a storey.

.2 Provide a relay to shut down the air handling system upon detection of smoke at the aforementioned smoke detector.

2.3 [HVLS FANS]

.1 In buildings equipped with sprinklers, all HVLS (High Volume, Low Speed) fans shall be interlocked to shut down immediately upon receiving a sprinkler waterflow signal via the fire alarm system.

2.4 [SMOKE DAMPERS]

.1 Smoke dampers and combination smoke and fire dampers shall be configured so as to close automatically upon a signal from an adjacent smoke detector located as described in CAN/ULC-S524, “Installation of Fire Alarm Systems”, within 1.5 m horizontally of the duct or air-transfer opening in the fire separation,

.1 on both sides of the air-transfer opening, or

.2 in the duct downstream of the smoke damper or combination smoke and fire damper.

.2 Provide smoke detectors in accordance with code requirements for control of smoke dampers.

2.5 [SMOKE CONTROL ANNUNCIATOR]

.1 On/Auto/Off switches and status indicators (LEDS) shall be provided for monitoring and manual control of each fan, damper, HVAC control unit, stairwell pressurization fan, and smoke exhaust fan. To ensure compliance the units supplied shall meet the following UL categories: UUKL, PAZX, UDTZ, QVAX as well as the requirements of NFPA 90A, HVAC, and NFPA 92A & 92B, Smoke Control. The control System shall be field programmable for either 90A operation or 92A/B operation to allow for future use and system expansion.

.2 The OFF LED shall be Yellow, the ON LED shall be green, the Trouble/Fault LED shall be Amber/Orange for each switch. The Trouble/Fault indicator shall indicate a trouble in the control

and/or monitor points associated with that switch. In addition, each group of eight switches shall have two LEDS and one momentary switch which allow the following functions: An Amber LED to indicate an OFF-NORMAL switch position, in the ON or OFF position; A Green LED to indicate ALL AUTO switch position; A Local Acknowledge/Lamp Test momentary switch.

.3 Each switch shall have the capability to monitor and control two addressable inputs and two addressable outputs. In all modes, the ON and OFF indicators shall continuously follow the device status not the switch position. Positive feedback shall be employed to verify correct operation of the device being controlled. Systems that indicate on/off/auto by physical switch position only are not acceptable.

.4 [All HVAC switches (i.e., limit switches, vane switches, etc.) shall be provided and installed by the HVAC contractor.]

.5 It shall be possible to meet the requirements mentioned above utilizing wall mounted custom graphic.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Do not begin installation until substrates have been properly prepared.

.2 If substrate preparation is the responsibility of another installer, notify the Consultant of unsatisfactory preparation before proceeding.

3.2 PREPARATION

.1 Clean surfaces thoroughly prior to installation.

.2 Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

.1 Install in accordance with manufacturer's instructions.

.2 Coordinate with installers of other door hardware.

.3 Adjust installed items to operate properly without interfering with operation of door and other hardware.

.4 Test for proper operation with building power energized; coordinate with start-up procedures of other installers.

3.4 SITE TESTS AND INSPECTIONS

.1 Perform functional test to confirm that held doors release upon smoke detection.

3.5 PROTECTION

.1 Protect installed products until completion of project.

.2 Repair or replace damaged products before Substantial Performance.

.3 Three bound copies which summarize the training instruction shall be submitted to the Owner for future reference.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Automatic door controls for restrooms.

.2 Emergency call systems for universal and barrier-free restrooms.

.3 Automatic door relay controls.

.4 Automatic door activation.

.5 Automatic door wireless activation.

1.2 RELATED REQUIREMENTS

.1 Section 08 71 00 – Hardware: requirements for door operators and electric strikes interconnected with this equipment.

.2 Section 26 05 00 – Common Work Results for Electrical.

1.3 REFERENCES

.1 ANSI A117.1 - Accessible and Usable Buildings and Facilities.

.2 ANSI A156.19 - Standard for Power Assist and Low Energy Power Operated Doors.

.3 Ontario Building Code 2012, section 3.8.3.12.(2) – Universal Washrooms.

1.4 SUBMITTALS

.1 Submit under provisions of Section 01 33 00 – Submittal Procedures.

.2 Product Data: Manufacturer's data sheets on each product to be used, including:

.3 Preparation instructions and recommendations.

.4 Storage and handling requirements and recommendations.

.5 Installation methods.

.6 Shop Drawings: Electrical schematic, device mounting requirements and rough-in for recessed devices.

.7 Verification Samples: For each finish product specified, two samples, minimum size 150 mm (6 in) square representing actual product, color, and patterns.

1.5 CLOSEOUT SUBMITTALS

.1 Functional test report.

.2 Training attendance records.

1.6 QUALITY ASSURANCE

.1 Manufacturer Qualifications: Minimum 5 year experience manufacturing similar products.

.2 Installer Qualifications: Minimum 2 year experience installing similar products.

.3 Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.

.1 Finish areas designated by Architect.

.2 Do not proceed with remaining work until workmanship is approved by the Consultant.

.3 Rework mock-up area as required to produce acceptable work.

1.7 PRE-INSTALLATION MEETINGS

.1 Convene minimum two weeks prior to starting work of this section.

1.8 DELIVERY, STORAGE, AND HANDLING

.1 Deliver and store products in manufacturer's unopened packaging bearing the brand name and manufacturer's identification until ready for installation.

.2 Handling: Handle materials to avoid damage.

1.9 PROJECT CONDITIONS

.1 Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by the manufacturer for optimum results. Do not install products under environmental conditions outside the manufacturer's recommended limits.

1.10 SEQUENCING

.1 Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.11 WARRANTY

.1 Manufacturer's Warranty: Provide manufacturer's warranty for defective parts for a three-year period from the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Camden Door Controls (basis of design).

.2 Substitutions: Thomas Door & Security Hardware, TA-3230C-KIT.

2.2 EMERGENCY CALL SYSTEMS FOR UNIVERSAL RESTROOMS

.1 Performance:

.1 Emergency Call System shall comply with the latest requirements of the Ontario Building Code (OBC), effective January 1, 2015.

.2 Emergency Call System shall be designed to provide a washroom occupant with the ability to request emergency assistance, to receive visual and audible confirmation that their request has been made, and visual and audible notification to building staff and occupants outside the restroom of an emergency condition.

.2 Product: Emergency Call Systems For Universal and Barrier Free Restrooms – CX-WEC10K2 System as manufactured by Camden Door Controls.

.1 Operation: the 'Press For Emergency Assistance' mushroom push button is activated by the occupant. This energizes the LED annunciator and sounder within the washroom and the dome

light with sounder outside the washroom. Both annunciators will be energized until the latching mushroom push button switch is pulled out.

.2 Components:

.1 The following items are part of the CX-WEC10K2 equipment package:

.1 CM-AF540SO Double gang, push/pull mushroom push button, red, 'Assistance Required', w/ LED annunciator and adjustable sounder, 'Assistance Requested'.

.1 ‘Press for Emergency Assistance’ switch, ‘Push/Pull’ operation 41.27 mm (1-5/8”) vandal resistant red button, N/O and N/C contacts, rated 10 Amp @ 30 VDC and permanently laser etched graphics (black).

.2 Single gang LED annunciator with adjustable sounder rated 85 dB at 102 mm (4 in), weather and vandal-resistant construction, brushed stainless steel faceplate, with 'ASSISTANCE REQUESTED'. ‘White Out’ text shall not be legible unless the annunciator is energized.

.3 Heavy gauge stainless steel double gang faceplate.

.2 CM-AF141SO: Single gang LED dome light with adjustable piezo sounder, rated 93 dB at 1 m (3 feet), weather (indoor/outdoor) and vandal resistant construction, white. 180 degree visibility with ‘ASSISTANCE REQUIRED' text printed on two sides of the lens.

.3 CM-SE21A: sign, to be located above the activation switch, 1.6 mm (1/16 in), 152 mm high by 270 mm wide (6 in by 10-5/8 in), fire-rated expanded PVC white with 25 mm (1 in) red lettering. The text shall be “IN THE EVENT OF AN EMERGENCY PUSH EMERGENCY BUTTON AND AUDIBLE AND VISUAL SIGNAL WILL ACTIVATE”.

.2 The following items are required, but not included in the CX-WC11 equipment package:

.1 CX-PS13 24V linear power supply and CX-TRX-4024 UL listed 40 VA transformer.

.2 Electric Strike: CX-ED2079 ('Universal' Grade 2 Electric Strike).

.3 Contact for Pushbutton (normally closed CM-4000/61N).

.4 Door contact.

2.3 AUTOMATIC DOOR CONTROLS FOR RESTROOMS

.1 Performance:

.1 Automatic door controls shall comply with Americans with Disability Act.

.1 Regulatory compliance with Accessibility Guidelines (ADAAG) and the Uniform Federal Accessibility Standard (UFAS) as required by Authority Having Jurisdiction (AHJ).

.2 Automatic door controls shall comply with National Building Code of Canada.

.3 Automatic door controls shall comply with NFPA National Fire Code or International Fire Code for restroom doors acting as egress doors as required by Authority Having Jurisdiction (AHJ).

.4 Emergency Power: System shall be provided with an emergency power connection.

.2 Product: Push Button and Annunciator Restroom Control System - CX-WC11 as manufactured by Camden Door Controls.

.1 Operation:

.1 The door is normally closed and either locked or unlocked. Pressing the exterior push plate unlocks and opens the door. Once inside and the door is closed, pressing the 'Push to Lock' mushroom pushbutton locks the door, disables the exterior ' Push to Open' push plate switch and illuminates the exterior annunciator to show ' Occupied when Lit'. Pressing the interior push plate switch unlocks the door, deactivates the illuminated annunciator, and resets the system. If the door is opened manually to exit the restroom, the overhead magnetic contact switch resets the system.

.2 Status: Normally locked. Fail secure electric strike.

.3 Status: Normally unlocked. Fail safe electric strike.

.2 Components:

.1 The following items are part of the CX-WC11 equipment package:

.1 CX-33PS includes Advanced Logic Control Relay and 2 Amp Power Supply in pre-wired metal cabinet.

.2 CM-45/4 114 mm (4.5 in) square activation (wall) switch (2 required), stainless steel construction, N/O contacts rated 15 Amps @ 30 VDC and paint filled debossed ‘wheelchair symbol and ‘Push To Open’ graphics (blue). Mounted on in-wall single gang electrical box.

.3 CM 400/8 ‘Push to Lock’ Mushroom Push Button with heavy duty brushed stainless steel faceplate, 40 mm (1-5/8”) vandal resistant red button and N/O contacts rated 10 Amps @ 30 VDC.

.4 CM-AF500 Single Gang LED Annunciator, with heavy duty 18 gauge, vandal resistant stainless steel faceplate, ‘Occupied When Lit’ ‘white out’ text, super-bright LEDs, 10 VDC to 36 VDC voltage, max. 40 mA current draw.

.5 CX-MDA surface mount SPST N/C Magnetic Door Contact.

.6 CX-ED2079 Electric Strike, grade 2 ‘universal’ strike for cylindrical locksets c/w 3 faceplates, 12/24V AC/DC, selectable fail safe/fail secure. The strike shall have horizontal faceplate adjustment.

.2 The following items are required, but not included in the CX-WC11 equipment package:

.1 CX-PS13 12/24V linear power supply and CX-TRX-4024 UL listed 40 VA transformer.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Do not begin installation until substrates have been properly prepared.

.2 If substrate preparation is the responsibility of another installer, notify the Consultant of unsatisfactory preparation before proceeding.

3.2 PREPARATION

.1 Clean surfaces thoroughly prior to installation.

.2 Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

.1 Install in accordance with manufacturer's instructions.

.1 Install push button and the red “assistance requested’ annunciator ganged together adjacent to the toilet.

.2 Install the emergency push button adjacent to the toilet, and post the sign above the emergency button.

.3 Install the dome light at exterior of the universal washroom, above the door of the washroom.

.4 Install conduit between system components, and install wiring as directed by manufacturer.

.2 Provide all low voltage control wiring between system components.

.3 [Connect emergency push button to remote duress system where noted on plans.]

3.4 FIELD QUALITY CONTROL

.1 Perform test of system in the presence of the Owner. Submit report documenting the test was completed.

3.5 DEMONSTRATION AND TRAINING

.1 Manufacturer's representative shall provide on-site training of staff and maintenance of operation, maintenance and "trouble/error" detection/correction.

3.6 PROTECTION

.1 Protect installed products until completion of project.

.2 Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

Part 1 - General

1.1 RELATED REQUIREMENTS

.1 Section 31 05 16 Aggregates for Earthworks

.2 Section 31 23 33.01 Excavation, Trenching and Backfilling

.3 Section 31 32 19.16 Geotextile Soil Stabilization

.4 Section 01 57 00 Temporary Erosion and Sediment Control

1.2 REFERENCE STANDARDS

.1 Ontario Provincial Standard Specifications (OPSS)

.1 OPSS 206: Grading

.2 OPSS 510 Removal

.3 OPSS 517 Dewatering

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Sustainable Design Submittals:

.1 Erosion and Sedimentation Control: submit erosion and sedimentation control plan in accordance with authorities having jurisdiction.

.2 Regional Materials: Not Used

Part 2 - Products

2.1 MATERIALS

.1 To Section 31 05 16 Aggregates for Earthwork.

Part 3 - Execution

3.1 EXAMINATION

.1 Verification of Conditions:

.1 Examine soil report.

.2 Before commencing work establish locations of buried services on and adjacent to the site.

.2 Evaluation and Assessment:

.1 Arrange with appropriate authority for relocation of buried services that interfere with the execution of the Work. Pay costs of relocating services.

.2 Testing of materials and compaction of backfill and fill will be carried out by a testing laboratory designated by the Contractor.

.3 Not later than 48 hours before backfilling or filling with approved material, notify the Consultant so that compaction tests can be carried out by designated testing agency.

.4 Before commencing work, conduct, with the Consultant, a condition survey of existing structures, trees and plants, lawns, fencing, service poles, wires, rail tracks and paving, survey bench marks and monuments which may be affected by work.

3.2 PREPARATION

.1 Temporary Erosion and Sedimentation Control:

.1 Use temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, in accordance with Section 01 57 00.

.2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

.3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

.2 Protection of in-place conditions:

.1 Protect excavations from freezing.

.2 Keep excavations clean, free of standing water, and loose soil.

.3 Where soil is subject to significant volume change due to change in moisture content, cover and protect to Consultant's approval.

.4 Protect natural and man-made features required to remain undisturbed. Unless otherwise indicated or located in an area to be occupied by new construction, protect existing trees from damage.

.5 Protect buried services that are to remain undisturbed.

.3 Removal:

.1 Remove obsolete buried services within 2 m of foundations. Cap cut-offs.

.2 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.

.3 Cut pavement or sidewalk neatly along the limits of the proposed excavation in order that surface may break evenly and cleanly.

.4 Remove trees, stumps, logs, brush, shrubs, bushes, vines, undergrowth, rotten wood, dead plant material, exposed boulders and debris within areas designated on drawings.

.5 Remove stumps and tree roots below footings, slabs, and paving, and to 600mm below finished grade elsewhere.

3.3 EXCAVATION

.1 Shore and brace excavations protect slopes and banks and perform work in accordance with provincial and municipal regulations.

.2 Do blasting in accordance with provincial and municipal regulations. Repair damage to approval of the Consultant. No blasting will be permitted within 3 m of any building and where damage would result.

.3 Excavate as required to carry out work, in all materials met.

.1 Do not disturb soil or rock below bearing surfaces. Notify the Consultant when excavations are complete.

.2 If bearings are unsatisfactory, additional excavation will be authorized in writing and paid for as additional work.

.3 Fill excavation taken below depths shown without the Consultant's written authorization with concrete of same strength as for footings.

.4 Excavate trenches to provide uniform continuous bearing and support for 150mm thickness of pipe bedding material on solid and undisturbed ground. Trench widths below point 150mm above pipe not to exceed diameter of pipe plus 600 mm.

.5 Excavate for slabs and paving to subgrade levels.

.1 Remove topsoil, organic matter, debris and other loose and harmful matter encountered at subgrade level.

3.4 SITE QUALITY CONTROL

.1 Fill material and spaces to be filled to be inspected and approved by the Consultant.

3.5 BACKFILLING

.1 Start backfilling only after inspection and receipt of written approval of fill material and spaces to be filled from the Consultant.

.2 Remove snow, ice, construction debris, organic soil and standing water from spaces to be filled.

.3 Lateral support: maintain even levels of backfill around structures as work progresses, to equalize earth pressures.

.4 Compaction of subgrade: compact existing subgrade under walks, paving, and slabs on grade, to same compaction as specified for fill. Fill excavated areas with gravel and sand compacted as specified for fill.

.5 Placing:

.1 Place backfill, fill and basecourse material in 150 mm lifts. Add water as required to achieve specified density.

.2 Place unshrinkable fill in areas as indicated. Consolidate and level unshrinkable fill with internal vibrators.

.6 Compaction: compact each layer of material to following densities for material to ASTM D698 in accordance with municipal standards.

.7 Under slabs and paving:

.1 As per Owner's geotechnical engineer's recommendations.

.8 In trenches:

.1 Up to 300 mm above pipe or conduit: sand placed by hand.

.2 Over 300 mm above pipe or conduit: as indicated on drawings.

.9 Under seeded and sodded areas: use site excavated material to the bottom of topsoil except in trenches and within 600 mm of foundations.

.10 Blown rock material, not capable of fine grading, is not acceptable, imported material must be placed on this type of material.

.11 Against foundations (except as applicable to trenches and under slabs and paving): excavated material or imported material with no stones larger than 200 mm diameter within 600 mm of structures.

.12 Underground tanks: use sand to the bottom of granular base courses or to the bottom of topsoil, as applicable.

3.6 GRADING

.1 Grade to ensure that water will drain away from buildings, walls and paved areas, to catch basins and other disposal areas approved by the Consultant. Grade to be gradual between finished spot elevations as indicated.

3.7 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Dispose of cleared and grubbed material off site daily.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Aggregate materials.

1.2 RELATED SECTIONS

.1 Section 31 05 13 - Soil Materials.

.2 Section 31 22 13 - Rough Grading.

.3 Section 31 22 19 - Finish Grading.

.4 Section 31 23 33.01- Excavating, Trenching And Backfilling

.5 Section 33 14 16 - Site Water Utility Distribution Piping.

.6 Section 33 31 11 - Site Sanitary Sewerage Piping.

.7 Section 33 41 00 - Storm Utility Drainage Piping

.8 Section 32 11 23 - Aggregate Base Course.

1.3 REFERENCES

.1 AASHTO M 147-65(2008) - Standard Specification for Materials for Aggregate and Soil-Aggregate Subbase, Base, and Surface Courses.

.2 AASHTO T 180-10 - Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 inch) Drop.

.3 ASTM C136-06 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.4 ASTM D698-12 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft3 (600 kN-m/m3)).

.5 ASTM D1557-12 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).

.6 ASTM D2167-08 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.

.7 ASTM D2487-11 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).

.8 ASTM D4318-10 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.4 SUBMITTALS FOR REVIEW

.1 Section 01 33 00: Submission procedures.

.2 Samples: Submit, in air-tight containers, 5 samples of each aggregate or mixture to be incorporated into the project to the testing laboratory designated by the owner.

.3 Submit the name of each material supplier and the specific type and source of each material. Any change in source throughout the job requires the approval of the Owner and Engineer.

.4 Submit materials certificate to on-site independent testing laboratory which is signed by the material producer and Contractor, certifying that materials comply with, or exceed, the requirements herein.

1.5 SUBMITTALS FOR INFORMATION

.1 Section 01 33 00: Submission procedures.

.2 Materials Source: Submit the name of imported materials suppliers.

.3 Sustainable Design:

.1 Manufacturer's Certificate: Certify that Products meet or exceed local municipal and provincial Standards.

1.6 CLOSEOUT SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Sustainable Design Closeout Documentation: Sieve analysis and compaction reporting

1.7 QUALITY ASSURANCE

.1 Perform Work in accordance with provincial & local municipal standards.

Part 2 Products

2.1 COARSE AGGREGATE MATERIALS

.1 Coarse Aggregate: Conforming to Provincial & Local Municipal standards for each type of material as identified within the provided plans and/or the geotechnical report.

.1 Sieve Size | Percent Passing.

.1 50 mm [100].

.2 25 mm [95].

.3 19 mm [95] to [100].

.4 16 mm [75] to [100].

.5 10 mm [55] to [85].

.6 4.75 mm [35] to [60].

.7 450 micro m [10] to [25].

.8 1.18 mm [15] to [35].

.9 75 micro m [5] to [10].

2.2 FINE AGGREGATE MATERIALS

.1 Conforming to Provincial & Local Municipal standards for each type of material as identified within the provided plans and/or the geotechnical report.

.1 Sieve Size | Percent Passing.

.1 4.75 mm [100].

.2 1.40 mm [10] to [100]0.

.3 300 micro m [5] to [90].

.4 150 micro m [4] to [30].

.5 75 micro m [0].

2.3 SOURCE QUALITY CONTROL

.1 Fine Aggregate Material - Testing and Analysis: Perform in accordance with Provincial and Local municipal standards.

.2 If tests indicate materials do not meet specified requirements, change material or material source and retest.

.3 Provide materials of each type from the same source throughout the Work.

Part 3 Execution

3.1 STOCKPILING

.1 Stockpile materials on site at locations designated by the Consultant and/or as indicated on the Contrac Drawings.

.2 Stockpile in sufficient quantities to meet Project schedule and requirements.

.3 Separate differing materials with dividers or stockpile them apart to prevent mixing.

.4 Direct surface water away from the stockpile site to prevent erosion or deterioration of materials.

3.2 STOCKPILE CLEANUP

.1 Remove the stockpile and leave the area in a clean and neat condition. Grade site surface to prevent free standing surface water.

.2 Leave unused materials in a neat, compact stockpile.

.3 If a borrow area is indicated, leave the area in a clean and neat condition. Grade site surface to prevent free standing surface water.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Removal of subsoil and stripping of topsoil.

.2 Cutting, grading, compacting, rough contouring, and filling the site for site structures and building pads.

1.2 RELATED SECTIONS

.1 Section 31 05 10 - Corrected Maximum Dry Density for Fill

.2 Section 31 05 16- Aggregate Materials

.3 Section 31 22 19 - Finish Grading

.4 Section 31 23 33.01 Excavating, Trenching and Backfilling

1.3 REFERENCES

.1 AASHTO T 180-10 - Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 inch) Drop.

.2 ASTM C136-06 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.3 ASTM D698-12 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft3 (600 kN-m/m3)).

.4 ASTM D1556-07 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.

.5 ASTM D1557-12 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).

.6 ASTM D2167-08 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.

.7 ASTM D2419-09 - Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.

.8 ASTM D2434-68(2006) - Standard Test Method for Permeability of Granular Soils (Constant Head).

.9 OPSS 206 Grading

.10 OPSS 401 - Trenching, Backfilling, and Compacting

.11 OPSS 510 Removal

.12 OPSS 802 - Topsoil

1.4 SUBMITTALS FOR INFORMATION

.1 Section 01 33 00: Submission procedures.

.2 Sustainable Design:

.1 Not Used

1.5 CLOSEOUT SUBMITTALS

.1 Section 01 78 10: Submission procedures.

.2 Record Documentation: Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.

.3 Sustainable Design Closeout Documentation: Geotechnical reporting on material type and compaction methods and results.

1.6 QUALITY ASSURANCE

.1 Perform Work to provincial & local municipal standards.

Part 2 Products

2.1 MATERIALS

.1 Topsoil: as specified in OPSS 802.

.2 Subsoil Fill: Native fill or imported fill per OPSS 206.

Part 3 Execution

3.1 EXAMINATION

.1 Verify existing conditions before starting work.

.2 Verify that the survey benchmark and intended elevations for the Work are as indicated.

3.2 PREPARATION

.1 Identify required lines, levels, contours, and datum.

.2 Stake and flag locations of known utilities.

.3 Locate, protect, and identify utilities that remain, from damage.

.4 Notify the local utility authority to remove and/or relocate utilities.

.5 Protect above and below grade utilities that remain.

.6 Protect plant life, lawns and other features remaining as a portion of final landscaping.

.7 Protect benchmarks, paving, fences, sidewalks, curbs and existing structures from excavating equipment and vehicular traffic.

3.3 SUBSOIL EXCAVATION

.1 Excavate subsoil from areas identified as cut areas on the provided plans.

.2 Do not excavate wet subsoil or excavate and process wet material to obtain optimum moisture content.

.3 When excavating through roots, perform work by hand and cut roots with a sharp axe.

.4 Remove subsoil from the site.

.5 Stockpile in the area designated on site to a depth not exceeding 2.5 m and protect from erosion. Remove from the site, and subsoil is not being reused. Removal per OPSS 510.

.6 Benching Slopes: Horizontally bench existing slopes greater than 3:1 to key placed fill material to slope to provide a firm bearing.

.7 Stability: Replace damaged or displaced subsoil to the same requirements as for specified fill.

3.4 FILLING

.1 Install Work in accordance with the Contract Documents.

.2 Fill areas to contours and elevations with unfrozen materials.

.3 Place fill material on continuous layers and compact in accordance with the schedule at end of this section.

.4 Maintain optimum moisture content of fill materials to attain the required compaction density.

.5 Make grade changes gradual. Blend slope into level areas. Compaction per Section 31 23 33.01 - Excavating, Trenching and Backfilling.

.6 Remove surplus fill materials from the site. Removal per OPSS 510.

3.5 TOLERANCES

.1 Top Surface of Subgrade: Plus or minus 30 mm from the required elevation.

3.6 FIELD QUALITY CONTROL

.1 Testing: To Provincial and local municipal standards.

.2 If tests indicate Work does not meet specified requirements, remove Work, replace and retest.

END OF SECTION

SEE ADD#4
Q#126

PART 1 - GENERAL

.1 DESCRIPTION

.1 This section specifies the quality and placement of topsoil and finish grading operations.

.2 Related work specified elsewhere:
Trees, Shrubs, and Groundcover - Section 32 93 00

.2 SOURCE QUALITY CONTROL

.1 Advise Landscape Architect of sources of topsoil to be utilized seven (7) days in advance of starting work.

.2 Contractor is responsible for soil analysis and requirements for amendments to supply topsoil as specified.

.3 MEASUREMENT FOR PAYMENT

.1 Supplying, placing and spreading topsoil will be measured in cubic metres as determined from actual surface area covered and depth of topsoil specified. Specified depth of topsoil shall be measured and approved by the Landscape Architect after settlement and consolidation as specified.

.2 Finish grading will be measured in square metres from actual surface measurements as determined by the Landscape Architect.

PART 2 - PRODUCTS

.1 TOPSOIL

.1 Topsoil: mixture of mineral particulates, micro-organisms, and organic matter which provides a suitable medium for supporting intended plant growth.

.1 Soil texture based on the Canadian System of Soil Classification, to consist of 20 - 70% sand and contain 2 - 10% organic matter by weight.

.2 Fertility: major soil nutrients present in the following ratios:
- Nitrogen (N): 20 - 40 micrograms of available N per gram of topsoil.
- Phosphorus (P): 10 - 20 micrograms of phosphate per gram of topsoil.
- Potassium (K): 80 - 120 micrograms of potash per gram of topsoil.
- Calcium, magnesium, sulfur and micro-nutrients present in balanced ratios to support germination and / or establishment of intended vegetation.

.3 Ph value: 6.5 - 8.0

.4 Contain no toxic elements or growth inhibiting materials.

.5 Free from debris and stones over 50mm diameter and course vegetative material, 10mm diameter and 100mm length, occupying more than 2% of soil volume.

.6 Consistence: friable when moist.

.2 SOIL AMENDMENTS

.1 Peatmoss:

.1 Derived from partially decomposed species of Sphagnum Mosses.

.2 Elastic and homogeneous , brown in colour.

.3 Free of wood and deleterious material which could prohibit growth.

.4 Shredded particle minimum size: 15mm

.2 Sand: washed course silica sand, medium to course textured.

.3 Limestone:

.1 Ground agricultural limestone containing minimum calcium carbonate equivalent of 85%.

.2 Gradation requirements: percentage passing by weight, 90% passing 1.0mm sieve, 50% passing 0.125mm sieve.

.4 Fertilizer: complete, commercial, with 35% soluble nitrogen.

PART 3 - EXECUTION

.1 PREPARATION OF EXISTING GRADE

.1 Verify that grades are correct. If discrepancies occur, notify the Landscape Architect or Engineer and do not commence work until instructed to by the Landscape Architect or Engineer.

.2 Grade soil, eliminating uneven areas and low spots, ensuring positive drainage.

.3 Remove debris, roots, branches, stones in excess of 50mm diameter and other deleterious materials. Remove soil contaminated with calcium chloride, toxic materials and petroleum products. Remove debris which protrudes more than 75mm above ground surface. Dispose of removed material off site.

.2 PLACING AND SPREADING OF TOPSOIL

.1 Place topsoil after Landscape Architect has accepted subgrade.

.2 Spread topsoil in uniform layers not exceeding 150mm, over unfrozen subgrade free of standing water.

.3 Spread topsoil to the following minimum depth after settlement and 80% compaction.

Planting beds	18" - 450mm minimum
Sodded and Seeded Area	4" - 100mm minimum

.4 Manually spread topsoil around any obstacles.

.3 SOIL AMENDMENTS

.1 Amendment to topsoil for use in planting beds and turf areas to be determined upon receipt of the required soils test.

.4 FINISH GRADING

.1 Grade to eliminate rough spots and low areas and ensure positive drainage. Prepare loose friable bed by means of cultivation and

subsequent raking.

.2 Consolidate topsoil to required bulk density using equipment approved by Landscape Architect. Leave surfaces smooth, uniform, and firm against deep footprinting.

.5 ACCEPTANCE

.1 Landscape Architect will inspect and test topsoil in place and determine acceptance of material, depth of topsoil, and finish grading. Approval of topsoil material subject to soil testing and analysis.

.2 Testing of topsoil will be carried out by a testing laboratory designated by the Landscape Architect. Soil sampling, testing and analysis to be in accordance with Provincial regulations and standards.

.6 SURPLUS MATERIAL

.1 Dispose of materials not required, as directed by the Landscape Architect, off site.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Final grading for topsoil, sodding and landscaping.

1.2 RELATED SECTIONS

.1 Section 01 71 00 - Examination and Preparation

.2 Section 31 05 10 - Corrected Maximum Dry Density for Fill

.3 Section 31 05 16 - Aggregate Materials

.4 Section 31 23 33.01 - Excavating, Trenching and Backfilling

Part 2 Products

2.1 MATERIALS

.1 Topsoil – In accordance with OPSS 802

.2 Refer to landscaping material specifications.

Part 3 Execution

3.1 EXAMINATION

.1 Verify existing conditions before starting work.

.2 Verify building and trench backfilling have been inspected.

.3 Verify substrate base has been contoured and compacted.

3.2 SUBSTRATE PREPARATION

.1 Eliminate uneven areas and low spots.

.2 Remove debris, roots, branches, and stones, in excess of 50 mm in size. Remove subsoil contaminated with petroleum products.

.3 Scarify the surface to a depth of 75 mm where topsoil is scheduled. Scarify in areas where equipment used for hauling and spreading topsoil has compacted subsoil.

3.3 PLACING TOPSOIL

.1 Place topsoil in areas where sodding is required to a nominal depth of 150mm. Place topsoil during dry weather.

.2 Fine grade topsoil to eliminate rough or low areas. Maintain profiles and contour of subgrade.

.3 Remove roots, weeds, rocks, and foreign material while spreading.

.4 Manually spread topsoil close to plant life and the building to prevent damage.

.5 Remove surplus subsoil and topsoil from the site.

.6 Leave stockpile area and site clean and raked, ready to receive landscaping.

3.4 TOLERANCES

.1 Top of Topsoil: Plus or minus 13 mm.

3.5 PROTECTION OF FINISHED WORK

.1 Protect landscaping and other features remaining as final work.

.2 Protect existing structures, utilities, paving, fences, sidewalks, and curbs.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Excavating trenches for utilities as per the designed on site servicing plan.

.2 Compacted fill from the top of utility bedding to subgrade elevations.

.3 Backfilling and compaction.

1.2 RELATED SECTIONS

.1 Section 01 52 00 - Construction Facilities and Temporary Controls: Water control in excavations.

.2 Section 31 05 10 - Corrected Maximum Dry Density for Fill

.3 Section 31 05 16 - Aggregate Materials

.4 Section 31 22 13 - Rough Grading

.5 Section 31 22 19 - Finish Grading

.6 Section 33 14 16 - Site Water Utility Distribution Piping:

.7 Section 33 31 11 - Site Sanitary Sewerage Piping

.8 Section 01 70 00 - Examination And Preparation

.9 Section 01 45 00: Quality Control

1.3 REFERENCES

.1 AASHTO T 180-10 - Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 inch) Drop.

.2 ASTM C136-06 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.3 ASTM D698-12 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft3 (600 kN-m/m3)).

.4 ASTM D1556-07 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.

.5 ASTM D1557-12 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).

.6 ASTM D2167-08 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.

.7 OPSS 401 Trenching, Backfilling, And Compacting

.8 OPSS 510 Removal

.9 OPSS 517 Dewatering for Excavation

.10 The Town of East Gwillimbury Engineering Standards and Design Criteria

1.4 DEFINITIONS

.1 Utility: Any buried pipe, duct, conduit, or cable.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Coordination:

.1 Coordinate with other work having a direct bearing on the Work of this Section.

.2 Verify work associated with lower elevation utilities is complete before placing higher elevation utilities.

1.6 SUBMITTALS FOR INFORMATION

.1 Section 01 33 00: Submission procedures.

.2 Sustainable Design:

.1 Not Used

1.7 CLOSEOUT SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Sustainable Design Closeout Documentation: Not Used

Part 2 Products

2.1 FILL MATERIALS

.1 Structural Fill Type: As specified in Sections 33 14 16 Site Water Utility Distribution Piping, 33 31 11 Public Sanitary Sewerage Gravity Piping and 33 41 00 Storm Utility Drainage Piping.

.2 Concrete: Lean concrete.

.3 Concrete: Structural concrete with a compressive strength of 32 MPa.

2.2 ACCESSORIES

.1 Geotextile/ Filter Fabric: Non-biodegradable, non-woven.

.1 Product: 270 R, manufactured by TerraFix

Part 3 Execution

3.1 EXAMINATION

.1 Section 01 70 00: Verify existing conditions before starting work.

.2 Verify that the survey benchmark, control point, and intended elevations for the Work are as shown on the drawings.

3.2 PREPARATION

.1 Identify required lines, levels, contours, and datum locations.

.2 Protect plant life, lawns and other features remaining as a portion of final landscaping.

.3 Protect benchmarks, curbs, sidewalks, fences, paving, existing structures, and fences, from excavating equipment and vehicular traffic.

.4 Maintain and protect above and below grade utilities which are to remain.

.5 Cut out soft areas of subgrade not capable of compaction in place. Backfill with Suitable Fill and compact to a density equal to or greater than requirements for subsequent backfill material.

3.3 EXCAVATING

.1 Excavate subsoil required for utilities as designed on the provided plans in accordance with OPSS 401 and OHSA.

.2 Cut trenches sufficiently wide to enable installation and allow inspection. Remove water or materials that interfere with the Work.

.3 Do not interfere with 45 degree bearing splay of foundations.

.4 Hand trim excavation and remove loose matter.

.5 Remove lumped subsoil, boulders, and rock up to 0.25 cu m, measured by volume.

.6 Correct areas over excavated in accordance with Section 31 23 23.

.7 Stockpile excavated material in an area designated on site and/or remove excess material not required from the site.

.8 Remove excavated material from the site in accordance with OPSS 501.

.9 Dewater excavation as required in accordance with OPSS 517.

3.4 BACKFILLING

.1 Backfill trenches to contours and elevations with unfrozen fill materials.

.2 Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.

.3 Place geotextile fabric over Structural Fill Type prior to placing the next lift of fill.

.4 Granular Fill: Place and compact materials in equal continuous layers not exceeding 200 mm compacted depth.

.5 Employ a placement method that does not disturb or damage foundation perimeter drainage and utilities in the trench.

.6 Maintain optimum moisture content of fill materials to attain the required compaction density.

.7 Remove surplus fill materials from the site. Removals per OPSS 510.

.8 Leave fill material stockpile areas completely free of excess fill materials.

3.5 TOLERANCES

.1 Top Surface of Backfilling Under Paved Areas: Plus or minus 15 mm from required elevations.

.2 Top Surface of General Backfilling: Plus or minus 25 mm from required elevations.

3.6 FIELD QUALITY CONTROL

.1 Section 01 45 00: Quality Control

.2 Compaction testing will be performed per Geotechnical Engineer's recommendations.

.3 If tests indicate the Work does not meet specified requirements, remove the deficient Work, replace, compact, and retest.

3.7 PROTECTION OF FINISHED WORK

.1 Reshape and re-compact fills subjected to vehicular traffic during construction.

3.8 SCHEDULES

.1 Pipe and Bedding:

.1 Cover pipe and bedding with Fill Type S, in 200 mm lifts, compacted to 95%.

END OF SECTION

Part 1 - General

1.1 RELATED REQUIREMENTS

.1 Section 31 05 16 Aggregates for Earthwork.

.2 Section 31 23 33.01 Excavation, Trenching and Backfilling

1.2 MEASUREMENT AND PAYMENT

.1 Measure geotextiles in square metres of surface covered by material. No allowance will be made for seams and overlaps.

1.3 REFERENCES

.1 ASTM International

- .1 ASTM A123/A123M-09, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- .2 ASTM D4491-99a(2009), Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
- .3 ASTM D4595-09, Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method.
- .4 ASTM D4716-08, Standard Test Method for Determining the (In-Plane) Flow Rate Per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head.
- .5 ASTM D4751-04, Standard Test Method for Determining Apparent Opening Size of a Geotextile.

.2 Canadian General Standards Board (CGSB)

- .1 CAN/CGSB-4.2 No. 11.2-2004, Textile Test Methods - Bursting Strength - Ball Burst Test (Extension of September 1989).
- .2 CAN/CGSB-148.1, Methods of Testing Geotextiles and Complete Geomembranes.
  - .1 No. 2-M85, Methods of Testing Geosynthetics - Mass per Unit Area.
  - .2 No. 3-M85, Methods of Testing Geosynthetics - Thickness of Geotextiles.
  - .3 No. 6.1-93, Methods of Testing Geotextiles and Geomembranes - Bursting Strength of Geotextiles Under No Compressive Load.
  - .4 No. 7.3-92, Methods of Testing Geotextiles and Geomembranes - Grab Tensile Test for Geotextiles.
  - .5 No. 10-94, Methods of Testing Geosynthetics - Geotextiles - Filtration Opening Size.

.3 CSA International

- .1 CSA-G40.20/G40.21-04(R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.4 Ontario Provincial Standard Specifications (OPSS)

.1 OPSS 1860, Material Specification for Geotextiles.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for geotextiles and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Test and Evaluation Reports:

.1 Submit copies of mill test data and certificate at least 4 weeks prior to the start of Work.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with the manufacturer's written instructions.

.2 Storage and Handling Requirements:

.1 Store materials off ground and in accordance with the manufacturer's recommendations in a clean, dry, well-ventilated area.

.2 Store and protect geotextiles from direct sunlight and UV rays.

.3 Replace defective or damaged materials with new ones.

.3 Not Used

Part 2 - Products

2.1 MATERIAL

.1 Geotextile: synthetic fibre fabric, supplied in rolls.

.1 To OPSS 1860

.2 Physical properties:

.1 To OPSS 1860

.3 Hydraulic properties:

.1 To OPSS 1860

.4 Securing pins and washers: to CSA-G40.21, Grade 300W, hot-dipped galvanized with minimum zinc coating of 600 g/m² to ASTM A123/A123M.

.5 Factory seams: sewn in accordance with the manufacturer's recommendations.

.6 Thread for sewn seams: equal or better resistance to chemical and biological degradation than geotextile.

Part 3 - Execution

3.1 EXAMINATION

.1 Verification of Conditions: Verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for geotextile material installation in accordance with the manufacturer's written instructions.

.1 Visually inspect the substrate in the presence of the Engineer.

.2 Inform the Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

.1 Place geotextile material by unrolling onto the graded surface in the orientation, manner and locations indicated and retain it in position with pins or stakes.

.2 Place geotextile material smooth and free of tension stress, folds, wrinkles and creases.

.3 Place geotextile material on sloping surfaces in one continuous length from the toe of the slope to the upper extent of the geotextile.

.4 Overlap each successive strip of geotextile 600 mm over the previously laid strip.

.5 Join successive strips of a geotextile by sewing.

.6 Pin successive strips of geotextile with securing pins.

.7 Protect installed geotextile material from displacement, damage or deterioration before, during and after the placement of material layers.

.8 After installation, cover with an overlying layer within 4 hours of placement.

.9 Replace damaged or deteriorated geotextile with the approval of the Engineer.

.10 Place and compact soil layers in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave the Work area clean at the end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

3.4 PROTECTION

.1 Vehicular traffic is not permitted directly on geotextile.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This Specification covers the requirements for inspecting new and existing sanitary and storm pipe sewers, and pipe culverts by closed circuit televisions.

1.2 RELATED SECTIONS

.1 Section 01 78 10 - Closeout Submittals

.2 Section 33 05 16 - Manholes and Catch Basins

.3 Section 33 31 11 - Site Sanitary Sewage Piping

.4 Section 33 41 00 - Storm Utility Drainage Piping

1.3 REFERENCES

.1 OPSS 409 Closed-Circuit Television (CCTV) Inspection of Pipelines

.2 OPSS 411 Cleaning and Flushing of Pipe Sewers, Catch Basins, Maintenance Holes, Ditch Inlets, and Oil-Grit Separators

.3 The Town of East Gwillimbury Engineering Standards and Design Criteria, Section 11.0

1.4 DEFINITIONS

.1 For this Specification the following definitions apply:

.2 CCTV: means closed circuit television.

.3 Drainage Structure: means a catch basin, maintenance hole or ditch inlet.

.4 NAAPI: means North American Association of Pipeline Inspectors.

1.5 SUBMISSION AND DESIGN REQUIREMENTS

.1 A copy of the CCTV operator's current NAAPI Certification Certificate is to be provided to the Engineer two weeks prior to the start of CCTV inspection operations. A copy of the said certificate is required for each operator working on the Project.

Part 2 Products

1.6 USB / FTP

.1 Video files must be provided via a USB flash drive or accessible through a secure FTP (File Transfer Protocol) site. The file format is to be operable through standard windows software, and any additional software required to view the

videos will be provided by the Contractor. The DVD format is only to be submitted upon acceptance by the Engineer.

1.7 SURVEY VEHICLE

.1 The survey vehicle shall contain a separate area for viewing, recording and controlling the CCTV operation.

.2 The viewing and control area shall be insulated against noise and externals in temperature. External and internal sources of light shall be controlled in a manner to ensure the light does not impede the view of the monitor screen. Proper seating accommodation shall be provided to enable persons, in addition to the operator to clearly view the monitor screen.

.3 All equipment utilized within the pipeline shall be stored outside the viewing, recording and control area.

.4 The vehicle shall include a telephone or suitable alternative as agreed with the Sitework Engineer of Record for the duration of the Work.

1.8 SURVEY EQUIPMENT

.1 The surveying equipment shall be capable of surveying a length of pipeline up to:

.1 350 m where entry to the pipeline may be obtained at each end of the pipeline;

.2 30 m where rodding is used; or

.3 150 m where a self propelled unit is used when entry is at one end of the pipeline only.

.2 Work shall not commence in a Work shift until the Engineer is satisfied that all items of the survey equipment have been provided and are in full working order.

.3 Each survey unit shall contain a means of transporting the CCTV camera in a stable condition through the pipeline.

.4 Where the CCTV camera is towed by winch and cable through the pipeline, all winches shall be stable during the entire CCTV inspection. All cables shall be steel or of equally non-elastic material to ensure the smooth and steady progress of the CCTV camera.

.5 Each unit shall carry sufficient numbers of guides and rollers such that, when surveying, all cables are supported away from pipe and maintenance hole edges. All CCTV cables and lines used to measure the camera's location within the pipeline shall be maintained in a taut manner and set at right angles, where possible, to run through or over the measuring equipment.

1.9 VIDEO EQUIPMENT QUALITY

.1 The electronic systems, television camera and monitor shall be of such quality as to enable the following to be achieved.

1.10 CAMERA

.1 The pan and tilt camera shall have the capability of panning the pipe at 360 degrees with a tilt capability of 275 degrees to ensure complete inspection and view of all laterals and deficiencies.

.2 Resolution: The live picture shall be visible with no interference and capable of registering a minimum resolution of 640 x 480.

.3 Colour Constancy: To ensure the camera Provides optimum results when used with its own illumination source, the lighting shall be fixed to intensity prior to commencing the survey. To ensure colour constancy, no variation in illumination shall take place during the survey.

1.11 DIGITAL RECORDER

.1 The digital recorder shall be capable of reproducing a minimum resolution of 640 x 480.

1.12 FOCUS, IRIS, ILLUMINATION

.1 The adjustment of focus and iris shall allow optimum picture quality to be achieved and shall be remotely operated. The illumination shall be such as to allow an even distribution of the light around the pipeline perimeter without the loss of contrast or flare out of picture shadowing.

Part 3 Execution

1.13 CCTV INSPECTION

.1 The Work shall include a CCTV inspection of the pipeline, and the preparation of all digital and written reports.

.2 The CCTV operator shall be certified by the NAAPI.

.3 A fixed camera shall be used for pipelines less than 300 mm in diameter. For pipelines equal to or greater than 300 mm a pan and tilt camera shall be used.

.4 At the start of each pipeline being surveyed, the length of the pipeline from zero chainage up to the cable calibration point shall be recorded and reported in order to obtain a full record of the: pipe sewer length from the inside face of the maintenance hole to the inside face of the next maintenance hole or outlet end of the pipe sewer; or pipe culvert length from one end of the pipe culvert to the other.

.5 The metre reading entered into the data display at the cable calibration point shall allow for the distance from the start of the survey to the cable calibration point such that the metre reading at the start of the survey is zero.

.6 In the case of surveying through a maintenance hole where a new header sheet is required, the metre reading shall be set at zero with the camera focused on the outgoing pipe entrance.

.7 At the start of each maintenance hole length, a data generator shall electronically generate and clearly display on the viewing monitor and video recording a record of data in alpha-numeric form containing the following minimum information:

.1 Automatic update of the camera's metre reading position in the pipeline from adjusted zero.

.2 Pipeline dimensions.

.3 Maintenance hole/pipe length reference numbers.

.4 Date of the survey.

.5 Road name/location.

.6 The direction of the survey.

.7 Time of start of the survey.

.8 Pipeline use.

.8 Once the survey of the maintenance hole length is underway, an automatic update of the camera's metre reading position in the pipeline from zero, in metres and tenths of a metre, shall be continually displayed.

.9 The camera shall be stopped when defects are being noted on the coding sheet.

.10 The survey shall be restarted at the opposite end of the pipeline if a blockage or obstruction is encountered.

1.14 CAMERA PREPARATION

.1 The camera lens shall be positioned centrally in the pipeline with a positioning tolerance of +/- 10% of the vertical pipeline dimension. In all instances, the camera lens shall be positioned looking along the longitudinal axis of the pipeline.

1.15 CAMERA TRAVEL SPEED

.1 The travelling speed of the camera in the pipeline shall be limited to:

.1 0.1 m/s for a pipeline of diameter less than 200 mm:

.2 0.15 m/s for diameters exceeding 200 mm but not exceeding 310 mm; and

.3 0.20 m/s for diameters exceeding 310 mm.

1.16 CAMERA POSITION METER READING DEVICE

.1 A suitable meter reading device shall be used which enables the cable length to be accurately measured to indicate the location of the camera. The metre reading device shall be accurate to +/- 1% of the length of the sewer surveyed. The tolerance shall be demonstrated using one or both of the following methods in conjunction with a linear measurement audit form, which shall be completed each day during the survey:

.2 Cable calibration devise.

.3 Tape measurement of the surface distance between maintenance holes.

.4 If the accuracy of the measuring device fails it is to be replaced. The Sitework Engineer of Record may require that those lengths of pipeline first inspected with the original measuring device be resurveyed using the new measuring device.

1.17 SURVEYING REPORTING

.1 Reports shall be submitted to the Engineer in the following formats, within 10 working days of the completion of the field Work, with the noted number of copies.

.2 2 copies of the report and CCTV surveys in USB flash drive format, or credentials to access the report and surveys on a secure FTP site.

.3 All required header information fields shall be completed and verified for correctness. The software used to produce the survey report shall not allow the operator to continue inputting information until the MSCC.

.4 All dimensions in the survey report shall be metric.

1.18 SITE CODING SHEETS

.1 Each pipeline length shall be recorded according to the MSCC. Any variation from the manual shall be noted in the survey report.

1.19 DRAWINGS

.1 One clean set of the Owner's Drawings showing maintenance hole numbers, which coincide with the coding sheets and video tapes, shall be returned to the Sitework Engineer of Record on completion of the survey. The Drawings shall be clearly annotated to show any discrepancies between the Drawings and the survey report. Such discrepancies shall be brought to the attention of the Sitework Engineer of Record during the survey.

1.20 PIPELINE CLEANING AND DEWATERING

.1 All pipelines shall be cleaned and flushed immediately in accordance with OPSS 411 prior to inspection.

END SECTION

SEE ADD#3 Q#19

Part 1 - General

1.1 RELATED REQUIREMENTS

.1	Excavating, Trenching and Backfilling	Section 31 23 33.01
.2	Aggregates for Earthwork	Section 31 05 16
.3	Aggregate Base Course	Section 32 11 23

1.2 REFERENCES

.1 ASTM International

.1 ASTM C117-04, Standard Test Methods for Material Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing.

.2 ASTM C131-06, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

.3 ASTM C136-06, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.4 ASTM D422-63(2007), Standard Test Method for Particle-Size Analysis of Soils.

.5 ASTM D698-07e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft³) (600kN-m/m³).

.6 ASTM D1557-09, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000ft-lbf/ft³) (2,700kN-m/m³).

.7 ASTM D1883-07e2, Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.

.8 ASTM D4318-10, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.

.2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.

1.3 SAMPLES

.1 Not Used

Part 2 - Products

2.1 MATERIALS

.1 Granular sub-base material: in accordance with Section 31 05 16 - Aggregate Materials and the following requirements:

.1 Granular 'B' or 50mm Crusher Run limestone to OPSS.MUNI 1010.

.2 Granular 'A' or 50mm Crusher Run limestone to OPSS.MUNI 1010 where indicated for modified heavy duty asphalt structure.

Part 3 - Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrate previously installed under other Sections or Contracts are acceptable for granular sub-base installation.

.1 Visually inspect the substrate in presence of the Sitework Engineer.

.2 Inform the Engineer of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 PREPARATION

.1 Temporary Erosion and Sedimentation Control:

.1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to sediment and erosion control drawings.

.2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

.3 Remove erosion and sedimentation controls upon completion of site restoration and stabilization of landscaped surfaces with grass seed within areas disturbed during removal.

3.3 PLACING

.1 Place granular sub-base after subgrade is inspected and approved by the Engineer.

.2 Construct a granular sub-base to depth and grade in areas indicated.

.3 Ensure no frozen material is placed.

.4 Place material only on a clean unfrozen surface, free from snow or ice.

.5 Begin spreading sub-base material on the crown line or high side of one-way slope.

.6 Place granular sub-base materials using methods which do not lead to segregation or degradation.

.7 For spreading and shaping material, use spreader boxes having adjustable templates or screeds which will place material in uniform layers of required thickness.

.8 Place material to full width in uniform layers not exceeding 150 mm compacted thickness.

.9 Shape each layer to smooth contour and compact to a specified density before the succeeding layer is placed.

.10 Remove and replace a portion of the layer in which material has become segregated during spreading.

3.4 COMPACTION

.1 Compaction equipment to be capable of obtaining required material densities.

.2 Compact to the density of not less than 98% SPMDD unless directed otherwise by the Sitework Engineer.

.3 Shape and roll alternately to obtain a smooth, even and uniformly compacted sub-base.

.4 Apply water as necessary during compaction to obtain specified density.

.5 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved by the Sitework Engineer.

.6 Correct surface irregularities by loosening and adding or removing material until the surface is within the specified tolerance.

3.5 PROOF ROLLING

.1 For proof rolling use a standard roller of 45,400 kg gross mass with four pneumatic tires each carrying 11,350 kg and inflated to 620 kPa. Four tires are arranged abreast with the centre to centre spacing of 730 mm maximum.

.2 Obtain written approval from the Sitework Engineer to use non standard proof rolling equipment.

.3 Proof roll at to a level in sub-base as indicated.

.1 If non standard proof rolling equipment is approved, the Sitework Engineer will determine the level of proof rolling.

.4 Make sufficient passes with the proof roller to subject every point on the surface to three separate passes of the loaded tire.

.5 Where proof rolling reveals areas of defective subgrade:

.1 Remove sub-base and subgrade material to depth and extent as directed by the Engineer.

.2 Backfill excavated subgrade with sub-base material and compact in accordance with this section.

.3 Replace sub-base material and compact.

.6 Where proof rolling reveals areas of defective sub-base, remove and replace in accordance with this section at no extra cost.

3.6 SITE TOLERANCES

.1 The finished sub-base surface is to be within 10 mm of the calculated sub-base elevation based on the required asphalt pavement thickness for finished grade elevations as indicated, but not uniformly high or low.

3.7 PROTECTION

.1 Maintain finished sub-base in condition conforming to this section until succeeding base is constructed, or until granular sub-base is accepted by the Sitework Engineer.

END OF SECTION

SEE ADD#2
Q#20

Part 1 General

1.1 SECTION INCLUDES

.1 Asphaltic concrete paving, wearing binder or base course.

.2 Surface sealer.

.3 Aggregate base course.

1.2 RELATED SECTIONS

.1 Section 32 17 23 - Painting: Pavement markings.

.2 Section 31 22 13 - Rough Grading

.3 Section 31 23 33.01- Excavating, Trenching and Backfilling

.4 Section 32 11 23 - Aggregate Base Course

.5 Section 32 16 00 - Curbs, Gutters and Sidewalks

.6 Section 33 05 16 - Maintenance Holes and Catch Basin Structures

.7 Section 33 05 16.01 - Adjustments of Manholes and Catch Basins

1.3 REFERENCES

.1 OPSS 1001 Aggregates – General

.2 OPSS 1003 Aggregates - Hot Mix Asphalt

.3 OPSS 1150 Hot Mix Asphalt

.4 OPSS 308 Tack Coating and Joint Painting

.5 OPSS 1212 Hot-Poured Rubberized Asphalt Joint Sealing Compound

1.4 PERFORMANCE REQUIREMENTS

.1 Paving: Designed for light duty commercial vehicles, residential streets, parking and main street arteries. Each area is identified on the provided plans.

1.5 SUBMITTALS FOR INFORMATION

.1 Sustainable Design:

.1 Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.6 CLOSEOUT SUBMITTALS

.1 Section 01 78 10: Submission procedures.

.2 Sustainable Design Closeout Documentation: As-constructed survey and asphalt mix designs and compaction and sampling test results.

1.7 QUALITY ASSURANCE

.1 Perform Work to OPSS 1150.

.2 Mixing Plant: Requirements for all Mixing Plants per 1150.06.01.

.3 Obtain materials from the same source throughout.

1.8 REGULATORY REQUIREMENTS

.1 Conform to applicable code for paving work on public property.

1.9 ENVIRONMENTAL REQUIREMENTS

.1 Section 01 35 26: Environmental conditions affecting products on site.

.2 Do not place asphalt when ambient air or base surface temperature is less than 4 degrees C, or the surface is wet or frozen.

.3 Place the bitumen mixture when the temperature is not more than 8 C degrees below the bitumen supplier's bill of lading and not more than the maximum specified temperature.

Part 2 Products

2.1 MATERIALS

.1 Asphalt Cement: In accordance with OPSS 1150.

.2 Aggregate for Base Course Mix: In accordance with OPSS 1003 and 1150.

.3 Aggregate for Surface Course Mix: In accordance with OPSS 1003 and 1150.

.4 Fine Aggregate: In accordance with OPSS 1003.

.5 Tack Coat: In accordance with OPSS 308.

.6 Seal Coat: In accordance with OPSS 1212.

2.2 ASPHALT PAVING MIX

.1 Use dry material to avoid foaming. Mix uniformly.

.2 Base Course: Thickness as indicated on Contract Drawings

.3 Surface Course: Thickness as indicated on Contract Drawings

2.3 SOURCE QUALITY CONTROL AND TESTS

.1 Submit the proposed mix design of each class of mix for review prior to the beginning of work.

.2 Test samples are to be determined by the Consultant.

Part 3 Execution

3.1 EXAMINATION

.1 Verify existing conditions before starting work.

.2 Verify that the compacted granular base and subgrade are dry and ready to support paving and imposed loads.

.3 Verify gradients and elevations of the base are correct.

3.2 SUBBASE

.1 Section 32 11 23: Aggregate base course forms the base construction for the work of this section.

3.3 PREPARATION - TACK COAT

.1 Apply the tack coat to the manufacturer's written instructions.

.2 Apply tack coat in accordance with OPSS 308.

.3 Apply tack coat on asphalt or concrete surfaces over subgrade surfaces at a uniform rate of 1.5 L/sq m. Apply tack coat to contact surfaces of curbs and gutters.

.4 Coat the surfaces of the catchbasin and manhole frames with oil to prevent bond with asphalt pavement. Do not tack coat these surfaces.

3.4 PLACING ASPHALT PAVEMENT - SINGLE COURSE

.1 Install Work in accordance with Provincial and Local municipal standards.

.2 Place asphalt within twenty-four (24) hours of applying primer or tack coat.

.3 Place binder course in successive lifts in order to achieve thickness as identified on the provided plans and as per Provincial and Local municipal standards.

.4 Install manhole frames and gutter drainage grilles and frames in the correct position and elevation.

.5 Compact pavement by rolling to a specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.

.6 Perform rolling with consecutive passes to achieve an even and smooth finish, without roller marks.

3.5 PLACING ASPHALT PAVEMENT - DOUBLE COURSE

.1 Place asphalt binder course within twenty-four (24) hours of applying primer or tack coat.

.2 Place binder course in successive lifts in order to achieve thickness as identified on the provided plans and as per Provincial and Local municipal standards.

.3 Place wearing course within two (2) hours of placing and compacting binder course.

.4 Install manhole frames and gutter drainage grilles and frames in the correct position and elevation.

.5 Compact pavement by rolling to a specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.

.6 Perform rolling with consecutive passes to achieve an even and smooth finish, without roller marks.

3.6 CURBS

.1 Install extruded asphalt curbs as shown and detailed on the provided plans.

3.7 SEAL COAT

.1 Apply seal coat to the surface course and asphalt curbs in accordance with Provincial or Municipality standards.

3.8 TOLERANCES

.1 Flatness: Maximum variation of 6 mm measured with 3 m straight edge.

.2 Variation from True Elevation: Within 13mm.

3.9 FIELD QUALITY CONTROL

.1 Section 01 45 00: Field inspection and testing.

Take samples and perform tests on AI MS-2.

.2 Independent Testing Laboratory shall prepare test reports that indicate test location, elevation data, and test results. The Owner, Engineer, and Contractor shall be provided with copies of reports within 96 hours of the time test were performed. In event that any test performed fails to meet these Specifications, the Owner, Engineer and Contractor shall be notified immediately by Independent Testing Laboratory. The Owner reserves the right to employ an Independent Testing Laboratory and to direct any testing that is deemed by them to be necessary. Contractor shall provide free access to the site for testing activities.

.3 Costs related to retesting due to failure shall be paid for by the Contractor at no additional expense to the Owner.

3.10 PROTECTION OF FINISHED WORK

.1 Immediately after placement, protect the pavement from mechanical injury for 2 days or until the surface temperature is less than 60 degrees C.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Formed and reinforced concrete sidewalks, street side curbs and gutters.

.2 Paraplegic ramps.

1.2 RELATED SECTIONS

.1 Section 31 23 23 - Excavating, Trenching and Backfilling

.2 Section 32 11 23 - Aggregate Base Course

1.3 REFERENCES

.1 ASTM D698-12 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft3 (600 kN-m/m3)).

.2 CSA-A23.1-09/A23.2-09 - Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.

.3 OPSS 351 Construction Specification for Concrete Sidewalk

.4 OPSS 353 Concrete Curb and Gutter Systems

.5 OPSS 510 Removal

.6 OPSS 1350 Concrete - Materials and Production

.7 OPSS 1212 Hot-Poured Rubberized Asphalt Joint Sealing Compound

1.4 SUBMITTALS FOR INFORMATION

.1 Section 01 33 00: Submission procedures.

.2 Sustainable Design:

.1 Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

.1 Section 01 78 10: Submission procedures.

.2 Sustainable Design Closeout Documentation: Not Used.

Part 2 Products

2.1 MATERIALS

.1 Granular Base: Sections 32 11 16.01 and 31 23 33.01 for Excavating, Backfilling and Compaction.

.2 Forms: Forms shall be according to OPSS 919.

.3 Concrete Mix and Materials: Per OPSS 1350

.4 Curing Compound: Curing compound shall be according to OPSS 1315

.5 Joint filler: Hot poured rubberized asphalt joint sealing compound shall be according to OPSS 1212.

.6 Form Release Agent: Non-staining mineral type, chemically active containing compounds that react to provide a water-soluble soap for ease of release.

Part 3 Execution

3.1 PREPARATION

.1 Construct embankments using excavated material free from organic matter or other objectionable materials.

.2 Dispose of surplus or unsuitable excavated material at a location off site OPSS 510.

.3 In constructing an embankment, provide a minimum of 1m shoulders, outside of lines of placed concrete.

.4 Place fill in a maximum of 150 mm layers, compact to 95% of optimum density or as directed by the Engineer.

.5 Obtain Engineer approval of subgrade before placing granular base.

.6 Place granular base material to lines, widths, and depths as indicated.

.7 Compact base to 100% of optimum density or as directed by the Engineer.

3.2 TOLERANCES

.1 Finish surfaces flat to within 3 mm in 1 m as measured with a straightedge placed on the surface.

3.3 JOINTS

.1 Install tooled transverse contraction joints after floating, when concrete is stiff but still plastic, at intervals specified within the Provincial and Local municipal standards.

.2 Place lateral expansion joints at intervals of 6 m or as specified within the Provincial and Local municipal standards.

.3 Place isolation joints around manhole rings, catch basins, and adjacent to concrete curbs, catch basins, buildings, or permanent abutting surfaces.

.1 Seal isolation joints with sealant approved by the Engineer.

.4 When the sidewalk is adjacent to the curb or gutter, form joints of the curb, gutter, and sidewalk to coincide (key).

3.4 CURING

.1 Cure concrete by adding moisture continuously to CSA-A23.1/A23.2, to exposed finished surfaces for a minimum of one (1) day after placing, or by sealing moisture with a surface curing compound approved by the Engineer.

.2 Apply the curing compound evenly to form a continuous film to the compound manufacturer's requirements.

3.5 PARAPLEGIC RAMPS

.1 Remove existing curbs, gutters or sidewalks as necessary to construct the paraplegic ramp.

.2 Removals are to begin and end at existing joints only. No saw cuts in existing work are permitted.

.3 Construct concrete paraplegic ramps to lines and grades and slope gradients as per Provincial and Local municipal standards.

.4 Hand finish ramp surfaces as per provincial and local municipal standards.

END OF SECTION

Updated through ADD#8

PART 1 - GENERAL

1.1 PRICING

.1 All costs associated with the work required by and associated with this Section shall be included as part of the Contract Price and in the price listed in item #1 of the Bid Form.

1.2 GENERAL INSTRUCTIONS

.1 Read and conform to:

.1 the General Conditions and the Supplementary Conditions of the Contract.

.2 Division 01 requirements and documents referred to therein.

1.3 SUMMARY

.1 Work Included: Provide labour, materials, products, consumables and equipment for the fencing work specified herein.

.2 Related Requirements: Specifications throughout the entirety of Divisions of this Project are directly applicable to this Section, and this Section is directly applicable to them.

1.4 REFERENCES

.1 Reference Standards: Latest published editions of reference standards listed in this Section in effect as of the closing date and time of the Request for Tenders for the Contract, including any amendments adopted, are applicable unless otherwise indicated.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Installation Meetings:

.1 Prior to starting work of this Section, convene a pre-installation meeting at Project site to review Project requirements and site conditions with pertinent parties. Conform to requirements of Section 01 30 00.

1.6 SUBMITTALS

.1 Product Data: Product Data: Submit manufacturer's literature and data sheets for each type of material provided under this Section for the Project in accordance with requirements of Division 01.

.2 Safety Data Sheets (SDS): Submit SDS for inclusion in Operation and Maintenance Manual specified in Section 01 70 00, for adhesives, sealants and any other material designated by Consultant.

.3 Shop Drawings: Submit Shop Drawings in accordance with Section 01 30 00.

PART 2 - PRODUCTS

2.1 MATERIAL

.1 Fencing, unless specified otherwise in Drawings and Shop Drawings, shall comply with the following requirements:

.1 All chain link fencing to be heavy-duty hot dipped galvanized finish to municipal standards and in conformance with the detailed Drawings.

.2 Refer to Shop Drawings and detail Drawings for specific requirements of fencing and chain link fencing. Refer to plans for fencing locations.

.2 Concrete mixes and materials: to Section 03 30 00 - Cast-in-Place Concrete and as per detail Drawings. Concrete strength to be 3000 psi after 28 Days, unless specified otherwise in Section 03 30 00 – Cast-in-Place Concrete.

.3 Chain link fence fabric: to CAN/CGSB-138.1-M80, as per detail Drawings and to a minimum of:

.1 Mesh to be hot dipped galvanized after waving and knuckled finish top and bottom selvage edges. Galvanized fabric to have a minimum zinc application of 490 g/m2 of surface area or as illustrated on the Drawings.

.4 All items to be as per detail Drawings and Shop Drawings.

2.2 FINISHES

.1 Galvanizing:

.1 For chain link fabric: to CAN/CGSB-138.1-M80 Grade 2.

.2 For pipe: 550 g/m2 minimum to ASTM A90-81.

.3 For other fittings: to CSA G164-M1981.

~~.3~~.2 Finish: to be black vinyl coated.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Site Verification of Conditions:

.1 Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to the installation. Commencement of work implies acceptance of previously completed work.

3.2 GRADING

.1 Remove debris and correct ground undulations along fence line to obtain smooth uniform gradient between posts. Provide clearance between bottom of fence and ground surface as specified on drawings.

3.3 GENERAL INSTALLATION

.1 Ensure Drawings and/or on-site instructions clearly indicate which side of fence line the fabric and overhang are to be installed.

.2 Erect fence along lines indicated and in accordance with CAN/CGSB-138.3-M80 and manufacturer's specifications.

.3 Excavate post holes to dimensions indicated.

.4 Space line posts as indicated, measured parallel to ground surface.

.5 Install additional bracing as indicated in detailed Drawings.

.6 Install corner post where change in alignment exceeds 10 degrees, unless otherwise specified on the Drawings.

.7 Install end posts at end of fence and at buildings. Install gate posts on both sides of gate openings.

.8 Place concrete/grout in post holes then embed posts into concrete to depths indicated. Concrete to drain away from posts. Brace to hold posts in plumb position and true to alignment and elevation until concrete has set.

.9 Do not install fence fabric until concrete has cured a minimum of 5 Days.

.10 Unless otherwise indicated, install brace between end and gate posts and nearest line post, placed in centre of panel and parallel to ground surface. Where indicated, install braces on both sides of corner and straining posts in similar manner.

.11 Install overhang tops and caps where required.

.12 Install top rail between posts, fasten securely to posts and secure waterproof caps and overhang tops.

.13 Install middle and bottom rails between posts and fasten securely, as per the detail Drawings.

.14 Lay out fence fabric. Stretch tightly to tension recommended by manufacturer and fasten to end, corner, gate and straining posts with tension bar secured to post with tension bar bands spaced as per details. Knuckled selvage at bottom; twisted selvage at top, unless otherwise indicated on details and Shop Drawings.

.15 Secure fabric to top rails, line posts and bottom rails with 6-gauge tie wires as per detail and Shop Drawings. Give tie wires minimum three twists.

3.4 INSTALLATION OF CHAIN LINK GATES

.1 Install gates as indicated on detail plans and Shop Drawings.

.2 Determine position of centre gate rest for double gate. Cast gate rest in concrete as directed. Dome concrete above ground level to shed water.

.3 Install gate stops where indicated.

3.5 TOUCH UP

.1 Touch up as required.

~~.1~~ .2 Clean damaged surfaces with wire brush removing loose and cracked coatings. Apply two coats of organic zinc-rich paint to damaged areas; pre-treat damaged surfaces according to manufacturers' instructions for zinc-rich paint.

3.6 RESTORATION

.1 Clean and trim areas disturbed by operations to satisfaction of the Consultant. Dispose of surplus material off site.

3.7 WARRANTY

.1 The Contractor shall provide a warranty, with a warranty period that is a minimum of five (5) years starting on Substantial Performance of the Work, for all fence and gate components including workmanship.

END OF SECTION

PART 1 - GENERAL

.1 GENERAL REQUIREMENTS

.1 This section specifies the supply and placement of cultivated sod.

.2 Related work specified elsewhere:
Topsoil and Finished Grading - Section 31 22 16

.2 QUALITY ASSURANCE

.1 The contractor must have five (5) years of experience in sodding work. All crew members must work under the direction of a skilled foreman.

.2 Submit topsoil test report with adjustment recommendation to consultant prior to sod installation.

.3 PRODUCT DELIVERY, STORAGE AND HANDLING

.1 Cut sod by approved methods in accordance with recommendations of the Nursery Sod Growers Association (N.S.G.A.) of Ontario. Cut in pieces approximately 1.000 square metres in area with a minimum soil thickness of 20mm.

.2 Roll or fold sod prior to lifting in such a manner as to prevent tearing or breaking.

.3 Protect sod during transportation to prevent drying and ensure that it arrives at the site in a fresh and healthy condition.

.4 Install sod immediately after arrival. If there is a delay in installation, keep sod moist and cool and protected from direct exposure to the sun until installation.

.5 Provide fertilizer in standard manufacturer's containers, clearly marked with the name of the manufacturer, weight and analysis.

.6 Store fertilizer in a weatherproof storage area until use.

.4 JOB CONDITIONS

.1 Proceed with sodding operations only during suitable weather conditions and in accordance with good horticultural practice.

.5 INSPECTION

.1 Obtain approval from the Landscape Architect of the finished topsoil surface before proceeding with sodding.

.2 Give timely notice, in writing, to the Landscape Architect when final acceptance is required.

.6 MAINTENANCE

.1 Maintain sodded areas from the time of installation, until final acceptance by the Landscape Architect.

.2 Maintenance shall include all measures necessary to establish and maintain all sodded areas in vigorous and healthy growing condition, including but not limited to:

.1 Mowing at regular intervals to maintain a maximum height of 60mm. Do not cut more than one third (1/3) of the grass height at any one mowing. Trim and clip edges. Remove clippings after mowing and clipping.

.2 Watering when required and in sufficient quantities to prevent sod from drying out.

.3 Weed control when required and / or directed. Use herbicide only in accordance with the manufacturer's recommendations, federal, provincial and local bylaws or ordinances. Make good all damage resulting from the use of herbicides at no extra cost.

.4 Make good any erosion that results from faulty workmanship and /or material at no extra cost.

.5 Replace with new sod any dead, deteriorated, or bare spots.

.7 GUARANTEE

.1 Guarantee all sodded areas for a period of six months from the date of acceptance.

.2 During the guarantee period replace all material that is dead or not in satisfactory, healthy growing state or which does not meet the requirements of the specifications, at no extra cost to the contract. Final determination of the acceptability of the sod will be made by the Landscape Architect.

PART 2 - PRODUCTS

.1 MATERIALS

.1 Grass Sod

Certified No. 1 grade 'Camel Grass' Sod with a composition of 100% TWCA Approved Kentucky Bluegrass or as specified on the drawings, grown and sold in accordance with the N.S.G.A. classifications. At the time of sale, the sod must have a strong, fiberous root system and be free of stone and burned or bare spots. Mosses and clover shall not be apparent in the turf with no more than 2 broadleaf weeds or 10 other weeds per 40 square meters.

.2 Wooden Pegs: 25mm x 25mm x 230mm minimum length hardwood pegs.

.2 TOPSOIL

.1 Topsoil: fertile and friable sandy loam with a minimum 2% organic matter content with acidity values between pH 6.0 and 7.5, free from admixtures of subsoil, clay lumps, stones or roots over 50mm in diameter, toxic chemicals or any other foreign matter.

.2 Test all topsoil, native and imported, for nitrogen, phosphorous, magnesium, soluble salt content, texture, organic matter content, pH and chemical residues through accredited laboratory with recommendations for improvement for intended use. Make improvements in accordance with analysis.

.3 Topsoil may be taken from existing stockpile provided it meets specified requirements.

.4 At no extra cost to the Contract, provide topsoil from another source if quantity of suitable stockpiled material is not sufficient.

PART 3 - EXECUTION

.1 PREPARATION

.1 Provide a finished topsoil surface that is smooth and firm against footprints, with a fine loose texture, before sod is placed. Finished topsoil surface is to be free of rocks or other deleterious material.

.2 INSTALLATION OF PLANT MATERIAL

.1 Lay sod with tight butt joints. Do not leave any open joints or overlap adjacent pieces of sod.

.2 Ensure finished sod surface is flush with adjoining grass area, pavement, or top surface of curbs.

.3 On slopes steeper than 3:1, lay sod perpendicular to the slope and peg each row at intervals of not more than 600mm on each side of the sod strip. Drive pegs flush with the surface of the sod.

.4 Immediately after installation, water the sod with sufficient quantities of water to penetrate the sod and top 50mm of the underlying topsoil.

.5 When the sod has dried sufficiently to prevent damage, roll all sodded areas to ensure a good bond between topsoil and sod.

.6 Ensure that topsoil is amended as recommended by the soil analysis.

.3 CLEAN UP

.1 At the completion of sodding operations remove all excess material from the site at no extra cost.

.2 Make good all damage resulting from work carried out under this contract, at no extra cost.

END OF SECTION

PART 1 - GENERAL

1.1 General Requirements

.1 This section specifies the supply and placement of mechanical seeding in all areas indicated as such on the drawings to the satisfaction of the specifications.

.2 Related work elsewhere, Topsoil and Finished Grading, Section 31 22 16.

1.2 Quality Assurance

.1 Obtain approval of seed mixture in writing from the Consultant before work commences.

.2 The contractor must have five(5) years of experience in mechanical seeding work. All crew members must be under the direction of a skilled foreman.

1.3 Scheduling

.1 Schedule mechanical seeding to coincide with preparation of soil surface.

.2 Recommended schedule for mechanical seeding using grass mixtures to be preformed only during the periods of March 1 to June 30 and August 1 to December 31.

.3 No work shall be performed when the ground is frozen, wet or otherwise untillable, or when even distribution of materials cannot be obtained.

PART 2 - PRODUCTS

2.1 Delivery and Storage

.1 The seed mixture shall be mixed and supplied by a recognized seed house with tested rates for purity and germination of not less than government standard rates.

.2 All grass seed specified, shall be mixed and supplied by a recognized seed house with tested rates for purity and germination of not less than government standard rates.

3. Seed shall be packed in a bag clearly showing the name of the supplier and indicating the certified quantities of different types of the mixture. The Consultant may request a test for purity and germination.

2.2 Materials

.1 Seed: "Canada pedigreed grade" in accordance with Government of Canada Seeds Act and Regulations, having minimum germination of 75% and minimum purity of 97%.

.2 Mixture:" Certified", "Canada No. 1 Grass Mixture" in accordance with Government of Canada Seeds Act and Regulations with the following mixture composition at a rate of 185kg/Ha.:

20% Ecostar Hard Fescue
35% Creeping Red Fescue
35% Jamestown II Chewings Fescue
10% Top Gun Perennial Rye

.3 Water: Potable and free of impurities that would inhibit germination and growth.

.4 Fertilizer: To Canada "Fertilizers Act" and "Fertilizers Regulations". Adjust nitrogen and potassium on the field according to attached soil test report.

PART 3 - EXECUTION

3.1 Workmanship

.1 Protect areas from trespass until grass is established.

.2 Keep site well drained.

.3 Perform work under optimum field conditions. Do not undertake seeding operation under adverse conditions including moisture, temperature, wind or scheduling related work.

.4 Clean up immediately soil or debris spilled onto pavement and dispose of deleterious materials.

3.2 Preparation of Surfaces

.1 Rough grade soil shall be scarified to a minimum depth of 75mm to produce an even, loose textured surface, free of all stones, roots, branches, etc., large than 25mm.

.2 Fine grade areas to be seeded free of humps and hollows. Ensure all areas are free of deleterious and refuse materials. The finished grade shall be smooth,

loose textured and free of all stones, roots, branches, etc., larger than 25mm diameter and shall be inspected by the Consultant prior to commencing seeding operations.

.3 Areas to be seeded are to be cultivated to a minimum depth of 25mm.

3.3 Fertilizing Program

.1 Fertilizer shall be applied by means of an approved mechanical spreader immediately prior to seeding. The fertilizer shall be well worked into the upper 50mm of soil by discing or harrowing.

3.4 Installation

.1 Obtain Consultant's approval of topsoil grade and depth before starting seeding.

.2 Sow during calm weather (winds less then 6mph) using equipment suitable for the area involved to the approval of the Consultant. Sow half of the required seed in one direction and the remainder at right angles. Incorporate the seed into the soil a minimum depth of 6mm simultaneously or within on half hour after seeding operation. Mix carefully with light chain harrow or wire rake and roll area immediately afterward with water ballast type lawn or agricultural type roller.

.3 Water with fine spray, avoiding washing out seed. Apply enough water to ensure penetration of minimum of 50mm.

.4 Re-seed at 2 week intervals where germination has failed.

.5 Protect seeded areas from trespass satisfactory to the Consultant.

3.5 Maintenance During Establishment Period

.1 Perform the following maintenance operations from the time of the seed application until acceptance by Consultant. Such maintenance shall include all measures necessary to establish and maintain grass in a vigorous growth condition.

.2 Grass Mixture:

.1 Repair and reseed dead or bare spots to allow establishment of seed prior to acceptance.
.2 Mow grass to 40mm whenever it reaches a height of 60mm.
.3 Fertilized seeded areas after the first cutting to the specified rates. Spread half of the fertilizer in one direction, and the remainder at right angles.

.4 Eliminate weeds by mechanical means.
.5 Water seeded area to maintain optimum soil moisture level for germination and continued growth of grass. Control watering to prevent washouts.
.6 Erosion resulting from contractor's faulty workmanship and / or materials shall be repaired and reseeded at his expense.

3.6 Inspection

.1 Acceptance inspection will be conducted within sixty (60) days after completion.

.2 Where the contractor requests inspection for partial acceptance of mechanical seeding work, the contractor will notify the Consultant in writing at least two (2) days in advance.

.3 Partial acceptance will be given when mechanical seeding work has been delayed due to circumstances beyond the control of the contractor or when further mechanical seeding work would be in accordance with good horticultural practice and would jeopardize the performance of work and materials.

.4 At the time of inspection for acceptance, all mechanical seeded areas shall have a healthy and even stand of grass, free of thin, poor, or burned out patches.

3.7 Acceptance

.1 Seeded areas will be accepted by the Landscape Architect provided that:
.1 Plants are uniformly established and seed areas are free of rutted, eroded, bare or dead spots and free of weeds.
.2 Seeded areas have been fertilized.

.2 Areas seeded in the fall will be accepted in the following spring, one month after the start of the growing season, provided that acceptance conditions are fulfilled.

3.8 Maintenance During Warranty Period

.1 Perform the following operations from time of acceptance until end of warranty period:
.1 Repair and reseed dead or bare spots to the satisfaction of the Consultant.

END OF SECTION

Part 1 General

1.1 SCOPE

.1 This specification covers the requirements for sodding.

1.2 RELATED SECTIONS

.1 Section 31 22 19 - Finish Grading

.2 31 23 33.01 Excavating, Trenching and Backfilling

.3 Section 01 57 00 - Temporary Erosion and Sediment Control

1.3 REFERENCES

.1 OPSS 803 Sodding

1.4 DEFINITIONS

.1 Weeds: Includes Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Coordination:

.1 Coordinate with other work having a direct bearing on the work of this section.

.2 Coordinate with installation of underground sprinkler system piping and watering heads.

.2 Sequencing: Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

1.6 SUBMITTALS FOR INFORMATION

.1 Section 01 33 00: Submission procedures.

.2 Sustainable Design:

.1 Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.7 CLOSEOUT SUBMITTALS

.1 Section 01 78 10: Submission procedures.

.2 Maintenance Contracts:

.1 Provide service and maintenance of sodded areas for three (3) months from the Date of Substantial Completion.

.2 Maintain sodded areas immediately after placement until the grass is well established and exhibits a vigorous growing condition.

.3 Operation Data: Submit for continuing Owner maintenance.

.4 Maintenance Data: Include maintenance instructions, cutting method and maximum grass height; [types, application frequency, and recommended coverage of fertilizer].

1.8 QUALITY ASSURANCE

.1 Sod: Minimum age of eighteen (18) months, with root development that will support its own weight without tearing, when suspended vertically by holding the upper two corners.

.2 Submit sod certification for grass species and location of sod source.

.3 Sod Producer: Company specializing in sod production and harvesting with a minimum of five (5) years experience, and certified by the Province of Ontario.

.4 Installer: Company approved by the sod producer.

1.9 REGULATORY REQUIREMENTS

.1 Comply with regulatory agencies for fertilizer and herbicide composition.

.2 Provide a certificate of compliance indicating approval of fertilizer and herbicide mixture.

1.10 DELIVERY, STORAGE, AND PROTECTION

.1 Deliver sod and protect exposed roots from dehydration.

.2 Do not deliver more sod than can be laid within twenty-four (24) hours.

Part 2 Products

2.1 MATERIALS

.1 Sod: Per OPSS 803.05.01.

.2 Stakes: Per OPSS 803.05.02

.3 Fertilizer: Per OPSS 803.05.03

2.2 SOURCE QUALITY CONTROL

.1 Provide mix formulation for fertilizer.

.2 Analyze to ascertain the percentage of nitrogen, phosphorus, potash, soluble salt content, organic matter content, and pH value.

.3 Submit a minimum 10 oz sample of topsoil proposed. Forward the sample to the approved testing laboratory in sealed containers to prevent contamination.

.4 Testing is not required if recent tests are available for imported topsoil. Submit these test results to the testing laboratory for approval. Indicate, by test results, information necessary to determine suitability.

Part 3 Execution

3.1 EXAMINATION

.1 Verify existing conditions before starting work.

.2 Verify that the prepared soil base is ready to receive the work of this section.

3.2 PREPARATION OF SUBSOIL

.1 Prepare subsoil and eliminate uneven areas and low spots.

.2 Maintain lines, levels, profiles and contours. Make changes in grades gradual. Blend slopes into level areas.

.3 Remove foreign materials and undesirable plants and their roots. Do not bury foreign material beneath areas to be sodded.

.4 Remove contaminated subsoil.

.5 Scarify subsoil to a depth of 100 mm where topsoil is to be placed.

.6 Repeat cultivation in areas where equipment, used for hauling and spreading topsoil, has compacted subsoil.

3.3 PLACING TOPSOIL

.1 Spread topsoil to a minimum depth of 50 mm over the area to be sodded.

.2 Place topsoil during dry weather and on the dry unfrozen subgrade.

.3 Remove vegetable matter and foreign non-organic material from topsoil while spreading.

.4 Grade topsoil to eliminate rough, low or soft areas, and to ensure positive drainage.

.5 Install edging at the periphery of sodded areas in straight lines to a consistent depth.

3.4 FERTILIZING

.1 Apply fertilizer to the manufacturer's written instructions.

.2 Apply after smooth raking of topsoil and before installation of sod.

.3 Apply fertilizer no more than forty-eight (48) hours before laying sod.

.4 Mix thoroughly into the upper 50 mm of topsoil.

.5 Lightly water to aid the dissipation of fertilizer.

3.5 LAYING SOD

.1 Moisten the prepared surface immediately before laying sod.

.2 Lay sod within twenty-four 24 after harvesting to prevent deterioration.

.3 Lay sod tight with no open joints visible, and no overlapping; stagger end joints 300 mm minimum. Do not stretch or overlap sod pieces.

.4 Lay smooth. Align with adjoining grass areas.

.5 Place the top elevation of sod 13 mm below adjoining paving, curbs, and edging.

.6 On slopes 1:2 and steeper, lay sod perpendicular to the slope and secure every row with wooden pegs at a maximum of 600 mm on centre. Drive pegs flush with the soil portion of the sod.

.7 Prior to placing sod, on slopes exceeding 0.66:1, place wire mesh over the topsoil. Securely anchor in place with wood pegs sunk firmly into the ground.

.8 Water sodded areas immediately after installation. Saturate sod to 100 mm of soil.

.9 After sod and soil have dried, roll sodded areas to ensure a good bond between sod and soil and to remove minor depressions and irregularities.

3.6 MAINTENANCE

.1 Mow grass at regular intervals to maintain a maximum height of 65 mm. Do not cut more than 1/3 of the grass blade at any one mowing.

.2 Neatly trim edges and hand clip where necessary.

.3 Immediately remove clippings after mowing and trimming.

.4 Water to prevent grass and soil from drying out.

.5 Roll the surface to remove minor depressions or irregularities.

.6 Control the growth of weeds. Apply herbicides in accordance with the manufacturer's written instructions. Remedy damage resulting from improper use of herbicides.

.7 Immediately replace sod in areas which show deterioration or bare spots.

.8 Protect sodded areas with warning signs during the maintenance period.

.9 The Contractor shall maintain the site and control erosion as specified in this specification until the sod has been replaced.

END OF SECTION

PART 1 - GENERAL

.1 RELATED WORK

.1 This section specifies the supply and installation of plant material.

.2 Related work specified elsewhere:
Topsoil - Section 32 91 19

.2 QUALITY ASSURANCE

.1 Planting work is to be carried out by experienced personnel under the direction of a skilled foreman.

.2 Submit topsoil test report with adjustment recommendation to consultant.

.3 PRODUCT DELIVERY, STORAGE AND HANDLING

.1 Supply manufactured items such as fertilizer, bonemeal, mulch, etc., in standard containers, clearly indicating contents, weight, component analysis, and the name of the manufacturer.

.2 Store manufactured materials, subject to deterioration, in a weatherproof place on site and in such a manner that their effectiveness is not impaired.

.3 Supply plant material as specified on the plant list.

.4 Provide all material, specified "B. & B." (balled and burlapped) on the plant list, with a solid, earth root ball, wrapped in burlap.

.5 Do not use plant material on which the root ball has been cracked or broken preparatory to or during the planting process.

.6 Cut all roots cleanly when digging plants. Split roots are not acceptable. Roots should be cut even with the edges of the root ball.

.7 Protect all plant material from damage and breakage. Protect all parts of the plant material from drying out from the time of digging until they are installed.

.8 Do not transport plant material in an open truck unless it is adequately protected from sun and wind.

.9 Carefully tie in all branches before transporting.

.10 Pad all points of contact between plant material and equipment.

.11 Heel in any plant material that cannot be planted during the current day's operations.

.12 Keep all roots and root balls moist prior to planting.

.4 JOB CONDITIONS

.1 Proceed with planting operations only during suitable weather conditions.

.5 SUBSTITUTIONS

.1 Supply and install plant material as specified on the plant list. Substitutions with other plant material will not be allowed without the written approval of the Landscape Architect.

.6 INSPECTION

.1 Make plant material available for inspection at source by the Landscape Architect before installation and inform him/her as to when the inspection can take place.

.2 Approval of plant material at source will not impair the right of the Inspector to inspect plants upon arrival on the site or during the course of construction and to reject plants which have been damaged, or which, in any way do not conform to the specifications.

.3 Give timely notice in writing to the Landscape Architect when acceptance is required.

.4 If partial acceptance is desired, give notice to the Landscape Architect.

.5 Partial acceptance will be given when planting work has been delayed due to circumstances beyond the control of the contractor or where planting would not be in accordance with good horticultural practices and would jeopardize the performance of the work and plants.

.6 Final inspection of all plant material will be made at the end of the specified guarantee period. All plants must be in a healthy growing condition at the time of this inspection.

.7 MAINTENANCE

.1 Maintain all plant material from the time of planting until the date of acceptance.

.2 Maintenance shall include all measures necessary to establish and maintain all plants in vigorous and healthy growing condition, including but not limited to:

.1 Cultivating and weeding of planting beds and tree pits. Use herbicides in accordance with the manufacturer's directions. Make good any damage, resulting from herbicide use at no extra cost.

.2 Watering when required and in sufficient quantities to saturate the root system.

.3 Pruning, including the removal of the dead or broken branches.

.4 Disease and insect control when required. Use chemical methods in accordance with the manufacturer's directions. Make good any damage at no extra cost.

.5 Keep all accessories in good condition and properly adjusted. Repair or replace accessories when required at no extra cost.

.6 At the time of acceptance, all materials must be in a healthy, vigorous growing condition. Beds and tree pits must be freshly cultivated and free of weeds, rubbish and debris.

.8 GUARANTEE

.1 Guarantee all plant material for a period of one year commencing on the date of acceptance.

.2 During the guarantee period replace all material that is dead or not in satisfactory, healthy growing state or which does not meet the requirements of the specifications, at no extra cost to the contract. Final determination of the acceptability of the plants will be made by the Landscape Architect.

.3 All replacements must be plants of the same size and species as shown on the plant list, supplied and planted in accordance with the drawings and specifications.

PART 2 - PRODUCTS

.1 PLANT MATERIAL

.1 All plant material must be nursery grown and meet the specifications set

out in the latest Guide Specifications for Nursery Stock prepared by the Canadian Nursery Trades Association (C.N.T.A.) for size, height, spread, grading, quality and method of cultivation.

.2 Nomenclature of specified plants shall conform to the International Code of Nomenclature for Cultivated Plants and the latest edition of Standardized Plant Names.

.3 Any plant material not conforming to 2.0.1.A. above will be designated as collected plants.

.4 Collected plants may only be used when approved in writing by the Landscape Architect.

.5 Plant Material: true to name and type, structurally sound, well branched; healthy and vigorous and free from disease, insect infestations, rodent damage, sun scald, frost cracks and other abrasions to the bark and densely foliated with healthy, well developed root system. Pruning wounds must show vigorous bark growth on all edges and all parts must show live and green cambium tissue when cut.

.6 All material must conform to the sizes shown on the plant list except that larger material may be used when approved by the Landscape Architect. Use of larger plants will not increase the contract price.

.7 Plant material sizes must conform to the following standards:

.1 Caliper - diameter of the trunk measured 300mm above the normal grade around the plant.

.2 Height - measured from the normal grade around the plant to the top of the main foliage mass.

.3 Spread - the diameter of the main foliage mass, at its widest point.

.2 TOPSOIL

.1 Topsoil: fertile and friable sandy loam with a minimum 2% organic matter content with acidity values between pH 6.0 and 7.5, free from admixtures of subsoil, clay lumps, stones or roots over 50mm in diameter, toxic chemicals or any other foreign matter.

.2 Test all topsoil, native and imported, for nitrogen, phosphorous, magnesium, soluble salt content, texture, organic matter content, pH and chemical residues through accredited laboratory with recommendations for improvement for intended use. Make improvements in accordance with analysis.

.3 Topsoil may be taken from existing stockpile provided it meets specified requirements.

.4 At no extra cost to the Contract, provide topsoil from another source if quantity of suitable stockpiled material is not sufficient.

.3 OTHER MATERIAL

.1 Tree wrap: 224 g (8 oz.) burlap supplied in strips 150 mm minimum to 250 mm maximum (6" minimum to 10" maximum) width or heavy, waterproof crepe paper 100 mm to 150 mm (4" to 6") wide.

.2 Anchor stakes: metal "T" bars of the type used for the erection of snow

fence.

.3 Wire: #9 gauge galvanized wire for trees 75 mm (3") calliper or larger and #10 gauge galvanized wire for smaller trees.

.4 Hose: two ply reinforced, 13 mm (1/2") diameter, new, rubber garden hose.

PART 3 - EXECUTION

.1 PREPARATION

.1 Obtain the approval of the Landscape Architect of all planting excavations as outlined.

.2 INSTALLATION OF PLANT MATERIAL

.1 Ensure width of all planting excavations is 300 mm (12") greater on all sides than the width of the root ball.

.2 Place plant plumb in the centre of the planting pit with a minimum of 150 mm (6") of compacted planting soil mixture under the root ball. Face the plant to give the best appearance or relationship to adjacent structures. Cut away ropes and fold down top 1/3 of the root ball burlap into the pit.

.3 Backfill with planting soil in 150 mm (6") layers and firmly tamp each layer to ensure the plant retains its orientation. Ensure no air pockets remain around the roots.

.4 Thoroughly water when hole is 1/2 full of tamped soil mixture, and again

when the operation is complete.

.5 Except for plants in planting beds, construct an earth saucer around each plant equal to the diameter of the rootball and 50 mm (2") minimum depth to retain water around the roots.

.3 INSTALLATION OF PLANTING ACCESSORIES

.1 Wrap all trees over 50 mm (2") caliper. Apply wrapping in a spiral manner from grade to above the second branch. Secure wrapping with suitable cord.

.2 Stake or guy all trees as outlined in the drawings and details.

.4 PRUNING

.1. Prune plants after planting to compensate for root loss and in such a manner that the natural shape and character is retained.

.2 Do not cut a leader. Use only clean and sharp tools.

.5 CLEAN-UP

.1 At the completion of the planting operations, remove all surplus material from the site at no extra cost.

.2 Make good all damage resulting from planting operations at no extra cost.

END OF SECTION

COUNTERPOINT LAND DEVELOPMENT BY | DILLON CONSULTING

York Regional Police

FUNCTIONAL SERVICING AND STORMWATER MANAGEMENT REPORT

350 Garfield Wright Boulevard

Version: 1st Submission

August 30, 2024

EXECUTIVE SUMMARY

This Functional Servicing and Stormwater Management Report ('FSSR') has been prepared to support a Site Plan Approval ('SPA') for the site municipally known as 350 Garfield Wright Boulevard in the Town of East Gwillimbury (referred to as 'the subject site' in this report). The report has been prepared on behalf of York Regional Police (the applicant).

The subject site is currently vacant, and it is proposed to be developed into a helicopter hangar building and parking, an associated vehicle parking, and landscaped areas.

The servicing strategy for the proposed development is summarized as follows:

Water Servicing:

The adjacent municipal roadways contain typical sized watermains to service the proposed development. The domestic and fire flow water demands were calculated in accordance with Town of East Gwillimbury criteria and the Fire Underwriter's Survey methodology. The maximum day demand plus fire flow demand is 12,026 L/min.

A hydrant flow test will need to be conducted on the existing watermain on Garfield Wright Boulevard to confirm available watermain pressure at the required flow rates.

Sanitary Servicing:

The subject site is located outside the urban service boundary of the Town of East Gwillimbury and there are no sanitary sewers in the vicinity of the subject site. The proposed hangar building will be serviced by a private on-site septic system consisting of a Waterloo anaerobic digester, a Waterloo Biofilter, and an in-ground dispersal bed. The sanitary daily design flow for the subject site is 3,629 L/day and has been calculated in accordance with Part 8 of the Ontario Building Code.

Stormwater Servicing & Stormwater Management:

The subject site is located within the York Region Industrial Subdivision (YRIS) SWM facility service area. The YRIS SWM facility provides quality, erosion control, and quantity control for the entire catchment area of YRIS. Stormwater quantity control for the development area will be provided by the downstream YRIS SWM facility. The downstream YRIS SWM facility will provide water balance, erosion control, and stormwater quality control (Enhanced Level 1 / 80% TSS removal). Per the Lake Simcoe Region Conservation Authority Phosphorus Budget Guidance Tool, the pre-development phosphorus loading is 0.05 kg/year. The unmitigated post-development phosphorus loading is 1.22 kg/year. To mitigate the phosphorus loading to levels below the pre-development conditions, a treatment train approach consisting of an upstream infiltration trench and a Jellyfish filter unit to reduce the phosphorus loading to 1.22 kg/year.

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- Domestic and Fire Demand Calculations

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- Sanitary Demand Calculations
- Septic System Design Details
- Percolation Test Report & Test Pit Plan

Appendix C - Stormwater Design Calculations

- East Gwillimbury IDF Curve data and Post Development Stormwater Release Rates
- MECP PBGT output
- Jellyfish Filter ETV verification statement
- Background YRIS SWMF design reports

Appendix D - Background Plans

- Engineering Drawings prepared by Counterpoint Engineering Inc.
- Site Plan Drawing, prepared by Parkin Architects Limited

1.0 INTRODUCTION

1.1 BACKGROUND

This Functional Servicing and Stormwater Management Report (FSSR) has been prepared to support the development of the new York Regional Police (YRP) hangar to be located within York Regional lands located east of Bales Drive East in the Town of East Gwillimbury. Dillon Consulting Limited (Counterpoint Land Development) has been retained by Parkin Architects Limited to prepare the SWM and functional site servicing/grading plans of the proposed development.

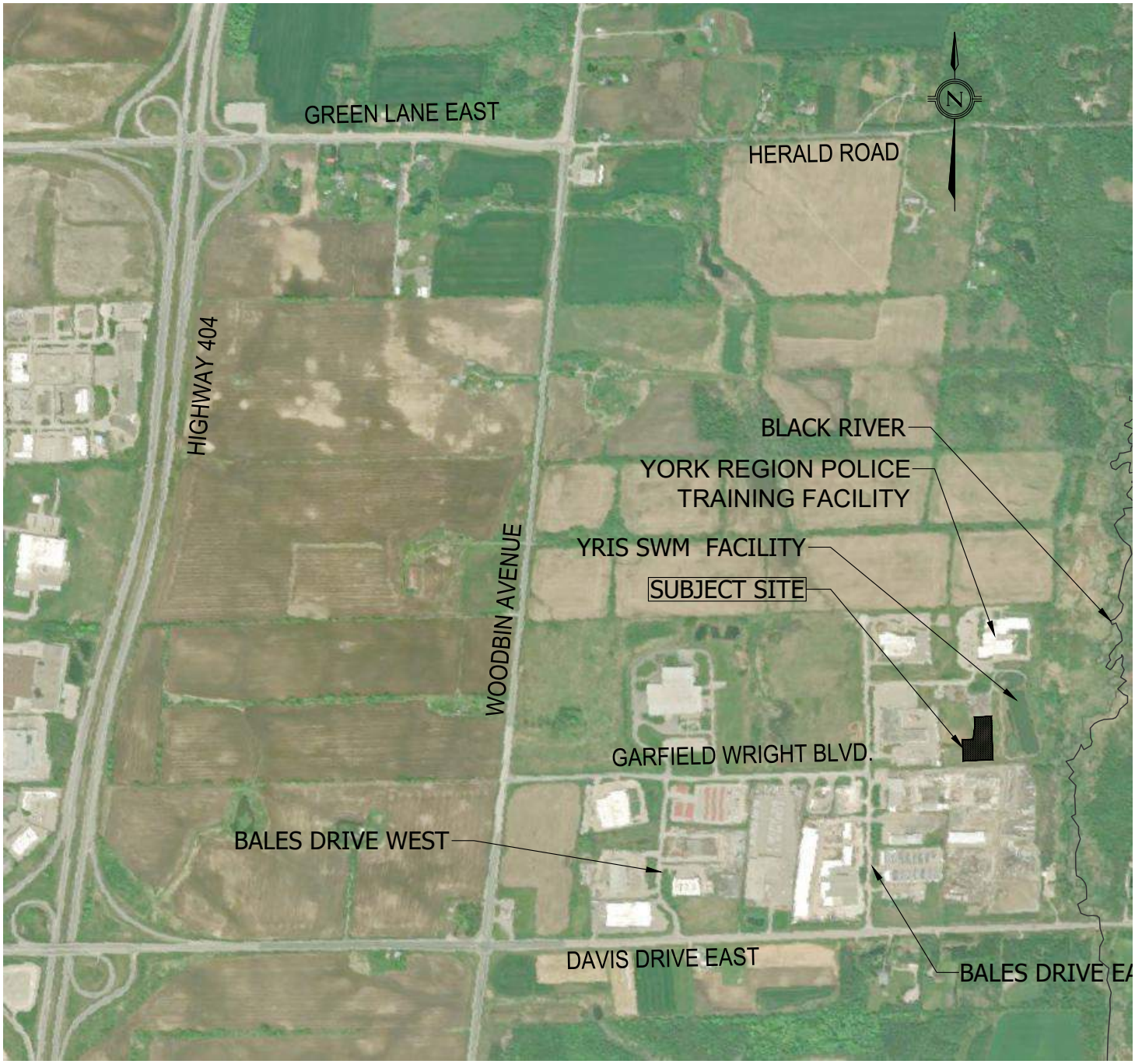
The subject site is located on the north side of Garfield Wright Boulevard and is bounded by the existing York Region Industrial Subdivision (YRIS) SWM facility to the east, the existing gravel parking lot to the north and the existing septic bed/open space to the west. Refer to **Figure 1** for the Site Location Plan.

The proposed development will consist of a one-story building consisting of office space and helicopter parking, a helicopter landing pad and parking areas, driveways and a parking lot, and associated landscaped areas.

1.2 STUDY PARAMETERS

This functional servicing assessment for the subject site is based on the review of the following documents and drawings:

- Architectural site plan prepared by Parkin Architects Limited
- Technical Design Brief – Stormwater Management Facilities for York Regional Industrial Subdivision 19T-94016; July 2004 prepared by Cumming Cockburn Limited (CCL).
- Storm Drainage Area Plan (Drawing 5390-STM2) for the YRIS storm sewers prepared by CCL and dated May 2004.
- Ontario Building Code, Section 8
- Town of East Gwillimbury Engineering Standards and Design Criteria, September 2012
- Lake Simcoe Region Conservation Authority Technical Guidelines for Stormwater Management Submissions April 2022
- Lake Simcoe Region Conservation Authority Black River Subwatershed Plan
- Ministry of the Environment, Conservation and Parks Design Guidelines for Drinking Water Systems, January 2016
- Stormwater Management Implementation Report for 2696 & 2740 Davis Drive Industrial Development, dated July 2013 prepared by RJ Burnside & Associates Ltd.
- Servicing and Grading Plans for the Technicore Industrial Subdivision, dated February 2007 and prepared by RJ Burnside.
- Determination of Estimated T-Time, dated July 31, 2016, and prepared by Azimuth Environmental Consulting Inc./GEI Consultants



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YRP HELICOPTER HANGAR

SITE LOCATION PLAN

DESIGNED BY: PM	DATE: FEB 08, 2023
CHECKED BY: PM	PROJECT No. 24015
DRAWING BY: PM	
CHECKED BY: PM	FIGURE No. 1
SCALE: NTS	

Z:\Shared\Projects\2024\24015_Parkin_YRP Helicopter Hangar\Design\Drawings\Figures\24015_Site Location Plan.dwg

2.0 WATER SUPPLY

2.1 EXISTING WATER SUPPLY

There is an existing 300 mmø watermain on the south side of Garfield Wright Boulevard. Refer to **Figure 2 - Water Servicing Plan** for the existing watermain layout. There are two municipal hydrants located on the south side of the road allowance. There are no existing water service services within the subject site.

Municipal water service is currently provided to the Town of East Gwillimbury and some other areas, distributed through a network of water mains with diameters up to 400 mm. The remainder of the municipality relies on individual wells for their water needs. The municipal water system depends on a groundwater supply from local wells.

2.2 WATER DEMAND

2.2.1 DOMESTIC DEMAND

Calculation of the water demand for the proposed development has been performed using the guidelines outlined within the Town of East Gwillimbury Engineering Standards and Design Criteria (September 2012), and the MECP Design Guidelines for Drinking Water Systems (2016).

Per the Town of East Gwillimbury, the average day demand for commercial land use is 28,000 L/ha/day. Maximum Day and Peak Hour factors shall be 2.0 and 2.75 respectively, or as recommended by the MECP.

Refer to **Appendix A** for the supporting calculations of the following proposed domestic demands:

- Maximum Hour Demand = 35.8 L/min
- Maximum Day Demand = 26.0 L/min

2.2.2 FIREFLOWS

The fire flow required for the proposed hangar building has been calculated using the criteria indicated in the Water Supply for Public Fire Protection Manual, 1999, by the Fire Underwriters Survey (FUS). The calculation incorporates various parameters such as coefficient for fire-resistant construction, area reduction accounting for a fire-resistant (one-hour rating) protection, reduction for low-hazard occupancies, adjustment for sprinkler protection system, and factor for neighbouring building proximity. Based on the calculations, the minimum fire suppression flow required is 4,725 L/min. This fire flow plus the maximum day demand or peak hour demand, whichever is greater, must be available at the nearest hydrant with a minimum pressure of 140 KPa. Refer to **Appendix A** for the supporting calculations of the following proposed fireflows:

HANGAR
FFE: 273.80

1-STOREY OFFICES
FFE: 273.80

H
FATO

HELICOPTER PARKING

SNOW STORAGE

100mm DOMESTIC SERVICE

200mm FIRE SERVICE

SIAMESE CONNECTION

HYD & V

150mm HYDRANT LEAD

VALVE CHAMBER

200mmØ WATERMAIN

TAPPING SLEEVE
c/w 200mm V&B

V&B

EX. HYD & V

EX. HYD & V

GARFIELD WRIGHT BLVD

Plastic Lid for Septic

3.00

3.00

Chain Link Fence

Post & Wire Fence

CHAIN LINK FENCE

GATE

Gate

Stucco Wall

Chain Link Fence

Post & Wire Fence

BOTTOM OF SLOPE

TOP OF SLOPE

EDGE OF GRAVEL

EDGE OF WATER

CONCRETE HEADWALL

CONCRETE CURB AND GUTTER

C/L OF PAVEMENT

CURB CUT

CONCRETE

BUSH

DITCH

POS

5 0m 10 20 30

1:600

N

LEGEND

- PROPERTY LINE
- PROPOSED BUILDING EVELOPE
- EXISTING WATER SUPPLY
- PROPOSED WATER SUPPLY
- PROPOSED BACKFLOW PREVENTER
- PROPOSED WATER METER
- PROPOSED VALVE AND BOX
- SIAMESE CONNECTION

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350 GARFIELD WRIGHT BOULEVARD
TOWN OF EAST GWILLIMBURY, ONTARIO

WATER SERVICING PLAN

DESIGNED BY: PM	DATE: APRIL 2024
CHECKED BY: PW	PROJECT No. 24015
DRAWING BY: ET	
CHECKED BY: PM	FIGURE No. 2
SCALE: 1:600	

- Fire Flow Demand (2 hours) = 12,000 L/min
- Maximum Day Demand plus Fire Flow Demand = **12,026 L/min**

In accordance with the FUS fire flows for the existing watermain on Garfield Wright Boulevard will not be less than **12,026 L/min** for a 2-hour duration in addition to the maximum daily domestic demand, delivered with a residual pressure of not less than 140 kPa.

A hydrant flow test will need to be conducted on the existing watermain on Garfield Wright Boulevard to confirm available watermain pressure at the required flow rates.

2.3 WATER SERVICE CONNECTION

It is proposed to install a 200mm diameter water service for the building connecting to the existing 300mm diameter municipal watermain on Garfield Wright Boulevard. This water connection will branch to a separate 100mm diameter domestic watermain and 200mm fireline. A valve chamber will be provided on the fireline at the streetline. The domestic water service and fire line will enter the hangar building from the west side at the mechanical room as indicated on the **Figure 2 – Water Servicing Plan.**

Fire protection will be provided by a proposed private site fire hydrant, which is located on the south side of the proposed hangar building. The fire hydrant will be located within 90m of the principal building entrances and 45m of the proposed Siamese connection in accordance with the Ontario Building Code. The location of the fire hydrants and Siamese connection are indicated on the **Figure 2 - Water Servicing Plan.**

3.0 WASTEWATER SERVICING

Given that the subject site is located outside the urban service boundary of the Town of East Gwillimbury, and that there are no sanitary sewers in the vicinity of the subject site, the proposed hangar building will be serviced by a private on-site septic system similar to the adjacent developments within the YRIS. In this regard, the proposed hangar building will be serviced by a septic system which consists of a Waterloo anaerobic digester, a holding tank housing a Waterloo biofilter, and an in-ground dispersal bed as indicated on the **Figure 3 – Sanitary Servicing Plan.**

3.1 SANITARY DEMAND

The daily design flow for a septic system is to be calculated in accordance with Part 8 of the OBC. For non-residential uses, the flow is calculated based on the most applicable occupancy as listed in OBC Table 8.2.1.3.B – office @ 450m^2.

Based on the office occupancy and floor area, the peak daily design flow is 3,629 L/day. Refer to the Sanitary Design Calculation included in **Appendix B**.

TEST PIT LOCATION

SEPTIC BED LOADING AREA = 465m²

SAND MANTLE

SEPTIC STONE AREA = 104 m²

INFERRED DIRECTION OF GROUND WATER FLOW

DISTRIBUTION PIPE
65m TOTAL LENGTH

75mmØ HDPE FORCEMAIN

WATERLOO PT- 3600
HOLDING TANK c/w
WATERLOO BIOFILTER

50% RETICULATION

WATERLOO BIOFILTER AD-9000
ANAEROBIC DIGESTER IN MODEL
ADIPC-14000 TANK

1.8m-150mmØ
PVC. SAN @ 2.00%

MH1A
TOP=273.40
NW INV:271.77

8.7m-150mmØ
PVC. SAN @ 2.00%

150mmØ SAN PLUG
INV:272.00

HANGAR
FFE: 273.80

1-STOREY OFFICES
FFE: 273.80

GARFIELD WRIGHT BLVD

Water

Post & Wire Fence

N

LEGEND

- PROPERTY LINE
- PROPOSED BUILDING EVELOPE
- EXISTING SANITARY SEWER
- PROPOSED SANITARY SEWER
- PROPOSED SANITARY MANHOLE

1:300 10 0m 5 10 15

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350 GARFIELD WRIGHT BOULEVARD
TOWN OF EAST GWILLIMBURY, ONTARIO

SANITARY SERVICING PLAN

DESIGNED BY: PM	DATE: APRIL 2024
CHECKED BY: PW	PROJECT No. 24015
DRAWING BY: ET	
CHECKED BY: PM	FIGURE No. 3
SCALE: 1:300	

3.2 SEPTIC SYSTEM COMPONENTS

The septic system is comprised of several components which are to be sized based on the daily design flow and the percolation rate ("T" time) of the native soil conditions. The configuration of the proposed septic system is illustrated in **Figure 3 – Sanitary Servicing Plan** and the sizing of the components is summarized in the following sections.

3.2.1 SEPTIC TANK

A gravity sanitary drain will convey sewage flows to the septic tank from the proposed hangar building via a sanitary manhole. In accordance with the manufacturer's design and installation guide, the treatment unit volume is to be a minimum of the daily design flow as follows:

- Minimum Tank Size = 3,629 L/day
- Selected Treatment Unit Size = 4,000 L (Anaerobic Digestor – AD-9000)

In accordance with the manufacturer's recommendations, an effluent filter is to be installed in the outlet of the septic tank. Access risers over the tank's inlet and outlet will extend to the finished grade for inspection and maintenance. Effluent from the septic tank will drain to the pump tank.

3.2.2 FLOW BALANCING

Given the relatively low sanitary daily design flow and intended use of the hangar building, sanitary flows will be predictable with minimal variability from day to day. As such flow balancing will not be required.

3.2.3 TERTIARY TREATMENT UNIT - WATERLOO BIOFILTER

In order to minimize the land area required for the disposal bed and to achieve a level of treatment higher than that of a conventional septic system, the use of an alternative treatment system has been considered.

There are several alternative treatment systems available that have been approved by the recognized by the Ontario Building Code. Alternative treatment systems designed as "Treatment Units" other than septic tanks must meet the requirements of Section 8.6.2.2 of the OBC, must produce either secondary or tertiary quality effluent, and must have received authorization from the Building Materials Evaluation Commission (BMEC). One such technology providing tertiary treatment is the Waterloo Biofilter® manufactured by Waterloo Biofilter Systems Inc.

The Waterloo Biofilter is an aerobic trickling filter that uses an absorbent synthetic filter material. Septic tank effluent is applied intermittently over modules of plastic foam pieces (patented biofilter medium) contained in wire mesh baskets. This synthetic media supports microbiological growth, and these microorganisms are responsible for the aerobic breakdown of the wastewater. Approximately 50% of the effluent exiting the unit is pumped back to the septic tank, while the other half is directed to a disposal bed.

In accordance with the manufacturer's guidelines, based on a balanced design flow of 3,629 L/day the Waterloo Biofilter Basket Tank System (BT-9000) is required. Details of the Waterloo Biofilter® are contained in **Appendix B** together with standard details for the anaerobic digester.

3.2.4 SUBSURFACE DISPOSAL

The BMEC authorization for the Waterloo Biofilter permits the use of an area bed dispersal system which is implemented in the majority of installations. The area bed is to be comprised of a stone layer overlying a sand layer where the stone layer is to be a minimum of 300 mm in depth, wrapped with a permeable geo-textile fabric, and comprised of stone meeting the requirements of the OBC. Distribution pipes having 75 mm diameter are to be spaced evenly within the stone layer with spacing not exceeding 1.2 m. The sand layer is to be a minimum of 600 mm in depth below the stone layer and 300 mm above the stone layer.

A field percolation test was conducted by Azimuth Environmental Consulting Inc. which determined that the native soils in the vicinity of the proposed area bed (TP 24-6) as silt, some sand, some clay with trace gravel. The investigation determined the soils have a percolation rate of a percolation rate ("T" time) of 50 min/cm. The field percolation test is included in **Appendix B.**

Stone Layer:

Given that the daily design flow is more than 3,000 L, the loading on the surface of the stone layer is calculated as follows:

Minimum Surface Area = Q / 50 = 3,629 / 50 L= 72.58 m^2

Design Surface Area = 6.5m x 16m = 104 m^2

Sand Contact Area:

Given that the "T" time of the native soil greater than 15 min/cm the sand layer is to extend over an area which is calculated as follows:

Minimum Surface Area = Q x T / 400 = 3,629 L x 50 min/cm / 400 = 453.62 m^2

Design Surface Area = 465.73 m^2 (Refer to **Figure 3- Sanitary Servicing Plan**)

4.0 STORM DRAINAGE

The subject site is located within the York Region Industrial Subdivision (YRIS) SWM facility service area. The details of the design of this SWM facility are provided in the report titled " Technical Design Brief – Stormwater Management Facilities for York Regional Industrial Subdivision 19T-94016" which was prepared by CCL. See **Appendix C**. Based on that report, the Town of East Gwillimbury and the LSRCA have both reviewed the design concept of the SWM facility and drainage area, provided comments, and approved the design.

The YRIS SWM facility has the following characteristics:

- It provides quality, erosion control, and quantity control for the entire catchment area of YRIS (approximately 29 Ha as indicated on Figure 7 of the CCL Technical Design Brief).
- It is designed for enhanced Level 1 quality control.
- It is designed to provide extended detention of a 25 mm storm for 24 hours for erosion control.
- It is designed to provide post-to-peak flow control for storms ranging from a 2-year design event to a 100-year design event.

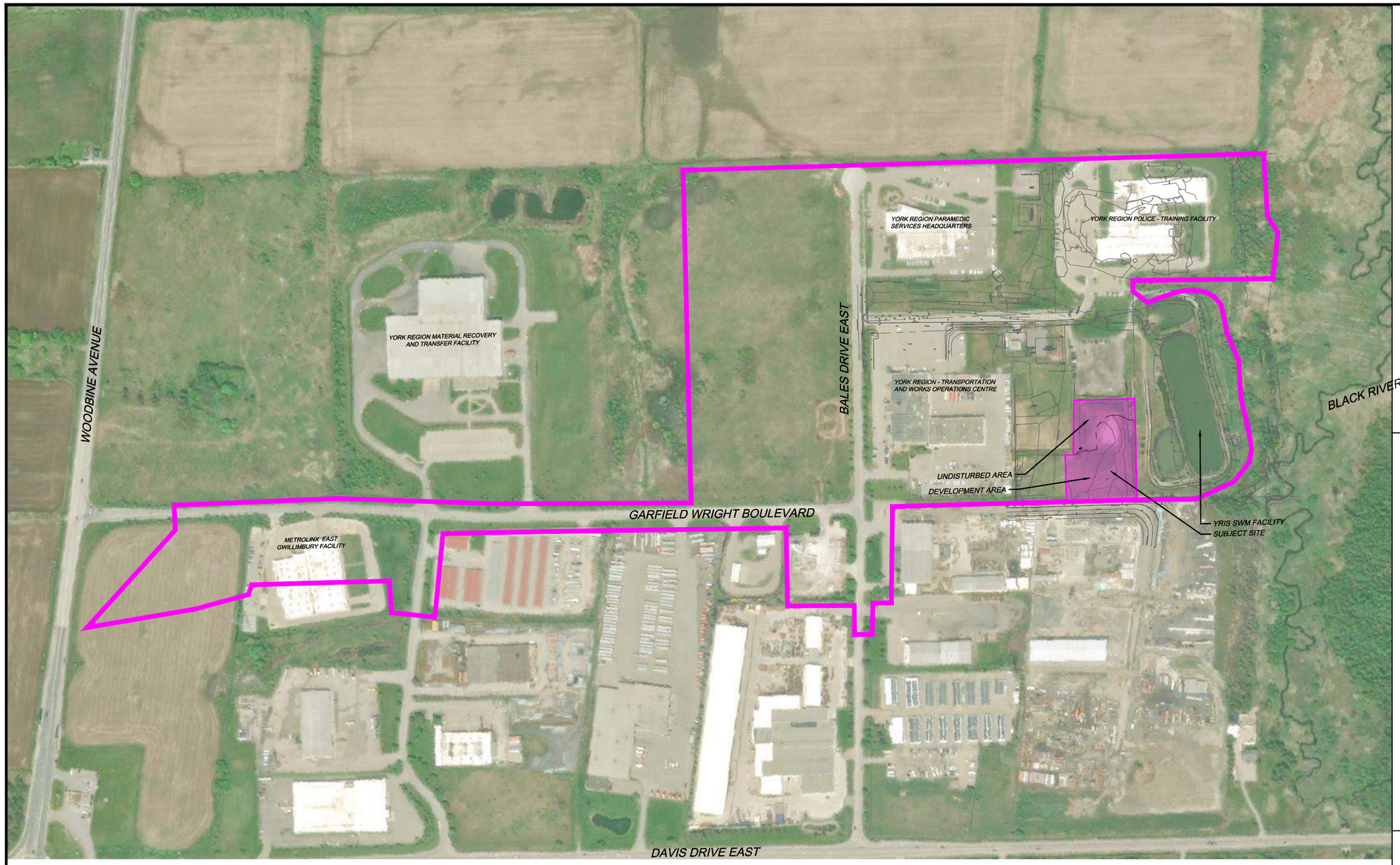
The design brief of the YRIS SWM facility notes that the SWM approach of the site plans within the service area will be addressed through the site plan approval process and East Gwillimbury Stormwater Master Plan and the Lake Simcoe Protection Plan in addition to the YRIS SWM facility design requirements.

Refer to **Figure 4 – YRIS SWMF Drainage Plan** for the location of the subject site within the extent of the drainage area of the YRIS SWM facility**.**

4.1 EXISTING CONDITIONS & WATERSHED

The subject site is located in the Lake Simcoe watershed, which is under the jurisdiction of the Lake Simcoe Region Conservation Authority (LSRCA). Specifically, the site is situated in the Black River Subwatershed, which occupies 375 km² of land south of the eastern portion of Lake Simcoe. The headwaters of the Black River originate on the Oak Ridges Moraine, and the river's watercourses flow mainly through natural features and agricultural areas throughout much of the system before reaching the community of Sutton and ultimately draining into Lake Simcoe. The Subwatershed supports a high level of natural features as well as agricultural activities. Its jurisdiction is primarily within York Region, with a small portion extending into Durham Region. The municipalities within its boundaries include Georgina, East Gwillimbury, Whitchurch-Stouffville, and Uxbridge.

Based on a review of the topographic survey which was provided by Parkin and prepared by Lloyd & Purcell Ltd. in 2014 and updated in 2024, the majority of the subject site can be described as having a gently sloping towards the east while a small portion of the subject site slopes towards the north. Drainage from the major portion of the subject site sheet flows directly to the YRIS SWM facility (south forebay) while drainage from the minor portion is collected by a swale and conveyed to the north forebay. The boulevard appeared to be unfinished and did not drain onto the roadway as per the typical subdivision design standard.



N

LEGEND

PROPERTY LINE

YRIS SWM FACILITY DRAINAGE AREA BOUNDARY

SUBJECT SITE

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350 GARFIELD WRIGHT BOULEVARD
TOWN OF EAST GWILLIMBURY, ONTARIO

YRIS SWMF DRAINAGE PLAN

DESIGNED BY: PM	DATE: APRIL 2024
CHECKED BY: PW	PROJECT No. 24015
DRAWING BY: ET	
CHECKED BY: PM	FIGURE No. 4
SCALE: 1:750	

Z:\Shared\Projects\2024\24015_Parkin_YRP Helicopter Hangar\Design\Drawings\Servicing\24015_Servicing.dwg

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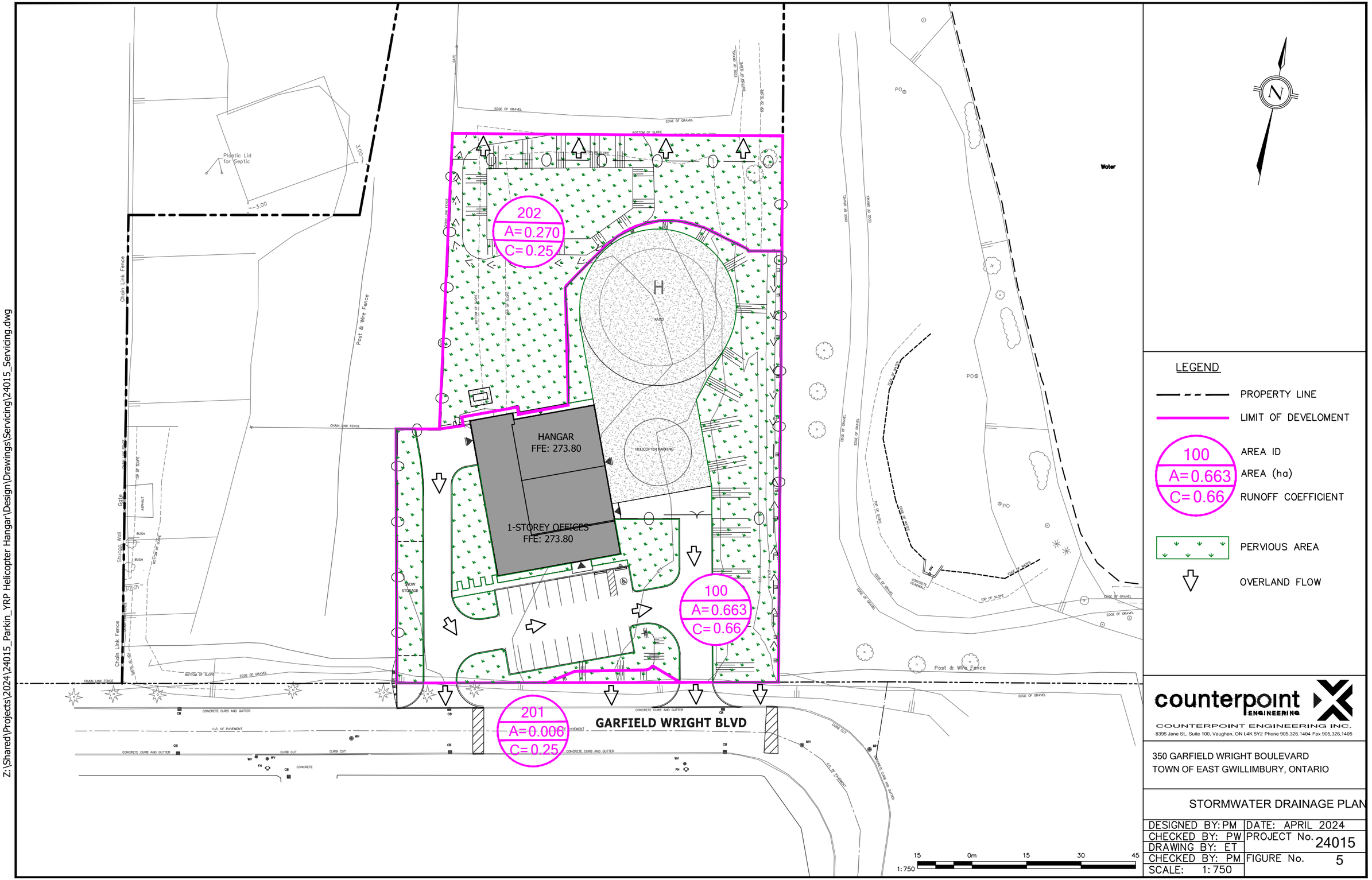

N

LEGEND

- PROPERTY LINE
- LIMIT OF DEVELOMENT
- 100 / A= 0.663 / C= 0.66 — AREA ID / AREA (ha) / RUNOFF COEFFICIENT
- PERVIOUS AREA
- OVERLAND FLOW

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350 GARFIELD WRIGHT BOULEVARD
TOWN OF EAST GWILLIMBURY, ONTARIO

STORMWATER DRAINAGE PLAN

DESIGNED BY: PM	DATE: APRIL 2024
CHECKED BY: PW	PROJECT No. 24015
DRAWING BY: ET	
CHECKED BY: PM	FIGURE No. 5
SCALE: 1:750	

4.2 STORMWATER MANAGEMENT CRITERIA

The following stormwater management criteria have been established for the subject site based on the review of the YRIS SWM facility design brief. The design criteria will conform to the

requirements of the LSRCA Watershed Development Policies and Town of East Gwillimbury Storm Drainage & SWM Design Criteria.

- Quantity Control: to be addressed by the YRIS SWM facility, based on site imperviousness of 80% (R = 0.75)
- Quality Control: to be addressed by the downstream YRIS SWM facility (Enhanced Level 1/ 80% TSS removal)
- Water Balance & Erosion Control: to be addressed by the downstream YRIS SWM facility.
- Phosphorus Loading: target onsite removal of 80% of the annual total phosphorus (TP) load from all major development areas through onsite measures.

4.3 STORMWATER RELEASE RATES

In the post development condition, the subject site is divided into two major areas – development area where impervious areas – asphalt, building and walkways are to be introduced and non-development areas where the existing condition (landscaped) will be maintained). Refer to **Figure 5 – Stormwater Drainage Plan** for the delineation of the post development drainage areas.

As noted in **Section 4.2**, quantity control for the entire site will be provided by the downstream YRIS SWM facility. As indicated on **Figure 5 – Stormwater Drainage Plan,** the post development runoff coefficient for the development area is 0.66 which is lower than the 0.75 as per the YRIS SWM facility design. No additional stormwater runoff attenuation is necessary.

The stormwater release rates have been calculated for the development area and are indicated on **Table 1** below and included in **Appendix C**.

Table 1: Stormwater Release Rates

POST-DEVELOPMENT DRAINAGE AREA	RECEIVING SYSTEM	5-YEAR RELEASE RATE (L/S)	100-YEAR RELEASE RATE (L/S)
Area 100 – Development Area	YRIS SWM Pond Municipal via storm sewer	139	21.2
Area 101 – Development Area	YRIS SWM Pond via Existing overland flow channel	312	52.8

4.4 PROPOSED STORM SERVICING

Stormwater from the 'development area' portion of the subject site will be captured by catch basins and conveyed internally through the site via storm sewers. The internal storm sewer system will be designed to convey the 5-year storm event in accordance with the Town of East Gwillimbury Engineering Standards and Design Criteria. DICB 101 and storm sewer lead will be designed to runoff from storm exceeding the 5-year storm event (up to the and including the 100-year event). Refer to **Figure 6 – Storm Servicing Plan** for the layout of the internal storm sewer system.

4.5 STORMWATER QUANTITY CONTROL

As noted in **Section 5.2** stormwater quantity control for the entire site (development + non development areas) will be provided by the downstream YRIS SWM facility. A Jellyfish filter unit will be provided upstream of the control manhole to provide further quality control and phosphorus removal that is discussed in **Section 5.7.** Refer to **Figure 6 – Storm Servicing Plan** for the location of the YRIS SWM facility.

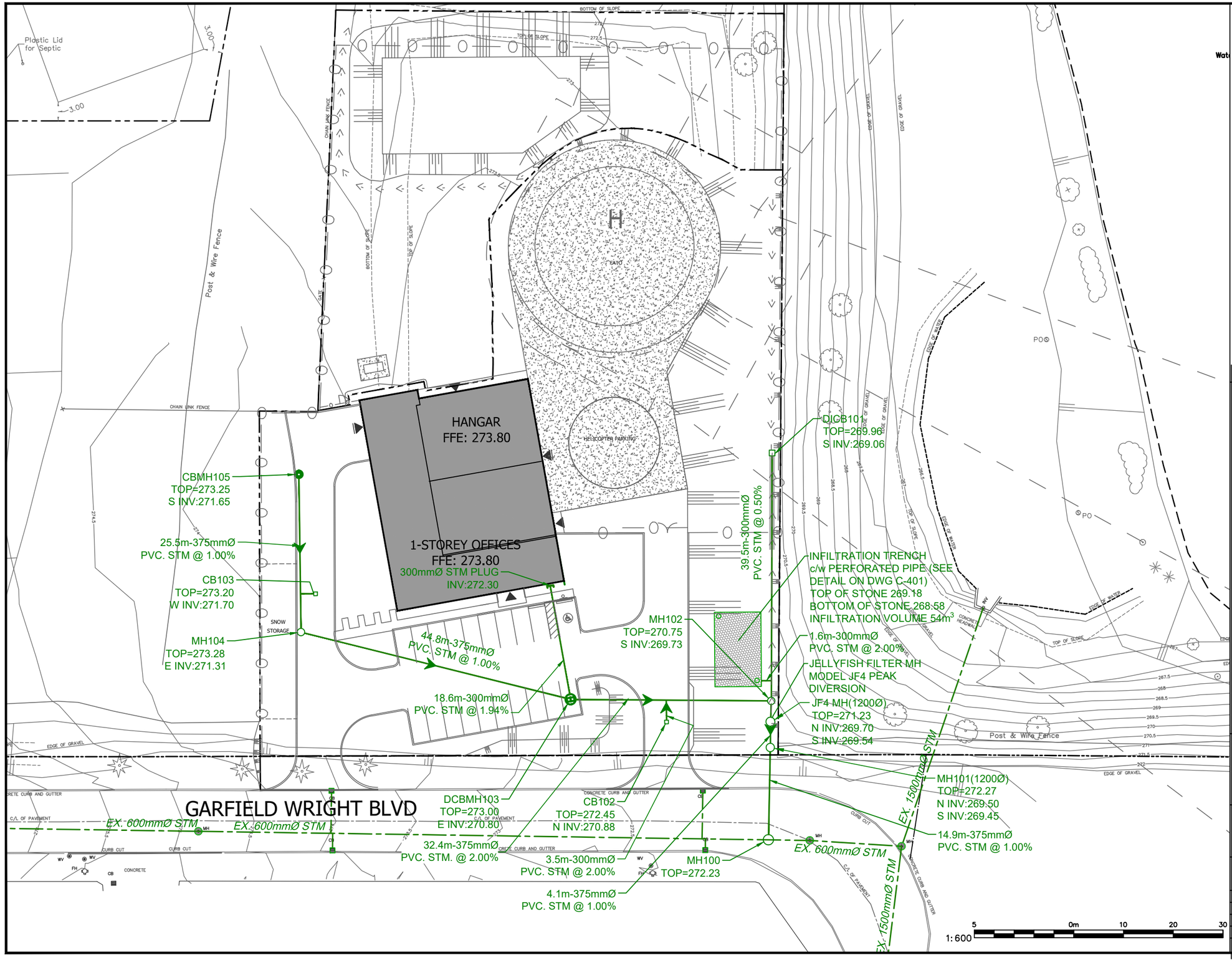
4.6 WATER BALANCE & STORMWATER QUALITY CONTROL

The downstream YRIS SWM facility will provide water balance, erosion control and stormwater quality Control (Enhanced Level 1 / 80% TSS removal).Refer to **Figure 6 – Storm Servicing Plan** for the location of the YRIS SWM facility.

4.7 PHOSPHORUS CONTROL

Lake Simcoe is enriched by nutrients from land use activities in its watershed and has, for many years, been the focus of efforts to protect and restore its water quality. In 2009, the Lake Simcoe Protection Plan (LSPP) was approved to regulate the input of nutrients, specifically phosphorus, into Lake Simcoe. The intent of the policies in the LSPP is for new development in the Lake Simcoe watershed to adopt BMP, LID techniques, and innovative stormwater management approaches to achieve sustainable development practices that reduce phosphorus loading from new urban development. In this regard, the policy requires that post-development loadings on any major development site be reduced from pre-development loadings.

To establish a method for quantifying and comparing pre- and post-development phosphorus loadings that reflect differing precipitation patterns, soils, and slopes across the Lake Simcoe watershed, the MECP released the Phosphorus Budget Guidance Tool (PBGT) to guide new development in the Lake Simcoe watershed in 2012. PBGT uses estimates of phosphorus export developed for specific land uses, coupled with standard estimates of phosphorus reduction efficiencies for various BMPs and LID techniques.



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350 GARFIELD WRIGHT BOULEVARD
TOWN OF EAST GWILLIMBURY, ONTARIO

STORM SERVICING PLAN

DESIGNED BY: PM	DATE: APRIL 2024
CHECKED BY: PW	PROJECT No. 24015
DRAWING BY: ET	
CHECKED BY: PM	FIGURE No. 6
SCALE: 1:600	

4.7.1 PRE-DEVELOPMENT LOADING

Under pre-development conditions, based on the land use categories of the PBGT the 0.6691 Ha site development area is considered to be partially "hay/pasture". Based on this category, the PBGT indicates that the pre-development phosphorus loading is 0.05 kg/year as summarized in **Table 2**.

The PBGT output for the pre-development loading is provided in **Appendix C** together with tables listing the various coefficients and land use categories.

4.7.2 POST-DEVELOPMENT LOADING

Under post-development conditions, based on the land use categories of the PBGT, the site is "High Intensity Development – Commercial". Based on this category, the PBGT indicates that the unmitigated post-development phosphorus loading is 1.22 kg/year.

The results summarized in **Table 2** indicate that there will be an increase decrease of 1.17 kg/year and therefore mitigation measures are required. The PBGT output for the post-development loading is provided in **Appendix C**.

Table 2: Phosphorus Loading Summary

LAND USE	AREA (HA)	PHOSPHORUS COEFFICIENT (KG/HA)	PHOSPHORUS LOAD (KG/YR)
PRE-DEVELOPMENT			
Hay/Pasture	0.6691	0.08	0.05
POST DEVELOPMENT			
High Intensity Development – Commercial	0.6691	1.82	1.22
SUBTOTAL (Before TP mitigation)			1.22
Infiltration Trench (c/w perforated pipe) will provide 87% TP removal from controlled areas@ 1.82 kg/Ha.	0.6691	1.82	0.73
TOTAL TP remaining (after infiltration trench mitigation)			0.16
Jellyfish filter will remove 77% of TP remaining after infiltration trench mitigation.	0.6691	1.82	0.12
TOTAL TP remaining (after infiltration trench + Jellyfish filter mitigation)			0.04

To mitigate the phosphorus loading to levels below the pre-development conditions, a treatment train approach consisting of an upstream infiltration trench (c/w perforated pipe) and Jellyfish

filter (housed in a precast manhole) will be implemented. LSRCA credits Perforated Pipe Infiltration/Exfiltration Systems with 87% TP removal while the Jellyfish filter is Environmental Technology Verification (ETV) certified for 77% TP removal. Refer to the ETV certification statement for the Jellyfish filter included in **Appendix C**. The infiltration trench will be situated upstream of the Jellyfish filter unit. Refer to **Figure 6 – Storm Servicing Plan** for the location of the infiltration trench and Jellyfish filter unit.

5.0 EROSION AND SEDIMENT CONTROL

Construction activity, especially operations involving topsoil stripping and bulk earthworks dramatically increases the availability of particulate matter for erosion and transport by surface drainage. To mitigate the adverse environmental impacts caused by the release of silt-laden stormwater runoff into receiving watercourses, measures for erosion and sediment control (ESC) are required for construction sites. The Erosion & Sediment Control Guidelines for Urban Construction, December 2006 will guide the selection of the proposed ESC measures. Control measures must be selected that are appropriate for the erosion potential of the site and they must be implemented and modified on a staged basis to reflect the site activities. Furthermore, their effectiveness decreases with sediment loading and therefore regular inspection and maintenance are required. The following ESC measures are proposed:

5.1 SILT FENCE

Silt Fences are to be installed adjacent to all grading limits to protect the development area prior to topsoil stripping and in other locations, such as at the bases of topsoil stockpiles. It is recommended that earthworks not extend immediately adjacent to the silt fence and instead 1m to 2 m vegetated buffer be maintained for additional protection. The silt fences are to be constructed with 150 x 150 mm heavy-duty wire farm fence fabric to properly support the geotextile. A heavy-duty silt fence which involves two fences with a straw bale between is recommended to be installed in the vicinity of the buffer area/valleyland.

5.2 MUDMAT

A mud mat is to be installed at the construction entrance prior to commencing earthworks to minimize the tracking of mud onto municipal roads. The mud mat will be installed at the location of the existing site entrance on Garfield Wright Boulevard.

5.3 SEDIMENT TRAPS

Sediment traps are to be installed at all catchbasin locations once the storm sewer system has been constructed to prevent silt laden runoff from entering. These sediment traps are comprised of clear stone and filter fabric over the catchbasin grate.

5.4 STORM SEWER BULKHEADS

Bulk heads are to be installed in the storm sewer manholes at key locations to provide additional sediment control of storm runoff prior to being conveyed to the receiving SWMF. The temporary bulkhead will be installed to the springline elevation of the storm sewer and will remain in place until all surfaces are stabilized. All accumulated sediment is to be removed from the manhole prior to removing the bulkhead.

6.0 CONCLUSIONS

This Functional Servicing and Stormwater Management Report presents a site servicing strategy for the proposed development that addresses the requirements of the applicable design guidelines and provides the basis for detailed servicing design.

We trust this report sufficiently addresses the site servicing requirements and allows for approval of the proposed SPA application with respect to the subject site for the proposed use described herein. Should there be any questions or comments, please feel free to contact the undersigned.

Sincerely,

Counterpoint Land Development by Dillon Consulting Limited

Pula Mathumo, P.Eng
Project Engineer/Manager
Email: pmathumo@counterpointeng.com

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APPENDIX A

Domestic and Fire Demand Calculations

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Water Demand Design Calculations

Project:	**350 Garfield Wright Boulevard**	**Prepared by:**	PM
Project No:	**24015**	**Checked by:**	PT
Client:	**York Regional Police**	**Last Revised:**	29-Aug-24
Location:	**East Gwillmbury, Ontario**		
Site Area:	0.67 ha (development area only)		

Domestic Demand per Landuse

Industrial	35,000	Litres/Ha/day	
Commercial	28,000	Litres/Ha/day	*Applicable to subject site
Institutional	18,000	Litres/Ha/day	

Per Capita Demand

Average flow	350	litres/person/day

Peaking Factors

Land Use	Minimum Hour	Maximum Hour	Maximum Day
Commercial	0.40	2.75	2.00

Water Demand based on Commercial landuse

Land Use	Area (Ha.)	Average Daily Demand (Litres/min)	Maximum Hour (l/min)	Maximum Day (l/min)	Fire Flow Required (l/min)	Max Day + Fire Flow (l/min)
Development Area	**0.67**	**13.0**	**35.8**	**26.0**	**12,000**	**12,026**

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REQUIRED FIRE FLOW WORKSHEET - PROPOSED DEVELOPMENT

Fire Underwriters Survey

Project : 350 Garfield Wright Boulevard
Project No: 24015
Date: 29-Aug-24

Prepared by: PM
Checked by: PT
Last Revised: 29-Aug-24

Guide for Determination of Required Fire Flow Copyright I.S.O

$$RFF = 220C\sqrt{A}$$

Where:

RFF = the Required Fire Flow in litres per minutes (LPM)
C = the Construction Coefficient is related to the type of construction of the building
A = the Total Effective Floor Area (effective building area) in square metres of the building

Type of Construction		Coefficient
Type V	Wood Frame	1.5
Type IV-A	Encapsulated Mass Timber	0.8
Type IV-B	Rated Mass Timber	0.9
Type IV-C	Ordinary Mass Timber	1.0
Type IV-D	Un-Rated Mass Timber	1.5
Type III	Ordinary	1.0
Type II	Noncombustible	0.8
Type I	Fire Resistive	0.6

Contents		Factor
NC	Non-Combustible	-25%
LC	Limited Combustible	-15%
C	Combustible	0%
FB	Free Burning	15%
RB	Rapid Burning	25%

1) Required Fire Flow

Type of Construction:	Type III
C=	1.0
A*=	918 m^2
F=	**6,666 L/min**

2) Occupancy and Contents Adjustment Factor

Type of Occupancy		C			
Contents Adjustment Factor		0%	=	0	L/min
F=	6666L/min +	0	L/min =	6,666	**L/min**

3) System Type Reduction

NFPA 13 Sprinkler:		YES	30%		
Standard Water Supply:		YES	10%		
Fully Supervised:		YES	10%		
Total Credit			50%		
Reduction of:		50%	L/min =	3,333	L/min
F=	6666L/min -	3,333	L/min =	3,333	**L/min**

4) Exposure Adjustment Charge

Building Face	Dist(m)	Charge
North	100	0%
East	100	0%
South	100	0%
West	100	0%
Total		0% of 6665.7 L/min = 0 L/min

(max exposure charge can be 75%)

Separation Distance	Maximum Exposure Adjustment Charge
0 m to 3 m	25%
3.1 m to 10 m	20%
10.1 m to 20 m	15%
20.1 m to 30 m	10%
Greater than 30	0%

F= 3333L/min + 0L/min = 3,333 **L/min**

F=	3,000	**L/min**	(round to the nearest 1,000L/min)
F=	50	**L/s**	
F=	793	**gpm**	

Min. Required Fireflow = 12,000 L/s per Town of East Gwillmbury Design Guidelines

APPENDIX B

Sanitary Demand Calculations

Percolation Test Report

Septic System Design Information

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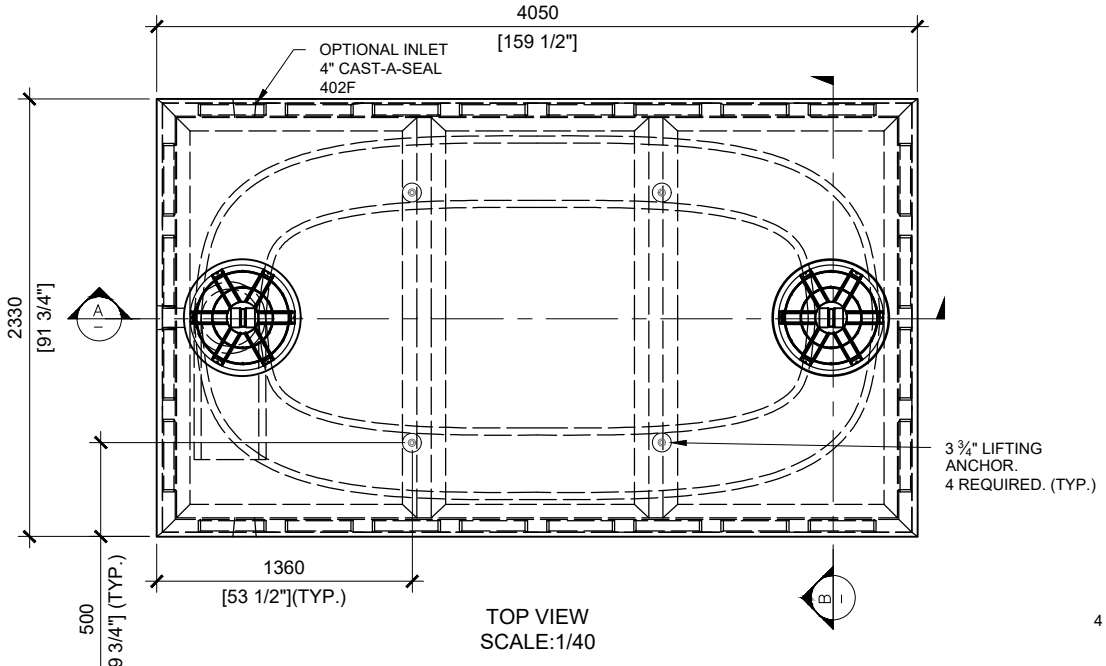
Sanitary Design Calculations

Project:	**350 Garfield Wright Boulevard**
Project No:	24015
Client:	York Regional Police
Location:	East Gwillmbury, Ontario
Site Area:	0.67 ha (development area only)
Date:	29-Aug-24

Daily Sanitary Design Flow

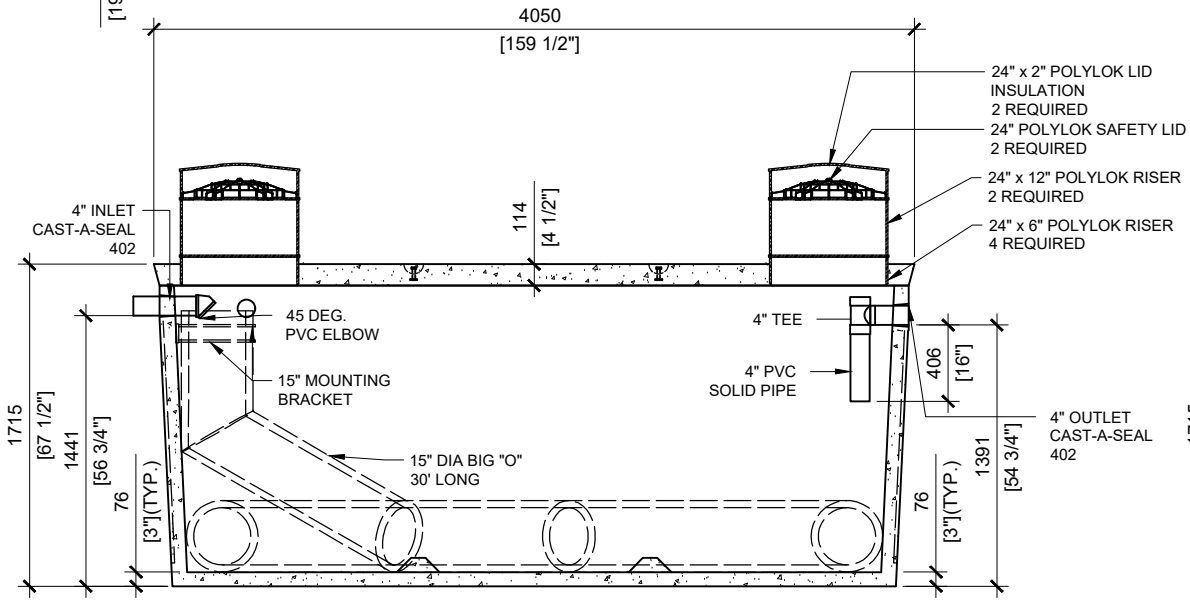
Ontario Building Code Non-Residential Design Flow Rates					
Occupancy		Unit	Daily Volume, Litres per unit *	Site Units	Daily Design Volume (Litres)
Office Building					
	Per each 9.3 m^2 of floor space	9.3 sq.m	75	450	3,629
Per 2012 OBC Code, Table 8.2.1.3.B					
			Average Flow =	0.04 L/s	
			=	2.52 L/min	



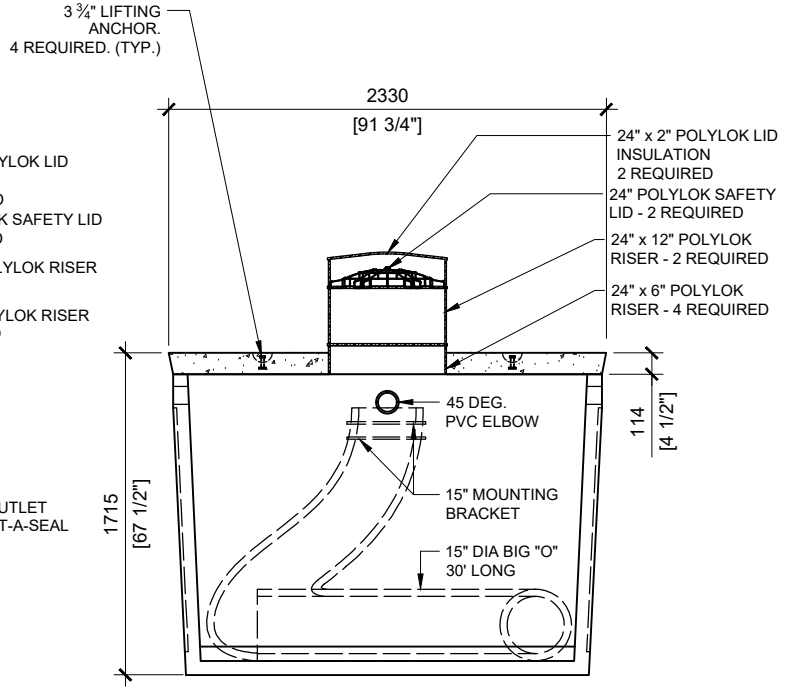
TOP VIEW
SCALE:1/40

GENERAL NOTES:

1. UNITS ARE SEALED WITH BUTYL TAPE AT THE JOINTS
2. DELIVERY IS MADE BY CRANE-EQUIPPED TRUCKS
3. EXCAVATION MUST BE READY, SAFE AND ACCESSIBLE FOR UNLOADING FROM THE REAR OF THE TRUCK.
4. MIN OVERHEAD CLEARANCE OF 18FT (5.5 METERS) IS REQUIRED
5. ALL UNITS MUST BE HANDLED WITH PROPER LIFTING EQUIPMENT
6. MAXIMUM BURIAL DEPTH = 1 METRE IN FIRM SOIL AWAY FROM ANY VEHICULAR TRAFFIC
7. TUF-TITE SAFETY LIDS INSTALLED IN BOTH OPENINGS AS PER CSA-B66-21



SECTION A
SCALE:1/40



SECTION B
SCALE:1/40

BROOKLIN CONCRETE PRODUCTS

MANUFACTURED:
LINDSAY, ON
1-800-655-3430

CONCRETE: 35MPa/5000PSI
AIR ENTRAINMENT: 5-8%
REINFORCEMENT: STEEL TO CSA CAN A23.1 /A23.3 G30.18 Fy=400MPa

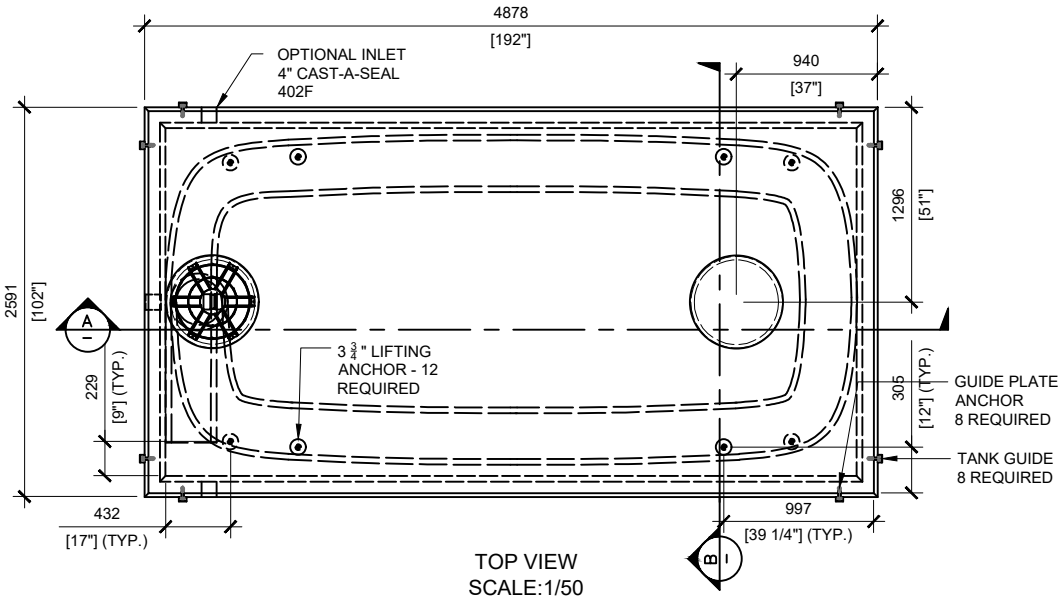
WEIGHT:
21,380lbs / 9,676kg

DRAWN BY:
PRASHAN

DATE:
DEC/2023

WATERLOO AD-9000

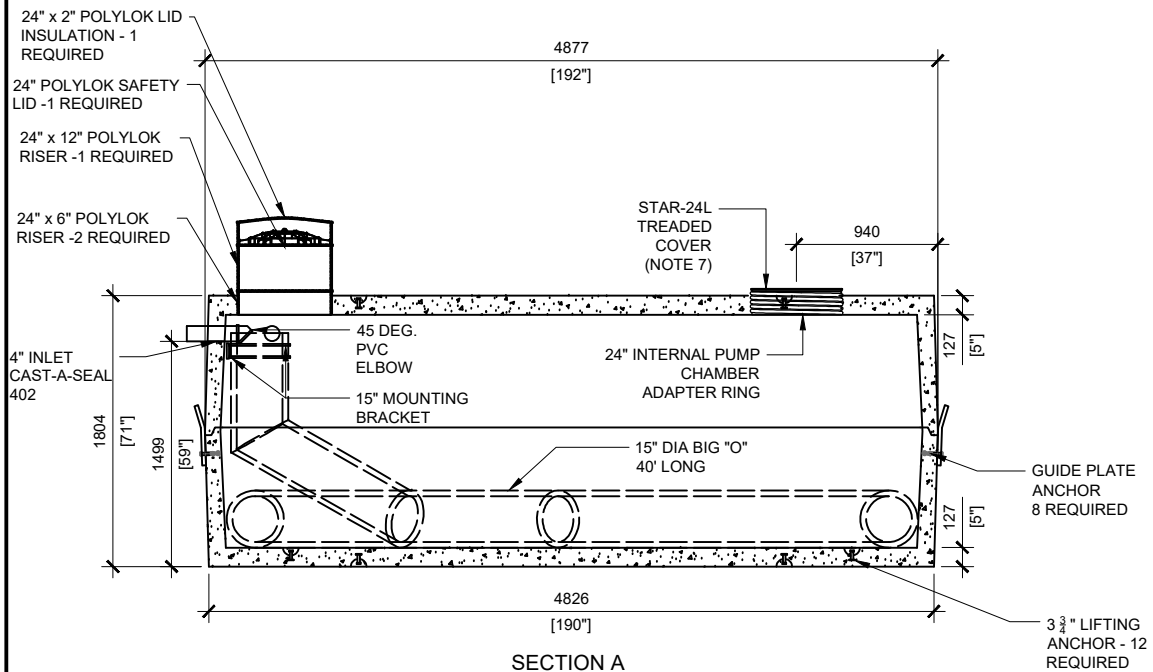
9,000 LITRES



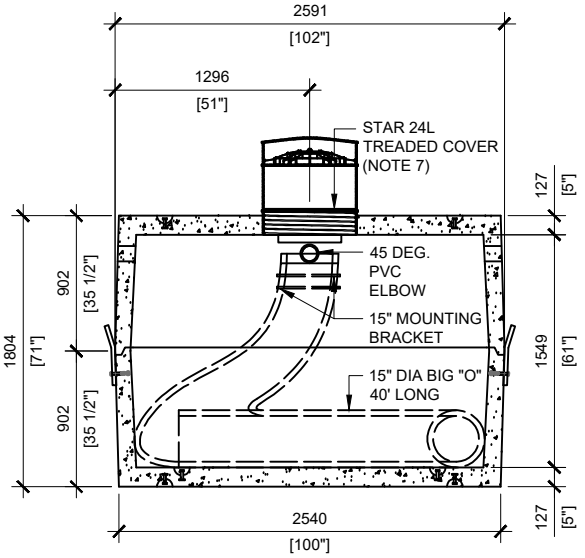
TOP VIEW
SCALE:1/50

GENERAL NOTES:

1. UNITS ARE SEALED WITH BUTYL TAPE AT THE JOINTS
2. DELIVERY IS MADE BY CRANE-EQUIPPED TRUCKS
3. EXCAVATION MUST BE READY, SAFE AND ACCESSIBLE FOR UNLOADING FROM THE REAR OF THE TRUCK.
4. MIN OVERHEAD CLEARANCE OF 18FT (5.5 METRES) IS REQUIRED
5. ALL UNITS MUST BE HANDLED WITH PROPER LIFTING EQUIPMENT (I.E. SPREADER BAR)
6. MAXIMUM BURIAL DEPTH = 1 METRE IN FIRM SOIL AWAY FROM ANY VEHICULAR TRAFFIC
7. THREADED COVER TO BE REMOVED AND REPLACED BY INTERNAL PUMP CHAMBER (PROVIDED BY WATERLOO) ON SITE



SECTION A
SCALE:1/50



SECTION B
SCALE:1/50

BROOKLIN CONCRETE PRODUCTS

MANUFACTURED:
LINDSAY, ON
1-800-655-3430

CONCRETE TYPE: SCC
CONCRETE: 45MPa at 28 days / 6,500PSI
AIR ENTRAINMENT: 5-8%
REINFORCEMENT: STEEL TO CSA CAN A23.1 /A23.3 G30.18 Fy=400MPa

WEIGHT:
BOTTOM - 17,712lbs / 8,050kg
TOP - 17,571lbs / 7,989kg

DRAWN BY: PRASHAN

WATERLOO ADIPC-14000

DATE: DEC/2023

14,000 LITRES

System Diagram – Baskets in Concrete Tank

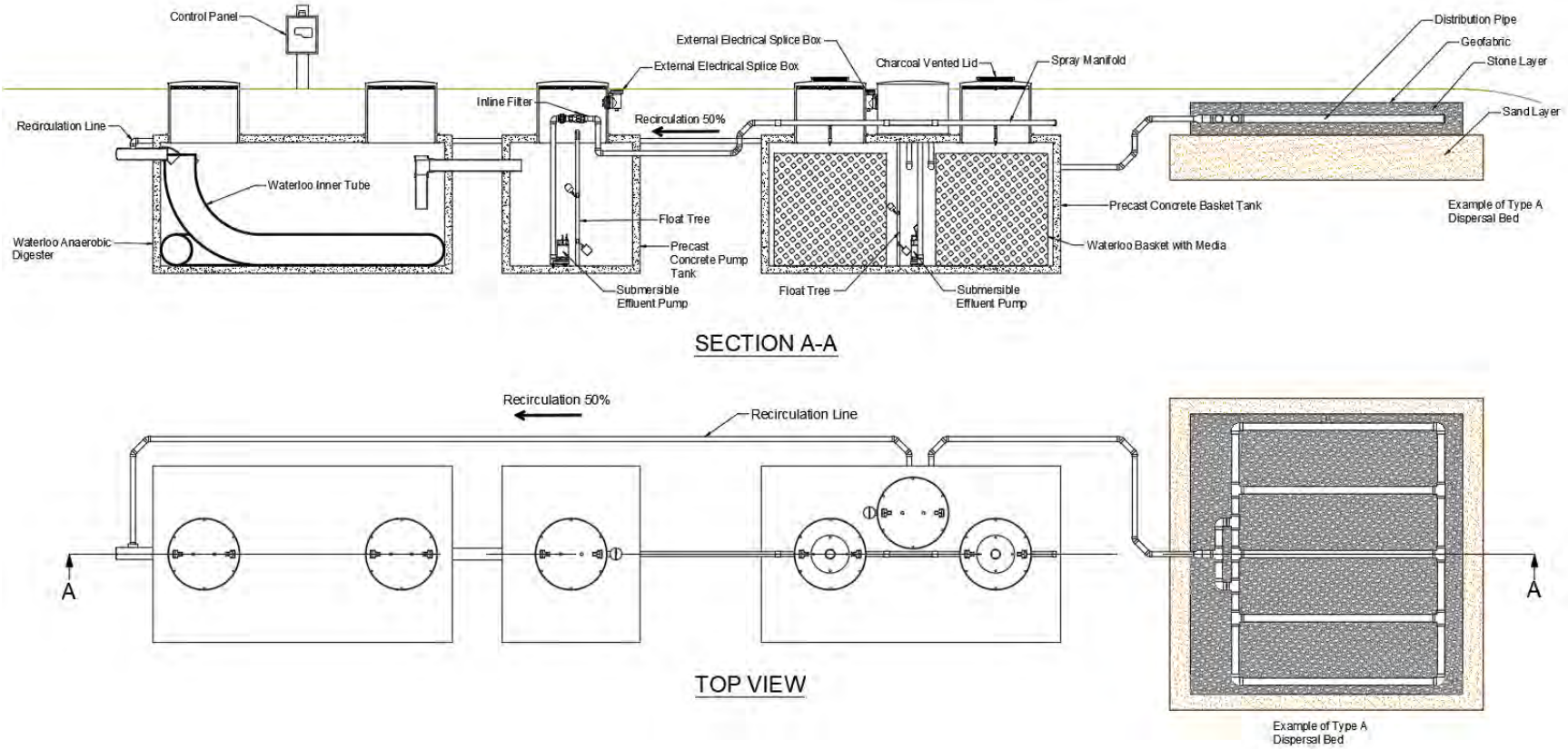


Figure 51. Anaerobic digester, pump tank, and baskets in concrete tank system diagram

System Diagram – Baskets in Concrete Tank

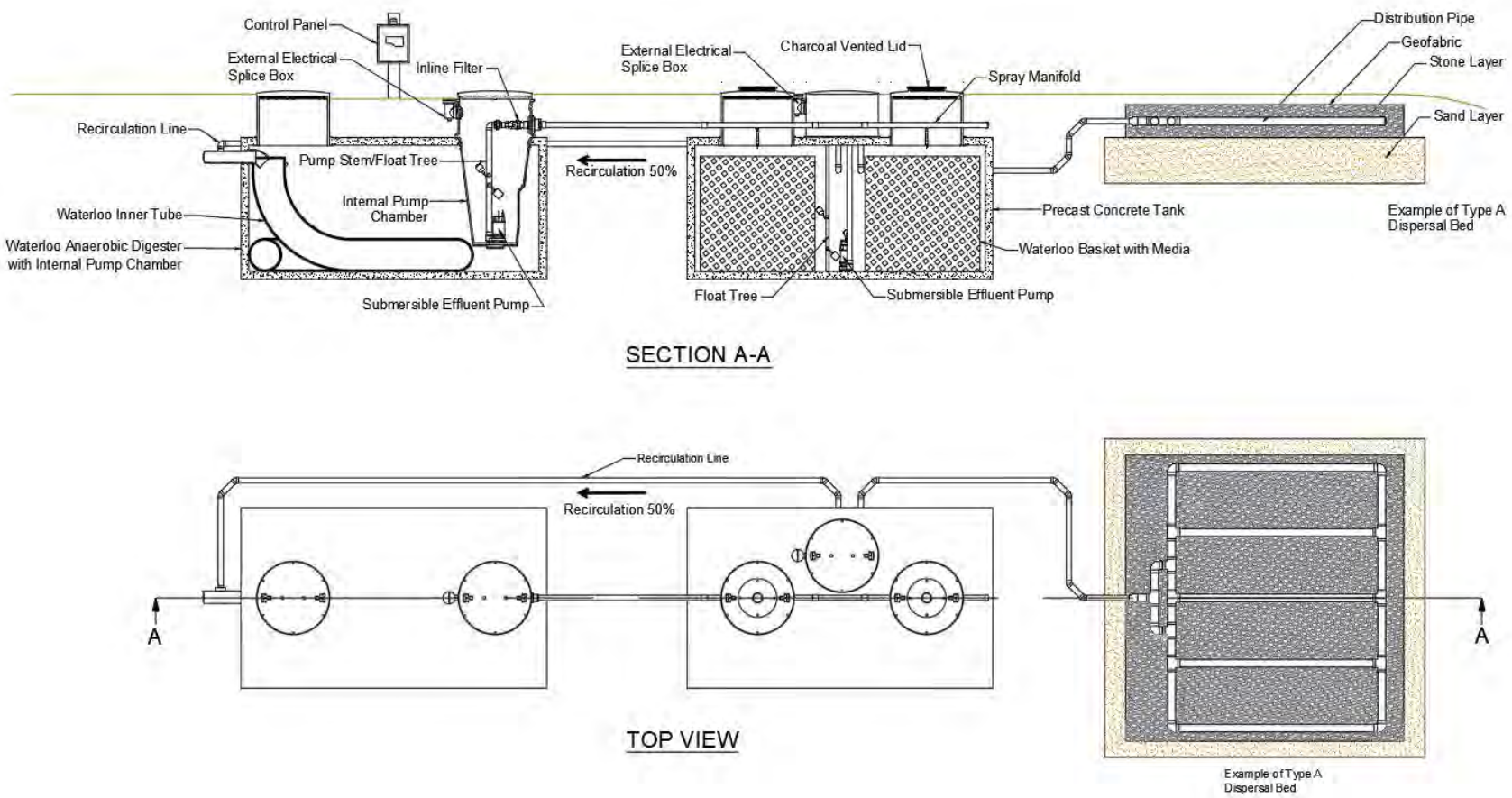


Figure 50. Anaerobic digester with internal pump chamber and baskets in concrete tank system diagram

GEI Consultants

July 31, 2024

Azimuth Environmental Consulting Inc.
642 Welham Road
Barrie, Ontario
L4N 9A1

Attn: Brendan MacNaughton

RE: Job No. 24-054
Determination of Estimated T-Time

GEI Consultants Ltd. (GEI) was provided with three (3) soil samples on July 23, 2024 to complete grain size analyses to determine the percolation rate of the tested soils (T-Time analysis).

The delivered samples were identified as shown below.

- TP-24-1-2, YRP Hanger
- TP-24-6-4, YRP Hanger
- TP-24-3-2, YRP Hanger

Three grain size distribution curves were developed by testing the above referenced soil samples in accordance with ASTM D6913 Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis and ASTM D7928 (sedimentation / hydrometer analysis). The result of the laboratory test and graphical representation of the grain size analyses are enclosed.

Determination of percolation rate is based on the "*Ministry of Municipal Affairs and Housing (MMAH) Supplementary Guidelines SB-6, Percolation Time and Soil Descriptions, September 14, 2012*". Based on this document, a summary of the result and the estimated percolation rates of the soil are as follows:

Client Reference	Soil Description (MIT)	USCS Soil Classification	Coefficient of Permeability (K- cm/sec)	Estimated Percolation Rate or "*T-Time*" (mins/cm)
TP-24-1-2	SILT, Some Clay, Trace Sand	M.L.	$<10^{-6}$	>50 mins/cm
TP-24-6-4	SILT, Some Sand, Some Clay, Trace Gravel	M.L.	10^{-6}	50 mins/cm
TP-24-3-2	SANDY SILT, Some Clay, Trace Gravel	M.L.	10^{-6}	50 mins/cm

*Reference MMAH Supplementary Standard SB-6, Table 2

It is noted that percolation time not only varies based on the grain size distribution but is also influenced by other soil characteristics such as the density of the soil, the structure of the soil, the percentage/mineralogy of clay, the plasticity of the soil, the organic content of the soil, and the groundwater table level which are not expressly calculated as part of a grain size analysis.

No field investigation was conducted by GEI in conjunction with the above testing and did not witness the depth or location in which these samples were obtained. GEI is providing the percolation rates as factual information, to be used in design by a qualified professional with due regard to the limitations as indicated above.

We trust this information is sufficient for your present purposes. Should you have any questions concerning the above, or if we can be of any further assistance, please do not hesitate to contact the undersigned.

Yours truly,
GEI Consultants Ltd.

Donna Davidson-Gorry
Laboratory Supervisor
(705) 718-6604
ddavidsongorry@geiconsultants.com

Andrew Jones
Materials Testing and Inspection Practice Lead
(705) 220-0060
ajones@geiconsultants.com

Enclosures (3)

Grain Size Analysis (T-Time)

ENCLOSURE 1

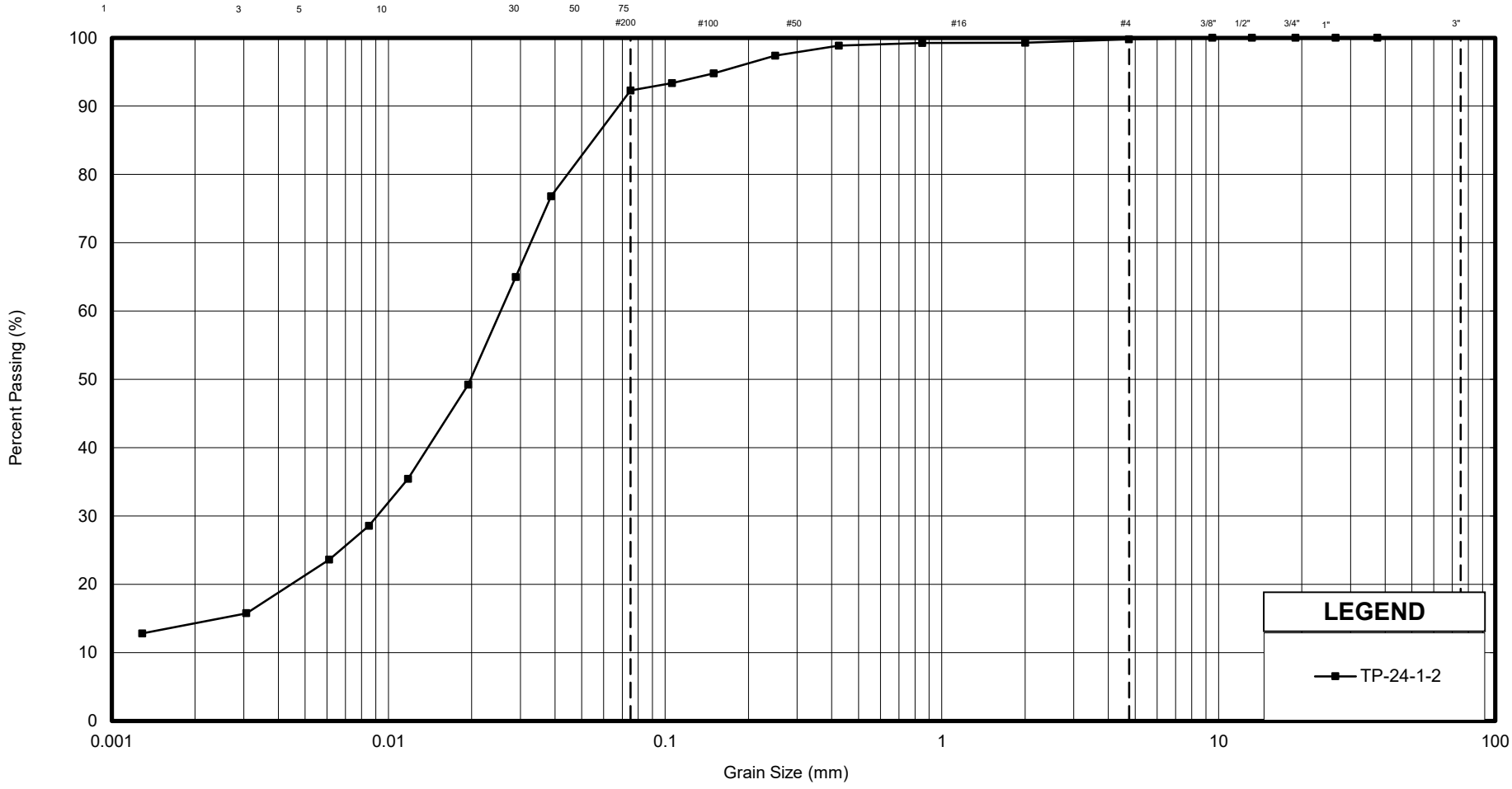
Grain Size Analysis (T-Time)

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY AND SILT	SAND			GRAVEL	
	Fine	Medium	Coarse	Fine	Coarse

GRAIN SIZE IN MICROMETERS

SIEVE DESIGNATION (IMPERIAL)



GEI Lab No.	Description	Gr.	Sa.	Si.	Cl.	D_{10}	D_{30}	D_{60}	C_u	C_c
7836	SILT, Some Clay, Trace Sand	-	7	78	15	-	0.009	0.025	-	-

GEI Consultants

Azimuth Environmental - Job No. 24-054, YRP Hanger

SILT

FIGURE No.

REF. No. 2005133

DATE July 2024

ENCLOSURE 2

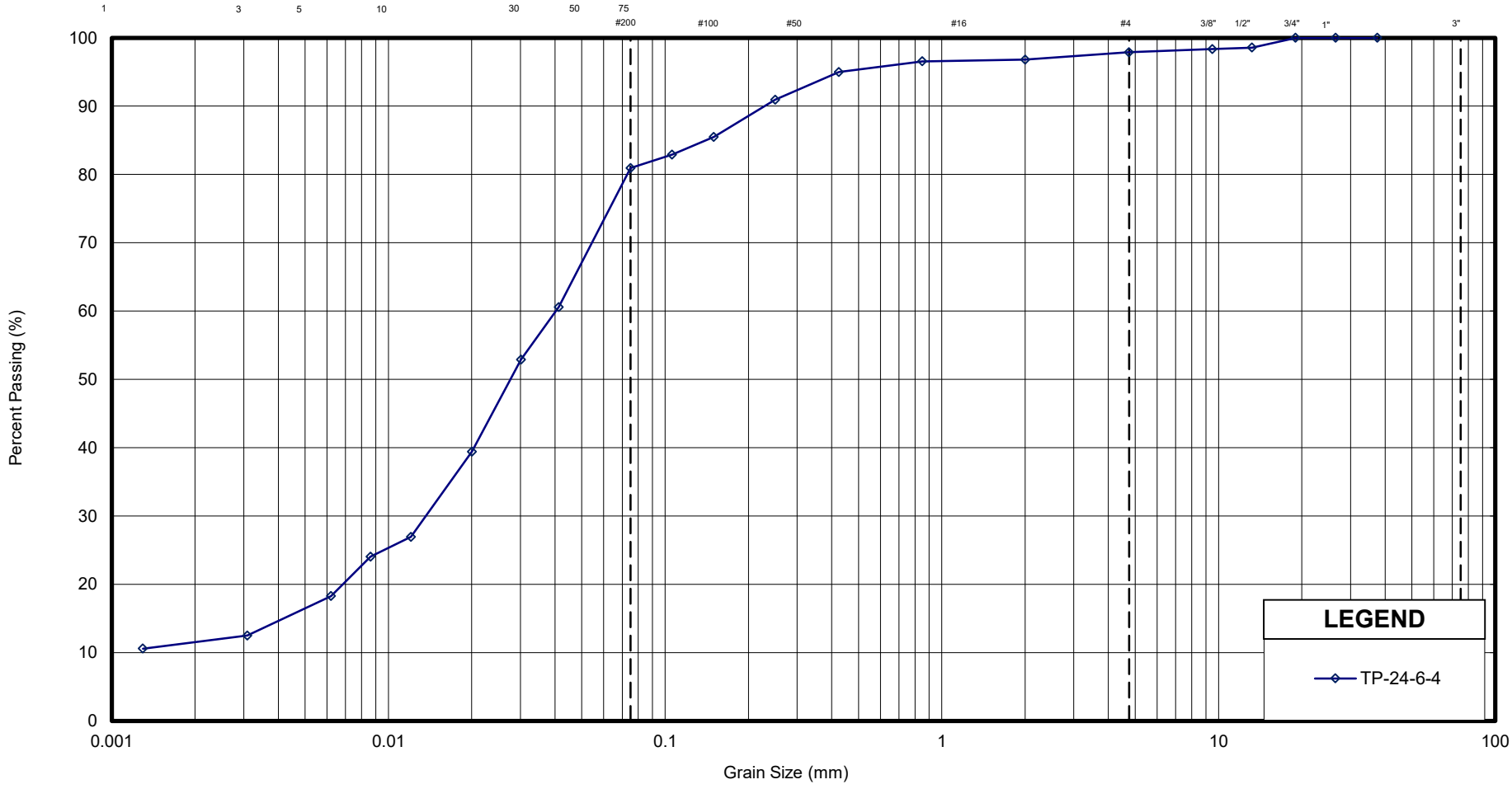
Grain Size Analysis (T-Time)

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY AND SILT	SAND			GRAVEL	
	Fine	Medium	Coarse	Fine	Coarse

GRAIN SIZE IN MICROMETERS

SIEVE DESIGNATION (IMPERIAL)



GEI Lab No.	Description	Gr.	Sa.	Si.	Cl.	D_{10}	D_{30}	D_{60}	C_u	C_c
7837	SILT, Some Sand, Some Clay, Trace Gravel	2	17	69	12	-	0.014	0.040	-	-

GEI Consultants

GRAIN SIZE DISTRIBUTION - Azimuth Environmental - YRP Hanger

SILT

FIGURE No.

REF. No. 2005133

DATE July 2024

ENCLOSURE 3

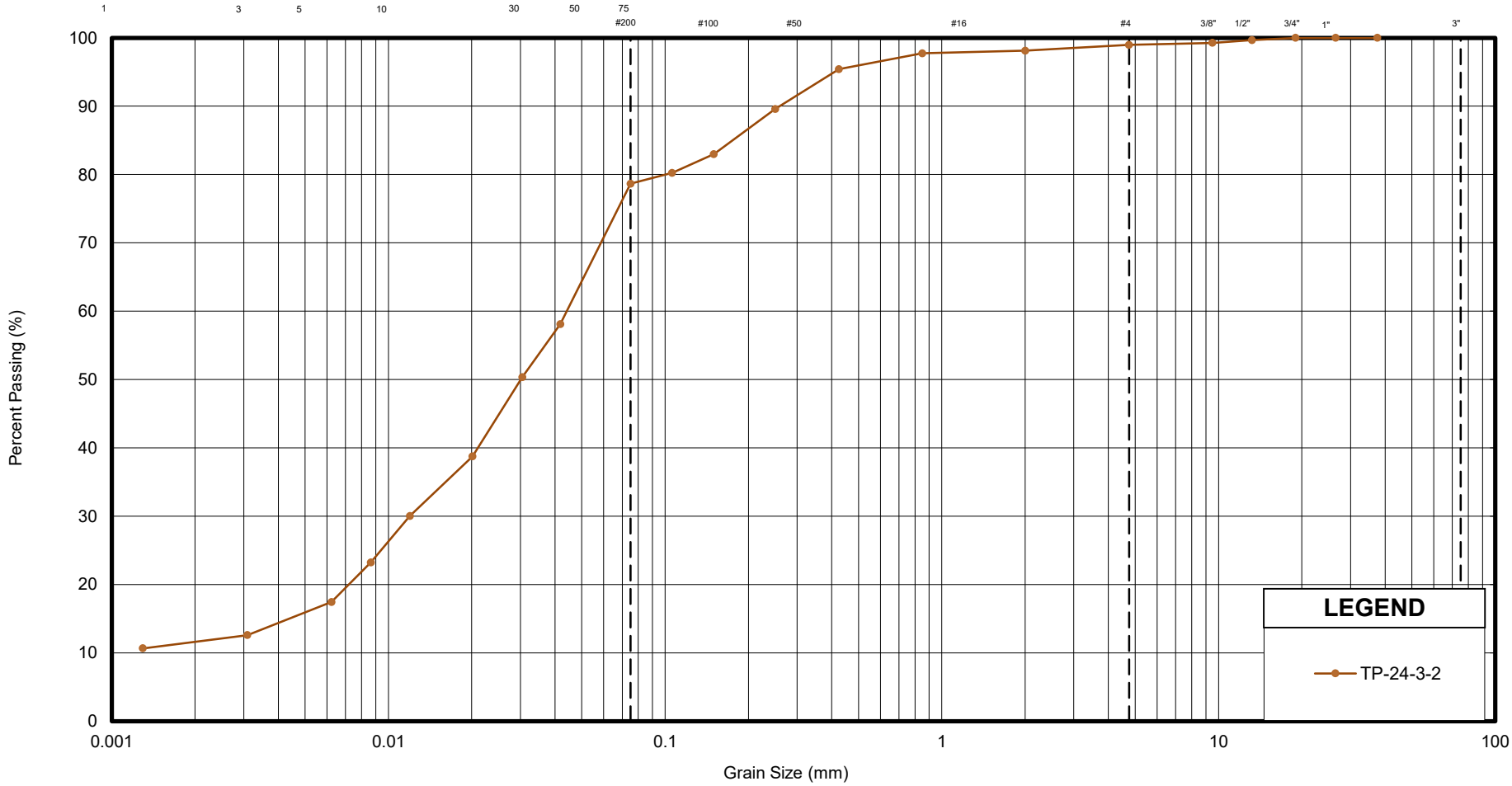
Grain Size Analysis (T-Time)

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY AND SILT	SAND			GRAVEL	
	Fine	Medium	Coarse	Fine	Coarse

GRAIN SIZE IN MICROMETERS

SIEVE DESIGNATION (IMPERIAL)



GEI Lab No.	Description	Gr.	Sa.	Si.	Cl.	D_{10}	D_{30}	D_{60}	C_u	C_c
7838	SANDY SILT, Some Clay, Trace Gravel	1	20	67	12	-	0.012	0.044	-	-

GEI Consultants

GRAIN SIZE DISTRIBUTION - Azimuth Environmental - YRP Hanger

SANDY SILT

FIGURE No.

REF. No. 2005133

DATE July 2024

AZIMUTH ENVIRONMENTAL CONSULTING, INC.

Environmental Assessments & Approvals

TEST PIT LOG

Project Name/ Project Client	YRP Hanger/ York Regional Police	**Project Address**	90 Bales Drive East, Sharon, ON	**Date**	July 23, 2024
Test Pit Number	TP24-1	**Contractor**	Provided by Proponent	**Elevation**	NA
Operator / Equipment	Brock Excavation / Track Mounted Excavator	**Test Pit Size**	1m x 3m	**Datum**	Ground Surface
Temperature	25°C	**Weather**	Sunny	**Sample Type**	Soil

Depth		**Soil description**	**Samples**		**pH**	**Remarks / Chemical Analysis**
From (m)	**To (m)**		**No.**	**Depth (mbgs)**		
0.00	0.30	Brown, dry, loose sandy topsoil with organics and rootlets.	1	-	-	-
0.30	2.10	*Fill:* Light brown, dry, compact silt w/ some fine sand and clay. Some mottling after 50 cm. Becoming moist at 70 cm.	2	-	-	Sample submitted for grain size and T-time assessment.
		Test Pit Terminated at 2.1 mbgs				

Comments	***Water Conditions in Test Pit***	
Standpipe not installed in test pit prior to backfilling.	☐ Wet upon completion ☑ Dry upon completion	

JOB No.	24-054
TEST PIT No.	TP24-1
FIELD STAFF	B.Pettersone

AZIMUTH ENVIRONMENTAL CONSULTING, INC.

Environmental Assessments & Approvals

TEST PIT LOG

Project Name/ Project Client	YRP Hanger/ York Regional Police	**Project Address**	90 Bales Drive East, Sharon, ON	**Date**	July 23, 2024
Test Pit Number	TP24-2	**Contractor**	Provided by Proponent	**Elevation**	NA
Operator / Equipment	Brock Excavation / Track Mounted Excavator	**Test Pit Size**	1m x 3m	**Datum**	Ground Surface
Temperature	25°C	**Weather**	Sunny	**Sample Type**	Soil

Depth		**Soil description**	**Samples**		**pH**	**Remarks / Chemical Analysis**
From (m)	**To (m)**		**No.**	**Depth (mbgs)**		
0.00	0.20	Brown, dry, loose sandy topsoil with organics and rootlets.	1	-	-	-
0.20	2.10	*Fill:* Light brown, dry, compact silt w/ some fine sand and clay. Some mottling after 50 cm. Becoming moist at 70 cm.	2	-	-	-
		Test Pit Terminated at 2.1 mbgs				

Comments	***Water Conditions in Test Pit***	
Standpipe not installed in test pit prior to backfilling.	☐ Wet upon completion ☑ Dry upon completion	

JOB No.	24-054
TEST PIT No.	TP24-2
FIELD STAFF	B.Pettersone

AZIMUTH ENVIRONMENTAL CONSULTING, INC.

Environmental Assessments & Approvals

TEST PIT LOG

Project Name/ Project Client	YRP Hanger/ York Regional Police	**Project Address**	90 Bales Drive East, Sharon, ON	**Date**	July 23, 2024
Test Pit Number	TP24-3	**Contractor**	Provided by Proponent	**Elevation**	NA
Operator / Equipment	Brock Excavation / Track Mounted Excavator	**Test Pit Size**	1m x 3m	**Datum**	Ground Surface
Temperature	25°C	**Weather**	Sunny	**Sample Type**	Soil

Depth		**Soil description**	**Samples**		**pH**	**Remarks / Chemical Analysis**
From (m)	**To (m)**		**No.**	**Depth (mbgs)**		
0.00	0.20	Brown, dry, loose sandy topsoil with organics and rootlets.	1	-	-	-
0.20	0.40	*Fill:* Light brown, dry, compact silt w/ fine sand and some stone and clay.	2	-	-	Sample submitted for grain size and T-time assessment.
0.40	0.50	*Buried Organics* : Dark brown to black, lots of organic material and woody debris.	3	-	-	-
0.50	1.95	*Fill:* Light brown, dry, compact to dense silt w/ some fine sand and clay. Some mottling after 50 cm. Becoming moist at 1.1 cm.	4	-	-	-
		Test Pit Terminated at 1.95 mbgs				

Comments	***Water Conditions in Test Pit***	
Standpipe not installed in test pit prior to backfilling.	☐ Wet upon completion ☑ Dry upon completion	

JOB No.	24-054
TEST PIT No.	TP24-3
FIELD STAFF	B.Pettersone

AZIMUTH ENVIRONMENTAL CONSULTING, INC.

Environmental Assessments & Approvals

TEST PIT LOG

Project Name/ Project Client	YRP Hanger/ York Regional Police	**Project Address**	90 Bales Drive East, Sharon, ON	**Date**	July 23, 2024
Test Pit Number	TP24-4	**Contractor**	Provided by Proponent	**Elevation**	NA
Operator / Equipment	Brock Excavation / Track Mounted Excavator	**Test Pit Size**	1m x 3m	**Datum**	Ground Surface
Temperature	25°C	**Weather**	Sunny	**Sample Type**	Soil

Depth		**Soil description**	**Samples**		**pH**	**Remarks / Chemical Analysis**
From (m)	**To (m)**		**No.**	**Depth (mbgs)**		
0.00	0.20	Brown, dry, loose sandy topsoil with organics and rootlets.	1	-	-	-
0.20	0.80	*Fill:* Light brown, dry, compact silt w/ fine sand and some stone and clay.	2	-	-	-
0.80	1.40	*Fill:* Dark grey, moist silty clay w/ some organics and trace sand. Refuse present (i.e., wood debris, concrete, wire, plastic, etc.).	3	-	-	-
1.40	2.30	*Fill:* Light brown, dry, compact silt w/ some fine sand and clay; trace organics. Refuse present (i.e., wood, concrete, plastic, etc.). Pocket of medium-coarse sand at 45 cm.	4	-	-	-
		Test Pit Terminated at 2.1 mbgs				

Comments	***Water Conditions in Test Pit***	
Standpipe not installed in test pit prior to backfilling.	☐ Wet upon completion ☑ Dry upon completion	

JOB No.	24-054
TEST PIT No.	TP24-4
FIELD STAFF	B.Pettersone

AZIMUTH ENVIRONMENTAL CONSULTING, INC.

Environmental Assessments & Approvals

TEST PIT LOG

Project Name/ Project Client	YRP Hanger/ York Regional Police	**Project Address**	90 Bales Drive East, Sharon, ON	**Date**	July 23, 2024
Test Pit Number	TP24-5	**Contractor**	Provided by Proponent	**Elevation**	NA
Operator / Equipment	Brock Excavation / Track Mounted Excavator	**Test Pit Size**	1m x 3m	**Datum**	Ground Surface
Temperature	25°C	**Weather**	Sunny	**Sample Type**	Soil

Depth		**Soil description**	**Samples**		**pH**	**Remarks / Chemical Analysis**
From (m)	**To (m)**		**No.**	**Depth (mbgs)**		
0.00	0.30	Brown, dry, loose sandy topsoil with organics and rootlets.	1	-	-	-
0.30	2.10	*Fill:* Light brown, dry, compact silt w/ some fine sand and clay; trace organics. Refuse present (i.e., wood, concrete, plastic, etc.). Pocket of medium-coarse sand at 45 cm.	2	-	-	-
		Test Pit Terminated at 2.1 mbgs				

Comments	***Water Conditions in Test Pit***
Standpipe not installed in test pit prior to backfilling.	☐ Wet upon completion ☑ Dry upon completion

JOB No.	24-054
TEST PIT No.	TP24-5
FIELD STAFF	B.Pettersone

AZIMUTH ENVIRONMENTAL CONSULTING, INC.

Environmental Assessments & Approvals

TEST PIT LOG

Project Name/ Project Client	YRP Hanger/ York Regional Police	**Project Address**	90 Bales Drive East, Sharon, ON	**Date**	July 23, 2024
Test Pit Number	TP24-6	**Contractor**	Provided by Proponent	**Elevation**	NA
Operator / Equipment	Brock Excavation / Track Mounted Excavator	**Test Pit Size**	1m x 3m	**Datum**	Ground Surface
Temperature	25°C	**Weather**	Sunny	**Sample Type**	Soil

Depth		**Soil description**	**Samples**		**pH**	**Remarks / Chemical Analysis**
From (m)	**To (m)**		**No.**	**Depth (mbgs)**		
0.00	0.20	Brown, dry, loose sandy topsoil with organics and rootlets.	1	-	-	-
0.20	0.96	*Fill:* Light brown, dry, compact silt w/ fine sand and some stone and clay.	2	-	-	-
0.96	1.60	*Fill:* Dark grey, moist silty clay w/ some organics and trace sand. Refuse present (i.e., wood debris, concrete, wire, plastic, etc.).	3	-	-	-
1.60	2.40	*Fill:* Light brown, dry, compact silt w/ some fine sand and clay; trace organics. Refuse present (i.e., wood, concrete, plastic, etc.). Pocket of medium-coarse sand at 45 cm.	4	-	-	Sample submitted for grain size and T-time assessment.
		Test Pit Terminated at 2.1 mbgs				

Comments	***Water Conditions in Test Pit***	
Standpipe not installed in test pit prior to backfilling.	☐ Wet upon completion ☑ Dry upon completion	

JOB No.	24-054
TEST PIT No.	TP24-6
FIELD STAFF	B.Pettersone

YRP Hanger - Servicing Assessment

Test Pit Location Plan

APPENDIX C

East Gwillimbury IDF Curve data and Post Development Stormwater Release Rates

MECP PBGT output

Jellyfish Filter ETV verification statement

Background YRIS SWMF design reports

All storm sewers are to have a minimum horizontal separation of 2.5 m and a vertical clearance of 0.5 m from watermains in accordance with MOE regulations.

35.3 Termination Points

All sewers shall be terminated at the subdivision limits when external drainage areas are considered in the design with suitable provision in the design of the terminal manholes to allow for the future extension of the sewer.

35.4 Sewer Alignment

All storm sewers shall be laid in a straight line between manholes unless radial pipe has been designed as outlined in Section 36.9.

35.5 Pipe Crossings

A minimum clearance of 75 mm shall be provided between the outside of the pipe barrel at the point of crossing for storm and sanitary sewers. A minimum clearance of 0.5 m shall be provided for all sewer and watermain crossings.

In the event the minimum clearances cannot be obtained, the designs must adhere to MOE policies. In addition the pipes shall be concrete encased to ensure that the pipes are properly bedded.

35.6 Changes in Pipe Size

No decrease of pipe size from a larger upstream pipe to a smaller downstream size will be allowed due to the increase in grade.

35.7 Pipe Bedding and Backfill

The class of pipe and the type of bedding shall be selected to suit loading and proposed construction conditions. Details and types of bedding and backfill are illustrated in OPSD 802.010 and 802.030. The width of the trench at the top of the pipe must be carefully controlled to ensure that the maximum trench width is not exceeded unless a higher class of bedding or higher pipe strength pipe is used. The recommendations of a Geotechnical Engineer will be required in determining strength of pipe required and construction methods to be used.

36.0 MANHOLES

36.1 Location

Manholes shall be constructed at the following locations:

- at changes in pipe size
- at pipe junctions
- at changes in pipe slope

counterpoint ENGINEERING

A SUBSIDIARY OF DILLON CONSULTING LIMITED

SWM DESIGN CALCULATIONS
Post-Development Release Rate Calculations (Rational Method)
Area 100 - development area

Project Name: 350 Garfield Wright Boulevard
Municipality: East Gwillmbury, Ontario
Project No.: 24015
Date: 28-Aug-24

Prepared by: PM
Checked by: PT
Last Revised: 28-Aug-24

Area 100

Location	Burlington
Area (ha)	0.67
Runoff Coefficient	0.66

Adjustment Factor

Up to 10-Year	1.00
25-Year	1.10
50-Year	1.20
100-Year	1.25

Rational Method

$$Q = KRCIA$$

Where:

Q = Design flow (m^3 / sec)
K = Conversion factor (0.00278)
R = Return period factor
C = Runoff coefficient
I = Rainfall intensity (mm / hour)
A = Contributing drainage area (ha)

Event:	2-Year
a	648
b	4.000
c	0.784
Runoff Coefficient	0.66
AC	0.44
Tc (min)	10
Rainfall Intensity (mm/hr)	82
Rational Flow Rate (l/s)	100

Event:	5-Year
a	930
b	4
c	0.798
Runoff Coefficient	0.66
AC	0.44
Tc (min)	10
Rainfall Intensity (mm/hr)	113
Rational Flow Rate (l/s)	139

Event:	10-Year
a	1021
b	3.000
c	0.787
Runoff Coefficient	0.66
AC	0.44
Tc (min)	10
Rainfall Intensity (mm/hr)	136
Rational Flow Rate (l/s)	166

Event:	25-Year
a	1100
b	2.000
c	0.776
Runoff Coefficient	0.73
AC	0.49
Tc (min)	10
Rainfall Intensity (mm/hr)	160
Rational Flow Rate (l/s)	216

Event:	50-Year
a	1488
b	3.000
c	0.803
Runoff Coefficient	0.79
AC	0.53
Tc (min)	10
Rainfall Intensity (mm/hr)	190
Rational Flow Rate (l/s)	279

Event:	100-Year
a	1770
b	4.000
c	0.820
Runoff Coefficient	0.83
AC	0.55
Tc (min)	10
Rainfall Intensity (mm/hr)	203
Rational Flow Rate (l/s)	312

Counterpoint Engineering Inc.
8395 Jane Street, Suite 100 Vaughan, Ontario L4K 5Y2
TEL: (905) 326-1404 FAX: (905) 326-1405
www.counterpointeng.com

counterpoint ENGINEERING

A SUBSIDIARY OF DILLON CONSULTING LIMITED

SWM DESIGN CALCULATIONS
Post-Development Release Rate Calculations (Rational Method)
Area 101 - non development area

Project Name: 350 Garfield Wright Boulevard
Municipality: East Gwillmbury, Ontario
Project No.: 24015
Date: 28-Aug-24

Prepared by: PM
Checked by: PT
Last Revised: 28-Aug-24

Area 100

Location	Burlington
Area (ha)	0.27
Runoff Coefficient	0.25

Adjustment Factor

Up to 10-Year	1.00
25-Year	1.10
50-Year	1.20
100-Year	1.25

Rational Method

$$Q = KRCIA$$

Where:

Q = Design flow (m^3 / sec)
K = Conversion factor (0.00278)
R = Return period factor
C = Runoff coefficient
I = Rainfall intensity (mm / hour)
A = Contributing drainage area (ha)

Event:	2-Year
a	648
b	4.000
c	0.784
Runoff Coefficient	0.25
AC	0.07
Tc (min)	10
Rainfall Intensity (mm/hr)	82
Rational Flow Rate (l/s)	15.3

Event:	5-Year
a	930
b	4
c	0.798
Runoff Coefficient	0.25
AC	0.07
Tc (min)	10
Rainfall Intensity (mm/hr)	113
Rational Flow Rate (l/s)	21.2

Event:	10-Year
a	1021
b	3.000
c	0.787
Runoff Coefficient	0.25
AC	0.07
Tc (min)	10
Rainfall Intensity (mm/hr)	136
Rational Flow Rate (l/s)	25.4

Event:	25-Year
a	1100
b	2.000
c	0.776
Runoff Coefficient	0.28
AC	0.07
Tc (min)	10
Rainfall Intensity (mm/hr)	160
Rational Flow Rate (l/s)	33.0

Event:	50-Year
a	1488
b	5.000
c	0.761
Runoff Coefficient	0.30
AC	0.08
Tc (min)	10
Rainfall Intensity (mm/hr)	189
Rational Flow Rate (l/s)	42.6

Event:	100-Year
a	1770
b	5.000
c	0.761
Runoff Coefficient	0.31
AC	0.08
Tc (min)	10
Rainfall Intensity (mm/hr)	225
Rational Flow Rate (l/s)	52.8

Counterpoint Engineering Inc.
8395 Jane Street, Suite 100 Vaughan, Ontario L4K 5Y2
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Ontario
MINISTRY OF THE ENVIRONMENT

Database Version: V 2.0 Release Update
Update Date: 30-Mar-12

Project DEVELOPMENT Summary

DEVELOPMENT: Parkin YRP
Subwatershed: Black River

Total Pre-Development Area (ha):	0.6691	Total Pre-Development Phosphorus Load (kg/yr):	0.05

Pre-Development Land Use	Area (ha)	P coeff. (kg/ha)	P Load (kg/yr)
Hay-Pasture	0.6691	0.08	0.05

POST-DEVELOPMENT LOAD

Post-Development Land Use	Area (ha)	P coeff. (kg/ha)	Best Management Practice applied with P Removal Efficiency		P Load (kg/yr)
High Intensity - Comm/Industrial	0.6691	1.82	Other	77%	0.28

Jelly fish unit used to treat the site. The jelly fish unit is credited for 77% phoshorous removal. ETV certification is provided in SWM Report.

Post-Development Area Altered:	**0.67**
Total Pre-Development Area:	**0.67**
Unaffected Area:	**0**

	P Load (kg/yr)
Pre-Development:	**0.05**
Post-Development:	**1.22**
Change (Pre - Post):	**-1.16**
2175% Net Increase in Load	
Post-Development (with BMPs):	**0.28**
Change (Pre - Post):	**-0.23**
423.25% Net Increase in Load	

DEVELOPMENT: **Parkin YRP**
Subwatershed: **Black River**

CONSTRUCTION PHASE LOAD

SUMMARY WITH IMPLEMENTATION OF BMPs	**P Load (kg/yr)**
Pre-Development:	**0.05**
Construction Phase Amortized Over 8 Years :	to be determined
Post-Development:	**0.28**
Post-Development + Amortized Construction:	**to be determined**
Pre-Development Load - Post-Development Load:	**-0.23**
Conclusion:	**423% Increase in Load**
Pre-Development Load - (Post-Development + Amortized Construction Load):	**to be determined**
Conclusion:	**to be determined**

Based on a comparison of Pre-Development and Post-Development loads, and in consideration of Construction Phase loads, the Ministry would encourage the Municipality to:

◆ Verification Statement ◆ Verification Statement ◆ Verification Statement ◆

VERIFICATION STATEMENT

GLOBE Performance Solutions

Verifies the performance of

Jellyfish® Filter

Developed by Imbrium Systems, Inc.,
Whitby, Ontario, Canada

Registration: GPS-ETV_V2022-03-01

In accordance with

ISO 14034:2016

Environmental Management —
Environmental Technology Verification (ETV)

John D. Wiebe, PhD
Executive Chairman
GLOBE Performance Solutions

March 1, 2022
Vancouver, BC, Canada

Verification Body
GLOBE Performance Solutions
404 – 999 Canada Place | Vancouver, B.C | Canada |V6C 3E2

Technology description and application

The Jellyfish® Filter is an engineered stormwater quality treatment technology designed to remove a variety of stormwater pollutants including floatable trash and debris, oil, coarse and fine suspended sediments, and particulate-bound pollutants such as nutrients, heavy metals, and hydrocarbons. The Jellyfish Filter combines gravitational pre-treatment (sedimentation and floatation) and membrane filtration in a single compact structure. The system utilizes membrane filtration cartridges comprised of multiple detachable pleated filter elements ('filtration tentacles") that provide high filtration surface area with the associated advantages of high flow rate, high sediment capacity, and low filtration flux rate.

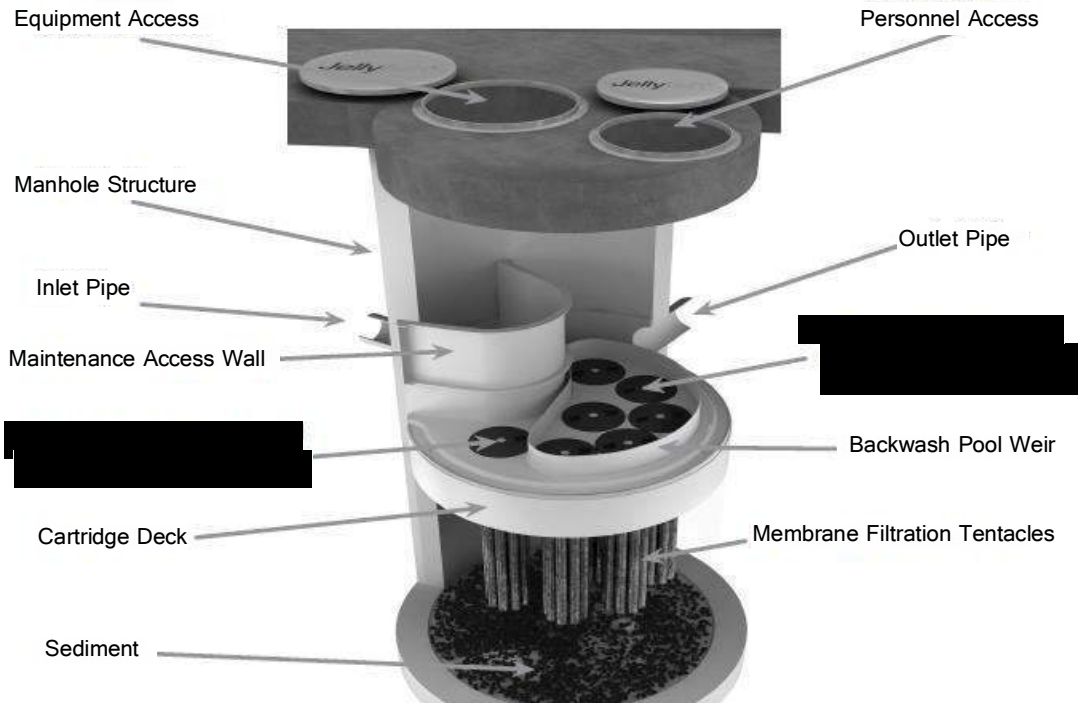

Figure 1. Cut-away graphic of a Jellyfish® Filter manhole with 6 hi-flo cartridges and 1 draindown cartridge

Figure 1 depicts a cut-away graphic of a typical 6-ft diameter Jellyfish® Filter manhole with 6 hi-flo cartridges and 1 draindown cartridge (JF6-6-1). Stormwater influent enters the system through the inlet pipe and builds a pond behind the maintenance access wall, with the pond elevation providing driving head. Flow is channeled downward into the lower chamber beneath the cartridge deck. A flexible separator skirt surrounds the filtration zone where the filtration tentacles of each cartridge are suspended, and the volume between the vessel wall and the outside surface of the separator skirt comprises a pre-treatment channel. As flow spreads throughout the pre-treatment channel, floatable pollutants accumulate at the surface of the pond behind the maintenance access wall and also beneath the cartridge deck in the pre-treatment channel, while coarse sediments settle to the sump. Flow proceeds under the separator skirt and upward into the filtration zone, entering each filtration tentacle and depositing fine suspended sediment and associated particulate-bound pollutants on the outside surface of the membranes. Filtered water proceeds up the center tube of each tentacle, with the flow from each tentacle combining under the cartridge lid, and discharging to the top of the cartridge deck through the cartridge lid orifice. Filtered effluent from the hi-flo cartridges enters a pool enclosed by a 15-cm high weir, and if storm intensity and resultant driving head is sufficient, filtered water overflows the weir and proceeds across the cartridge deck to the outlet pipe. Filtered effluent discharging from the draindown cartridge(s) passes directly to the outlet pipe, and requires only a minimal amount of driving head (2.5 cm) to provide forward flow. As

storm intensity subsides and driving head drops below 15 cm, filtered water within the backwash pool reverses direction and passes backward through the hi-flo cartridges, and thereby dislodges sediment from the membrane which subsequently settles to the sump below the filtration zone. During this passive backwashing process, water in the lower chamber is displaced only through the draindown cartridge(s). Additional self-cleaning processes include gravity, as well as vibrational pulses emitted when flow exits the orifice of each cartridge lid, and these combined processes significantly extend the cartridge service life and maintenance cleaning interval. Sediment removal from the sump by vacuum is required when sediment depths reach 30 cm, and cartridges are typically removed, externally rinsed, and recommissioned on an annual basis, or as site-specific maintenance conditions require. Filtration tentacle replacement is typically required every 3 – 5 years.

Performance conditions

The data and results published in this Verification Statement were obtained from the field testing conducted on a Jellyfish Filter JF6-6-1 (6-ft diameter manhole with 6 hi-flo cartridges and 1 draindown cartridge), in accordance with the requirements outlined by the Technical Guidance Manual for Evaluating Emerging Stormwater Treatment Technologies Technology Assessment Protocol – Ecology (TAPE) as written by the Washington State Department of Ecology, (WADOE, 2011). The drainage area providing stormwater runoff to the test unit was 86 acres and was 32% impervious. Throughout the monitoring period (March 2017 – April 2020), a total of 25 individual storm events were sampled. The Basic Treatment standard outlined in the TAPE requires ≥ 80% total suspended solids (TSS) removal at influent TSS concentrations ranging from 100 to 200 mg/L. In addition, the Phosphorus Treatment standard outlined in the TAPE requires ≥ 50% removal of total phosphorus (TP) at influent concentrations ranging from 0.10 to 0.5 mg/L. For this verification, the performance claim for TSS removal is for influent TSS concentration ≥ 100 mg/L, and the performance claim for TP removal is for influent TP concentration ≥ 0.1 mg/L. Based on these requirements, 15 and 18 sample pairs deemed qualified for evaluating the removal performance of TSS and TP, respectively. Prior to starting the performance testing program, a quality assurance project plan (QAPP) was submitted to and approved by the State of Washington Department of Ecology.

Table 1 shows the specified and achieved TAPE criteria for storm selection and sampling.

Table 1. Specified and achieved TAPE criteria for storm selection and sampling

Description	TAPE criteria value	Achieved value
Total rainfall	> 3.8 mm (0.15 in)	> 3.8 mm (0.15 in)[1]
Minimum inter-event period	6 hours	6 hours
Minimum flow-weighted composite sample storm coverage	Minimum 70% including as much of the first 20% of the storm	> 70%
Minimum influent/effluent samples	10, but a minimum of 5 subsamples for composite samples	10, except for two events that had 9 aliquots
Total sampled rainfall	N/A	8.29 in
Number of storms	Minimum 15 (preferably 20)	25

[1]N.B. Storm event depth was greater than the TAPE rainfall depth guideline of 0.15 inches for all events sampled, except for the 3/21/2017, 3/22/2019, 3/26/2019, and 04/13/2019 events. Given the size of the drainage basin, storm events below this threshold produced adequate runoff volume for sampling. Only two of these events were used to evaluate performance, and all had rainfall depths of 0.11 inches or greater. These events were included as their runoff volumes, precipitation durations, and influent TSS concentrations were all within range of the total data set.

The 6-ft diameter test unit has sedimentation surface area of 2.62 m^2 (28.26 ft^2). Each of the seven filter cartridges employed in the test unit uses filtration tentacles of 137 cm (54 in) length, with filter surface area of 35.4 m^2 (381 ft^2) per cartridge, and total filter surface area of 247.8 m^2 (2667 ft^2) for the seven cartridges combined. The design treatment flow rate is 5 L/s (80 gal/min) for each of the six hi-flo

cartridges and 2.5 L/s (40 gal/min) for the single draindown cartridge, for a total design treatment flow rate of 32.5 L/s (520 gal/min) at design driving head of 457 mm (18 in). This translates to a filtration flux rate (flow rate per unit filter surface area) of 0.14 L/s/m^2 (0.21 gal/min/ft^2) for each hi-flo cartridge and 0.07 L/s/m^2 (0.11 gal/min/ft^2) for the draindown cartridge. The design flow rate for each cartridge is controlled by the sizing of the orifice in the cartridge lid. The distance from the bottom of the filtration tentacles to the sump is 61 cm (24 in).

Performance claim(s)

The Jellyfish® Filter demonstrated the removal efficiencies indicated in **Table 2** for TSS and TP during field monitoring conducted in accordance with the Washington State Department of Ecology's Technology Assessment Protocol – Ecology (TAPE), and using the following design parameters:

- System hydraulic loading rate (system treatment flow rate per unit of sedimentation surface area) of 12.5 L/s/m^2 (18.4 gal/min/ft^2) or lower
- Filtration flux rate (flow rate per unit filter surface area) of 0.14 L/s/m^2 (0.21 gal/min/ft^2) or lower for each hi-flo cartridge and 0.07 L/s/m^2 (0.11 gal/min/ft^2) or lower for each draindown cartridge
- Distance from the bottom of the filtration tentacles to the sump of 61 cm (24 in) or greater
- Driving head of 457 mm (18 in) or greater

Table 2. Bootstrapped mean, median, and 95% confidence interval (median) for removal efficiencies of Total Suspended Solids (TSS) and Total Phosphorus (TP)

Parameter	Mean (%)	Median (%)	Median – 95% Lower Limit	Median – 95% Upper Limit
TSS [1]	87.6	90.1	85.1	91.6
TP [2]	77.3	77.5	70.8	85.6

[1] TSS influent concentration ≥ 100 mg/L
[2] TP influent concentration ≥ 0.1 mg/L

N.B. As with any field test of stormwater treatment devices, removal efficiencies will vary based on pollutant influent concentrations and other site-specific conditions.
The performance claims can be applied to other Jellyfish® Filter models smaller or larger than the tested model as long as the untested models are designed in accordance with the design parameters specified in the performance claims.

Performance results

Performance Claims – Removal Efficiency for Total Suspended Solids

Raw data summarizing the percent removal of total suspended solids (TSS) by the Jellyfish® Filter at the design system hydraulic loading rate of 12.5 L/s/m^2 (18.4 gal/min/ft^2) for 15 sample pairs deemed qualified are presented in **Table 3**. Data were analyzed and evaluated using a bootstrap approach of random sampling by replacement to estimate population distribution and thereby the upper and lower limit of the confidence interval.

Table 3. Raw data summarizing the percent removal of total suspended solids (TSS)

Event ID	TSS Influent (mg/L)	TSS Effluent (mg/L)	TSS Removal (%) (Inf ≥ 100 mg/L)
3/21/2017	102.0	22.0	78.4
4/7/2017	201.0	30.8	84.7
4/12/2017	108.0	24.4	77.4
4/19/2017	452.0	44.6	90.1
4/26/2017	257.0	10.0	96.1

6/15/2017	134.0	10.4	92.2
3/8/2018	755.0	47.2	93.8
3/14/2018	181.0	27.0	85.1
3/22/2018	224.0	20.0	91.1
4/5/2019	171.0	23.0	86.6
4/13/2019	117.0	25.0	78.6
5/18/2019	254.0	20.0	92.1
12/7/2019	200.0	17.0	91.5
3/30/2020	605.0	51.0	91.6
4/20/2020	210.0	29.0	86.2
n	15	15	15
Min	102.0	10.0	77.4
Max	755.0	51.0	96.1
Median	201.0	24.4	90.1
Mean	264.7	26.8	87.7
SD	190.9	12.3	5.9

Performance Claims – Removal Efficiency for Total Phosphorus

Raw data summarizing the percent removal of total phosphorus (TP) by the Jellyfish® Filter at the design system hydraulic loading rate of 12.5 L/s/m^2 (18.4 gal/min/ft^2) for 18 sample pairs deemed qualified are presented in **Table 4**. Data were analyzed and evaluated using a bootstrap approach of random sampling by replacement to estimate population distribution and thereby the upper and lower limit of the confidence interval.

Table 4. Raw data summarizing the percent removal of total phosphorus (TP)

Event ID	TP Influent (mg/L)	TP Effluent (mg/L)	TP Removal (%) (Inf ≥ 0.1 mg/L)
4/7/2017	0.706	0.092	87.0
4/12/2017	0.338	0.076	77.5
4/19/2017	0.500	0.036	92.8
4/26/2017	0.504	0.042	91.7
5/13/2017	0.256	0.110	57.0
6/8/2017	0.256	0.104	59.4
6/15/2017	0.362	0.052	85.6
3/8/2018	1.75	0.130	92.6
3/14/2018	0.652	0.094	85.6
3/22/2018	0.364	0.072	80.2
3/27/2019	0.226	0.070	69.1
4/5/2019	0.337	0.092	72.9
4/13/2019	0.249	0.087	65.1
5/18/2019	1.09	0.173	84.1
12/7/2019	0.335	0.105	68.7
12/19/2019	0.211	0.093	56.2
3/30/2020	1.05	0.092	91.2
4/20/2020	0.451	0.112	75.2
n	18	18	18
Min	0.211	0.036	56.2
Max	1.75	0.173	92.8
Median	0.363	0.092	78.9
Mean	0.535	0.091	77.3
SD	0.400	0.032	12.5

Verification

The verification was completed by the Verification Expert, the Centre for Advancement of Water and Wastewater Technologies ("CAWT"), contracted by GLOBE Performance Solutions, using the International Standard ***ISO 14034:2016 Environmental management -- Environmental technology verification (ETV)***. Data and information provided by Imbrium Systems to support the performance claim included the performance monitoring report "General Use Level Designation Technical Evaluation Report" prepared by CONTECH Engineered Solutions, Portland, OR, USA, and dated December 28, 2020. This report is based on a field testing completed by CONTECH personnel at a site in Dundee, Oregon between March 2017 and April 2020 in accordance with the Technical Guidance Manual for Evaluating Emerging Stormwater Treatment Technologies Technology Assessment Protocol – Ecology (TAPE) as written by the Washington State Department of Ecology (WADOE, 2011).

What is ISO14034:2016 Environmental management – Environmental technology verification (ETV)?

ISO 14034:2016 specifies principles, procedures and requirements for environmental technology verification (ETV) and was developed and published by the *International Organization for Standardization (ISO)*. The objective of ETV is to provide credible, reliable and independent verification of the performance of environmental technologies. An environmental technology is a technology that either results in an environmental added value or measures parameters that indicate an environmental impact. Such technologies have an increasingly important role in addressing environmental challenges and achieving sustainable development.

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19T-94016 Plans

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Prepared for *the Regional Municipality of York*

Technical Design Brief

Stormwater Management Facilities
York Region Industrial Subdivision 19T-94016
Town of East Gwillimbury, Regional Municipality of York

Project: 5390 **July, 2004**

consulting engineering | planning | environmental approvals

Town of East Gwillimbury
Community Programs & Infrastructure

Don Allan, CET, CST
Manager, Development Engineering

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Technical Design Brief, Stormwater Management Facilities
York Region Industrial Subdivision 19T-94016, Part of Lot 2, Concession 4
Northeast of Woodbine Avenue and Davis Drive
Town of East Gwillimbury, Regional Municipality of York

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Town of East Gwillimbury, Regional Municipality of York

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1.0 INTRODUCTION

Cumming Cockburn Limited has been retained by the Regional Municipality of York to develop the overall stormwater management plan for the York Region's Industrial Subdivision (19T-94016), located northeast of the intersection of Woodbine Avenue and Davis Drive at the Town of East Gwillimbury within the Regional Municipality of York (Region) as illustrated in **Figure 1**.

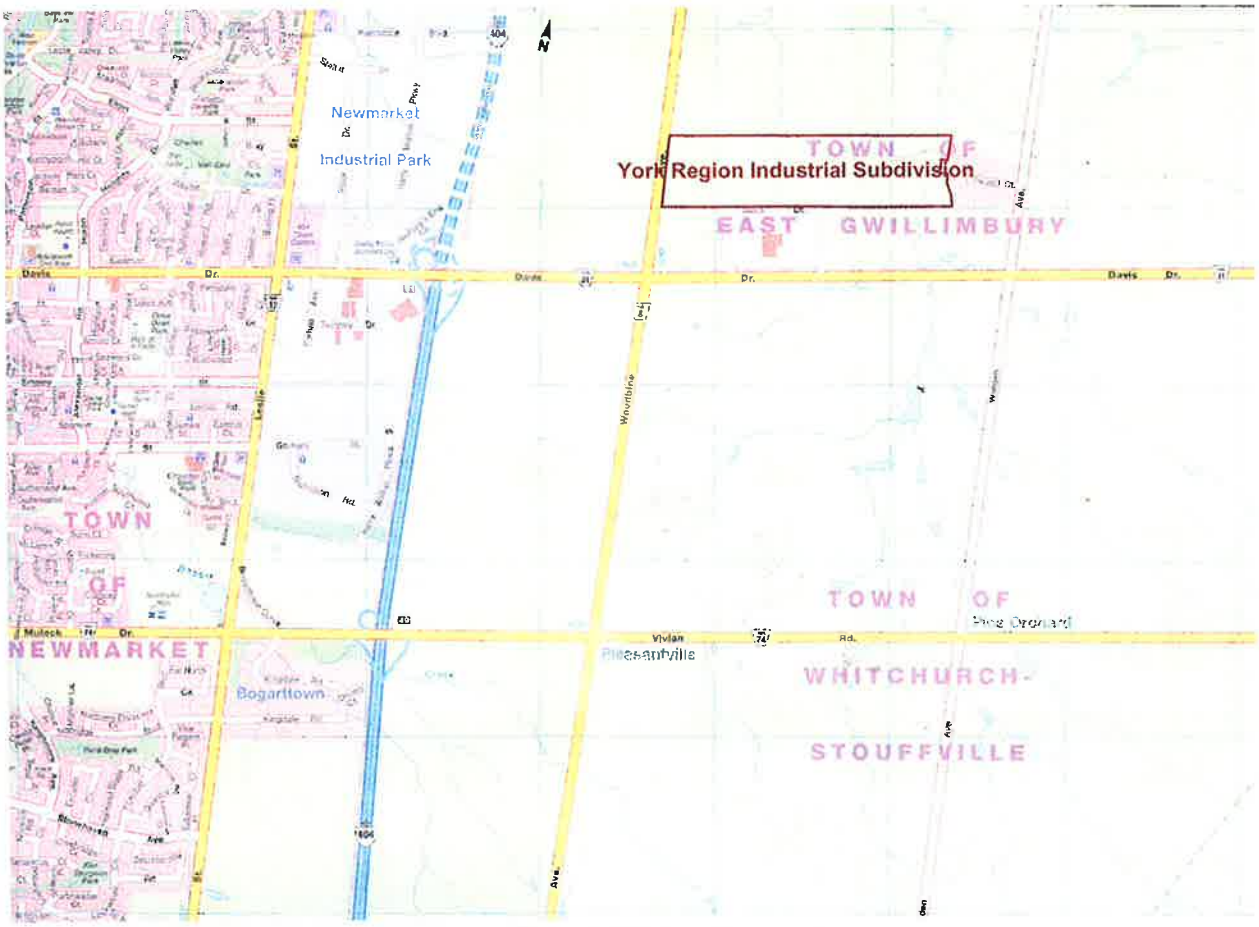

Figure 1. Site Location

As shown in **Figure 2**, the subject property consists of five parcels of land (Blocks 1, 2, 3, 4 and 5) with a total area over 60 ha. The Black River transverses the eastern portion (within Block 5) of the site and naturally collects and drains runoff from Blocks 4 and 5, and the east half of Block 3. An intermittent swale transverses the central portion (within Block 3) of the site and naturally collects and drains runoff from Blocks 1 and 2, the west half of Block 3 and the external industrial development area to the south.

York Region

YORK REGION INDUSTRIAL SUBDIVISION

Town of East Gwillimbury, Regional Municipality of York

FIGURE 2 EXISTING LAND USE

SCALE 1:5000

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According to the draft State of the Watershed Report for Black River Subwatershed (referred to as the Black River Subwatershed Study in this Report) by the Lake Simcoe Conservation Authority (LSRCA) in August 2002, the subject site and its external industrial development area to the south are located within the headwaters of the Black River and entirely outside of the designated Oak Ridges Moraine protection area as illustrated in **Figure 3**. As a result, it is not subject to the requirements of the Oak Ridges Moraine Conservation Act (Ont. Reg. 140/02).

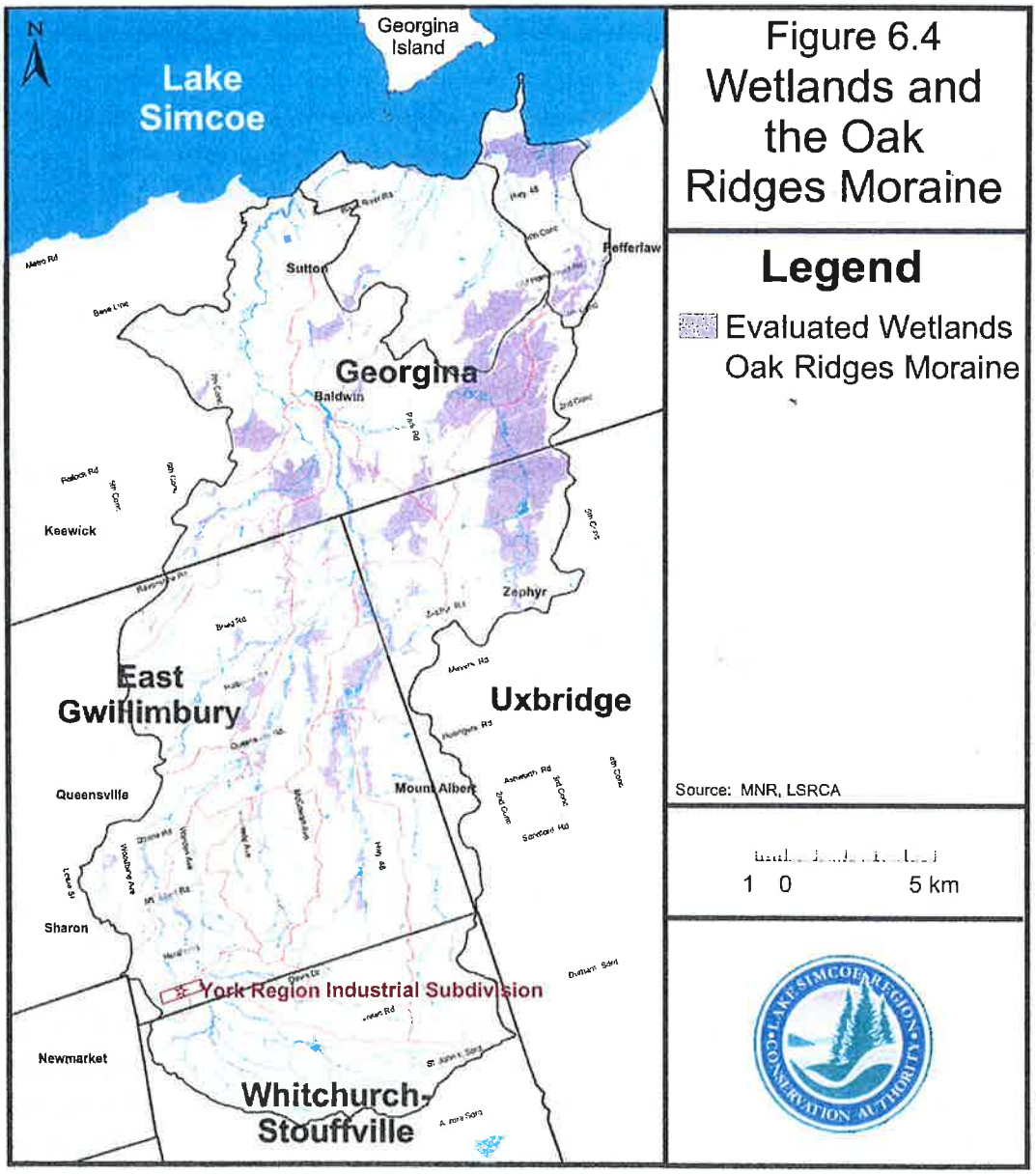

Figure 3. Site Location within Black River Watershed in Relationship with Oak Ridges Moraine (LSRCA, 2002)

A Functional Servicing Report for the York Region Industrial Subdivision was completed by URS Cole Sherman & Associated Limited in August 2002, and proposed two end-of-pipe stormwater management facilities of SWMF1 and SWMF2 located within Blocks 2 and 4 respectively to treat and attenuate runoff from the developments in Blocks 1 and 2, and in Blocks 3 and 4 respectively, and Block 5 is designated as open space. In addition to these two facilities, Cumming Cockburn Ltd. proposed one additional facility SWMF3 located at the south half of the intermittent swale in Block 3 to provide *Enhanced* (Level 1) water quality, erosion and flood controls not only for a part of the York Region Industrial Subdivision, but also for the external existing and future industrial development areas to the south (including the areas associated with the extension and urbanization of Garfield Wright Boulevard) as desired by the Town.

Since the engineering design of SWMF1 has been completed by Marshall Macklin Monaghan Ltd. in Oct. 2003 and approved by the regulatory agencies to service the immediate development of the York Region Material Recovery and Transfer Facility in Block 2 and the future industrial development in Block 1, the technical design brief for the two remaining facilities SWMF2 and SWMF3 was prepared by Cumming Cockburn Limited in Nov. 2003 and submitted to the Town, the LSRCA, and the Regional Municipality of York for review and comments.

According to the review comments received from the LSRCA dated Feb. 2 and April 16 of 2004 (see **Appendix A**), the Authority doesn't support the on-line facility SWMF3 because fish (Brook Stickleback) were observed and captured at a culvert approximately 188 m downstream of Garfield Wright Boulevard, based on the finding of a site visit conducted by the Authority's fisheries biologist and aquatic ecologist on April 16, 2004. The intermittent swale is, therefore, classified by the LSRCA as the headwaters of a fully functioning cold to coolwater tributary that would not require stormwater treatment regardless the existing development of Bales Industrial Subdivision.

Considering the LSRCA's concern on the fishery issue and the immediate development needs associated with the urbanization and extension of Garfield Wright Blvd, Cumming Cockburn Ltd., after consultation with the LSRCA, the Town and the Region (see **Appendix A**), proposes to use SWMF2 (located at the southeast corner of Block 4) to accommodate all the developments within Block 4, east portion of Block 3, and the areas associated with the extension and urbanization of Garfield Wright Boulevard. The intent of the revised stormwater management plan is to maximize useable lands, minimize the number of the stormwater management facilities, and maintain the current storm drainage pattern to the intermittent swale as much as possible for the existing fish habitat.

Since only a small portion of Block 4 is subject to the immediate development in addition to the extension and urbanization of Garfield Wright Boulevard, the primary objective of this report is to provide the technical design brief for the interim SWMF2 to accommodate the immediate development needs (i. e. the interim development condition), but a separate easement block (Block 9) is reserved and designated based on the engineering design of the ultimate SWMF2 for future extension of the interim SWMF2 to accommodate the full industrial development (i. e. the ultimate development condition).

2.0 SITE DESCRIPTION AND EXISTING DRAINAGE CONDITIONS

2.1 Background Information

The Regional Municipality of York, Lake Simcoe Region Conservation Authority, Town of East Gwillimbury, Matrix Management Corp., URS Architects & Engineers Canada Inc., and Marshall Macklin Monaghan Limited were consulted to acquire the available background information and clarify the stormwater management design criteria. The primary background materials gathered during the preparation of this report can be summarized as follows:

- Draft Plan for the York Region Industrial Subdivision, URS Architects & Engineers Canada Inc., April. 2004.
- Stormwater Management Plan for the York Region Waste Transfer Station, Marshall Macklin Monaghan Limited, Oct. 2003.
- Geotechnical Investigation for Pavement Design and Storm Sewers along Bales Drive and Roads "A" and "B", Shaheen & Peaker Ltd., Sept. 26, 2003.
- Functional Servicing Report for the York Region Industrial Subdivision, URS Cole Sherman & Associated Ltd., Aug. 2002.
- Sub-Surface Soils Investigation for York Industrial Subdivision, Jagger Hims Ltd., Aug. 2002.
- State of the Watershed Report: Black River Subwatershed (Draft), LSRCA, August 2002.
- Preliminary Hydrogeological Study for the Proposed Integrated Solid Waste Processing and Transfer Facility, Gartner Lee Limited, Feb. 2002.
- Soil Survey of York County - Report No. 19 of the Ontario Soil Survey, Ontario Ministry of Agriculture and Food and the Research Branch of Agriculture Canada, March 1955.

2.2 Existing Land Use

The subject property is legally described as Part of Lot 2, Concession 4 within the Town of East Gwillimbury. The site is bounded by Woodbine Avenue to the west, agricultural lands to the north, existing residential subdivision and open space to the east, and Garfield Wright Boulevard (formerly Bales Drive) and agricultural lands to the south.

Figure 2 presents the existing land use within and around the subject site. Except for an existing farmhouse with a driveway to Woodbine Ave. in Block 1, most of the subject lands are currently used for the sod farming. Block 5 (located at the east end of the subject site) lies mainly within the regulatory floodplain of the Black River and is characterized by natural riparian marsh meadow, typical of saturated soils with the groundwater table at or near to the ground surface.

To the south of the subject site, there is an existing industrial subdivision (referred to as Bales Industrial Subdivision in this Report) that is bounded by Garfield Wright Boulevard to the north,

Bales Drive East to the east, Davis Drive to the south and Bales Drive West to the west. Within the Bales Industrial Subdivision, there are several industrial buildings with large parking lots and vacant lands that can be developed in the future.

2.3 Native Soils and Groundwater Characteristics

The Soil Survey of York County (Report 19 of the Ontario Soil Survey published by the Ontario Ministry of Agriculture and Food and the Research Branch of Agriculture Canada in March 1955) and the findings of several site geotechnical investigations were used to determine soil types, soil drainage characteristics and groundwater natures within and around the subject site.

It was found that Schomberg silt loam (Shs) is dominant underlying soil presented within Blocks 1, 2 and 3, and the external area to the south, in addition to Brighton sandy loam (Brsl) mainly presented within Blocks 4 and 5.

The parent materials of Schomberg silt loam contain lacustrine, grey and calcareous clay and silt clay. Schomberg silt loam belongs to the soil group of Grey-Brown Podzolic with good drainage characteristics, and it is classified as the hydrologic soil group of BC with the runoff curve number (CN) of 68 under the Level II (average) antecedent moisture conditions for pasture, open space, lawns and parks, based on the Drainage Management Manual published by the Ontario Ministry of Transportation in 1997.

The parent material of Brighton sandy loam has well sorted grey, calcareous sand and stratified sand and gravel. Brighton sandy loam belongs to the soil group of Grey-Brown Podzolic with very good drainage nature, and it is classified as the hydrologic soil group of AB with the runoff curve number (CN) of 50 under the Level II (average) antecedent moisture conditions for pasture, open space, lawns and parks.

There is a weathered zone (layer with enhanced permeability) extending between 3.0 and 5.0 m in depth that is host to fluctuating groundwater levels. As the area is underlain by low permeability soils, there is a high-perched groundwater table that seasonally fluctuates between 0.5 m and 2.0 m below the ground surface, almost across the entire site. The depth of the groundwater table appears to become shallower towards the east when approaching the main branch of the Black River in Block 5.

A very minor portion of groundwater flows towards the Black River through the weathered zone, and forms a shallow horizontal groundwater flow from west to east. The results of geotechnical investigations indicate that the bulk of groundwater moves downwards since the average annual horizontal groundwater flow is only 1.1 litres/minute for the full width of the site, comparing to the downward flow rate of 47 litres/minute. Therefore, the water that soaks into the ground largely

moves downward to recharge the regional groundwater system, and only a very small part of it (<3%) moves laterally toward the Black River via the weathered zone. The hydrogeological study by Gartner Lee Ltd. in February 2002 indicated that this perched groundwater has low ecological value. All geotechnical reports to date further suggest that groundwater will not be a significant excavation issue and may be handled by a conventional sump or pumping technique.

2.4 Existing Drainage and Environmental Features

Figure 4 shows existing drainage conditions within and around the subject site. Currently, runoff from Blocks 4 and 5, and the east half of Block 3 drains easterly towards the main branch of the Black River. Runoff from Blocks 1 and 2, west half of Block 3 and the existing and future industrial development areas to the south drains towards the intermittent swale. The finding and conclusion of the geotechnical investigation reports indicate that the north portion of the intermittent swale is a localized shallow groundwater discharge zone during wet periods of a year. In addition, it also services as a surface drainage channel. According to the finding of a site visit by the LSRCA's fisheries biologist and aquatic ecologist on Apr. 16, 2004, the swale is classified as the headwater of a fully functioning cold to coolwater tributary that would not require stormwater treatment regardless the existing development of Bales Industrial Subdivision (see **Appendix A**).

Based on the Black River Subwatershed Study, there is no terrestrial issue and environmentally significant area (ESA) such as biological/hydrogeological ESA, significant wetland, area of natural and scientific interest (ANSI), or provincial archaeological protection area within the subject site and its external area to the south.

In Block 5, there is existing forest along the east side of the Black River as well as open marsh meadow over the balance. Under the interim and ultimate development plans for the York Region Industrial Subdivision, Block 5 is designated as the open space (green buffer area).

2.5 Interim and Ultimate Development Plans

Although the entire subject site is designated as the York Region Industrial Subdivision, there is preliminary draft plan of subdivision and two site plans that are ready for immediate development. The staff at the Region and the Town was contacted to clarify the immediate and potential future development plans for the subdivision and the external industrial development areas to the south. Based on the background information available at this time, the immediate (interim) and future (ultimate) developments that will be serviced by SWMF1 and SWMF2 (located at the northeast corner of Block 2 and at the southeast corner of Block 4 respectively) can be summarized in **Table 1**. The detailed interim and ultimate development plans are illustrated in **Figures 5 and 6** respectively.

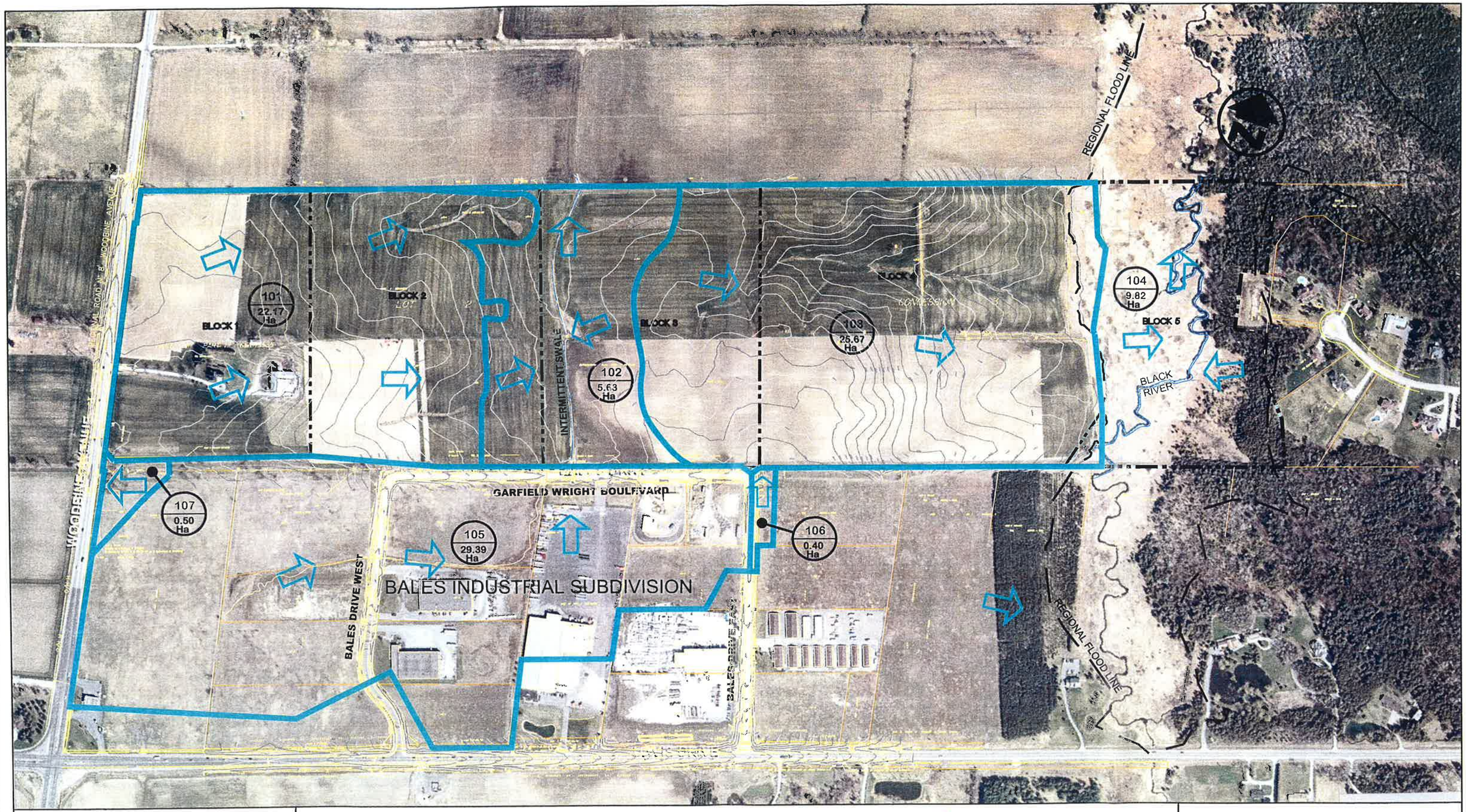

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FIGURE 4 EXISTING DRAINAGE CONDITIONS

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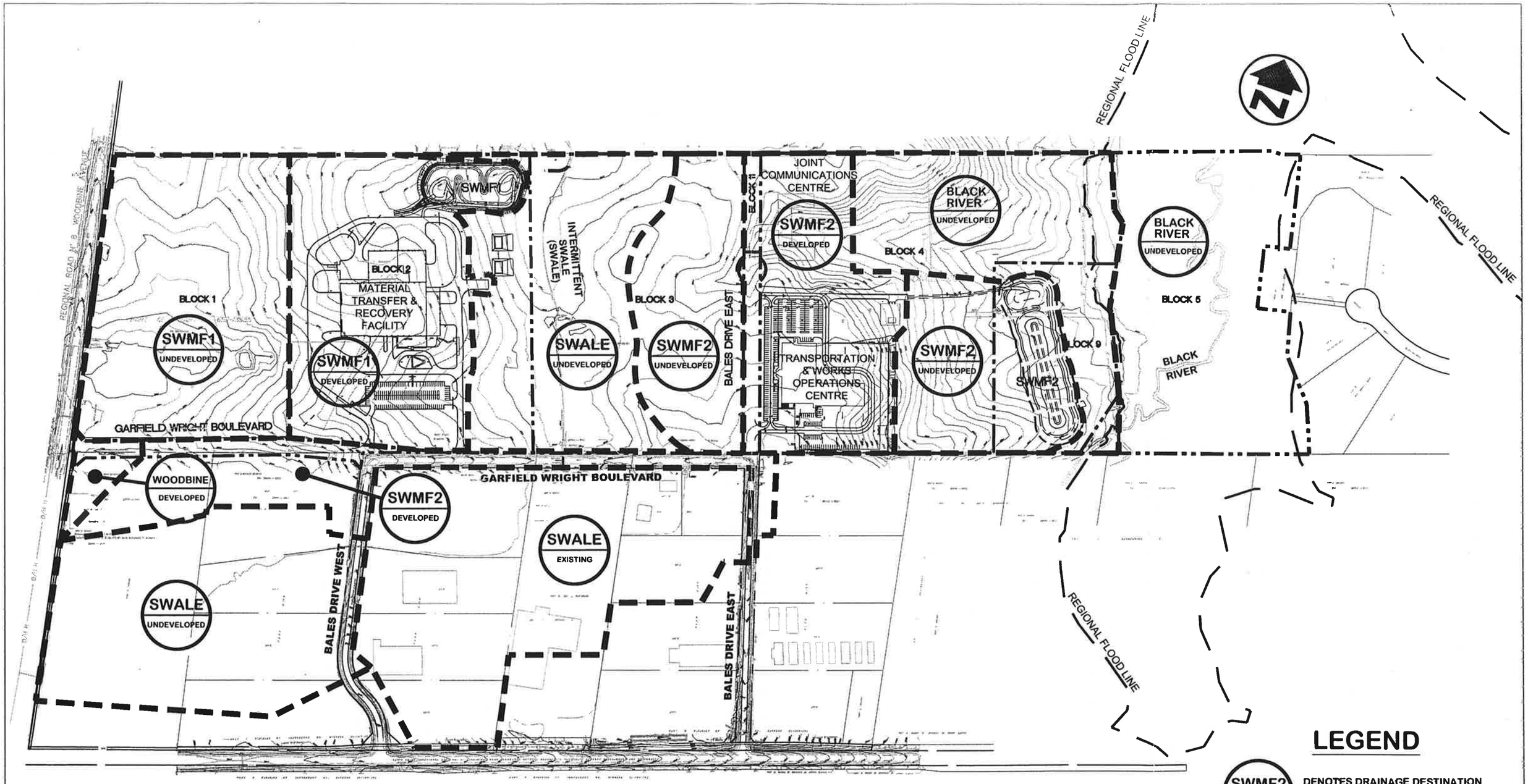

YORK REGION INDUSTRIAL SUBDIVISION

Town of East Gwillimbury, Regional Municipality of York

FIGURE 5 INTERIM DEVELOPMENT PLAN

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REGIONAL FLOOD LINE

REGIONAL FLOOD LINE

REGIONAL FLOOD LINE

REGIONAL ROAD No. 3 - WOODBINE AVENUE

JOINT COMMUNICATIONS CENTRE

SWMF1

BLOCK 1

BLOCK 2

MATERIAL TRANSFER & RECOVERY FACILITY

INTERMITTENT SWALE (SWALE)

BLOCK 3

BLOCK 4

BLOCK 5

BLOCK 9

BALES DRIVE EAST

TRANSPORTATION & WORKS OPERATIONS CENTRE

SWMF1 DEVELOPED

SWMF1 DEVELOPED

SWALE UNDEVELOPED*

SWMF2 DEVELOPED

SWMF2 DEVELOPED

SWMF2 DEVELOPED

SWMF2 POND

SWMF2

BLACK RIVER UNDEVELOPED

BLACK RIVER UNDEVELOPED

BLACK RIVER

GARFIELD WRIGHT BOULEVARD

GARFIELD WRIGHT BOULEVARD

WOODBINE DEVELOPED

SWMF2 DEVELOPED

SWALE DEVELOPED*

SWALE DEVELOPED*

BALES DRIVE WEST

BALES DRIVE EAST

REGIONAL FLOOD LINE

*ALL FUTURE DEVELOPMENT TO HAVE STORMWATER QUALITY AND QUANTITY CONTROLS.

LEGEND

SWMF2 / DEVELOPED — DENOTES DRAINAGE DESTINATION; DENOTES DESIGN DEVELOPMENT STATUS

YORK REGION INDUSTRIAL SUBDIVISION

Town of East Gwillimbury, Regional Municipality of York

FIGURE 6 ULTIMATE DEVELOPMENT PLAN

SCALE 1:5000

York Region

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Table 1. Interim and Ultimate Developments Serviced by SWMF1 and SWMF2

SWM Facility	Developments under Interim Conditions	Developments under Ultimate Conditions
SWMF1	• York Region Material Recovery and Transfer Facility in Block 2.	• All developments under the interim conditions. • Full industrial development in Block 1.
SWMF2	• Transportation and Works Operations Centre in Block 4. • Joint Communications Centre in Block 4. • Zenon Sewage Treatment Plant in Block 4. • North extension of Bales Drive East. • Urbanization of existing Garfield Wright Blvd. • West extension of Garfield Wright Blvd from Bales Drive West to Woodbine Avenue, and the small at the south side of the extended portion of Garfield Wright Blvd.	• All developments under the interim conditions. • Full industrial development within the east part of Block 3 to maximize developable lands. • Full industrial development for the balance of Block 4, excluding the easement Block 9 designated and reserved to accommodate the ultimate SWMF2.

Notes:

- SWM: stormwater management.
- SWMF: stormwater management facility.
- SWMF1: the first stormwater management facility (located at the northeast corner of Block 2) to accommodate the ultimate industrial development within Blocks 1 and 2. The design of the ultimate SWMF1 had been completed by Marshall Macklin Monaghan Limited in Oct. 2003 on behalf of Miller Waste Systems, and approved by the regulatory agencies.
- SWMF2: the second stormwater management facility (located at the southeast corner of Block 4) to accommodate the industrial development within Block 4, the major portion of Block 3 and the areas associated with the extension and urbanization of Garfield Wright Blvd to Woodbine Ave. The detailed engineering design of the interim SWMF2 is detailed in this Report and the attached engineering design drawings, in addition to the preliminary design of the ultimate SWMF2 with a designated stormwater management easement block (Block 9) to accommodate the ultimate SWMF2.
- The detailed interim and ultimate development plans are illustrated in **Figures 5 and 6**.

3.0 DESIGN OF STORMWATER MANAGEMENT FACILITIES

3.1 Stormwater Management Design Criteria

The following criteria were identified for the design of stormwater management facilities:

- Respect the regulatory floodplain of the Black River.
- Provide *Enhanced* (Level 1) water quality protection.
- Detain runoff from the 25-mm design storm over a period of 24 hours for erosion control.
- Control the post-development peak flows to or below the pre-development equivalents for the 1:2 to 1:100 year design storms.
- The minor drainage system designed to convey runoff up to the 1:5 year design storm.
- The major drainage system designed to convey runoff up to the 1:100 year design storm, and the water quantity control storage required for the pond checked by the 24-hour SCS storms.
- Minimize erosion potential at stormwater drainage outlets where flow becomes concentrated.
- Provide temporary erosion and sedimentation control during construction.

3.2 Interim and Ultimate Drainage Conditions

According to the interim and ultimate development plans (see **Figures 5 and 6**), the interim and ultimate drainage patterns in relationship with the facilities of SWMF1 and SWMF2 are proposed and presented in **Figures 7 and 8** respectively. As concluded in the Report entitled "Stormwater Management Plan for the York Region Waste Transfer Station" completed by Marshall Macklin Monaghan Ltd. in Oct. 2003 and approved by the regulatory agencies, the ultimate SWMF1 has been designed to accommodate the ultimate industrial development within Block 1 and Block 2.

SWMF2 is to accommodate the interim and ultimate industrial developments within Block 4, the major portion of Block 3 and the area associated with the extension and urbanization of Garfield Wright Blvd. Under this arrangement, the current drainage conditions within the existing Bales Industrial Subdivision and the majority of the area to its west will remain draining toward the intermittent swale as the source of water supply to the existing fish habitat along the intermittent swale. Only the minimum area associated with the extension and urbanization of Garfield Wright Blvd will be drained into SWMF2 for erosion, water quality and water quantity control. Because the extension of Garfield Wright Blvd to Woodbine Ave. and the small area to its south belong to the new developments, the peak flows up to the 1:100 year return period from these areas are to be conveyed via the storm sewer system to SWMF2 for water quantity control. It should be noted that, as required by the LSRCA, new development within the existing Bales Industrial Subdivision and the area to its west must provide *enhanced* water quality, water quantity and erosion controls before releasing water into the intermittent swale to prevent the flooding, protect the existing fish habitat, and the ecosystem along the swale.

LEGEND

5.23 ha / SWMF2 / 0% — DENOTES DRAINAGE AREA IN HECTARES; DENOTES DRAINAGE DESTINATION; DENOTES IMPERVIOUSNESS

DENOTES DRAINAGE DIRECTION

REGIONAL FLOOD LINE

WOODBINE AVENUE

BLOCK 1

10.21 ha / SWMF1 / 0%

GARFIELD WRIGHT BOULEVARD

SWMF1

BLOCK 2

MATERIAL TRANSFER & RECOVERY FACILITY

9.03 ha / SWMF1 / 44%

INTERMITTENT SWALE (SWALE)

8.56 ha / SWALE / 0%

BLOCK 3

5.23 ha / SWMF2 / 0%

BALES DRIVE EAST

JOINT COMMUNICATION CENTRE

7.54 ha / SWMF2 / 88%

BLOCK 4

7.42 ha / BLACK RIVER / 0%

TRANSPORTATION & WORKS OPERATIONS CENTRE

5.49 ha / SWMF2 / 0%

SWMF2

BLOCK 5

BLACK RIVER

9.82 ha / BLACK RIVER / EXISTING

0.50 ha / WOODBINE / 87%

10.52 ha / SWALE / 0%

5.36 ha / SWMF2 / 87%

BALES DRIVE WEST

BALES INDUSTRIAL SUBDIVISION

13.54 ha / SWALE / EXISTING

GARFIELD WRIGHT BOULEVARD

BALES DRIVE EAST

REGIONAL FLOOD LINE

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York Region

YORK REGION INDUSTRIAL SUBDIVISION

Town of East Gwillimbury, Regional Municipality of York

FIGURE 7 INTERIM POST-DEVELOPMENT DRAINAGE CONDITIONS

SCALE 1:5000

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LEGEND

5.23 ha
SWMF2
0%

DENOTES DRAINAGE AREA IN HECTARES
DENOTES DRAINAGE DESTINATION
DENOTES IMPERVIOUSNESS
DENOTES DRAINAGE DIRECTION

REGIONAL FLOOD LINE

WOODBINE AVENUE

BLOCK 1
10.21 ha
SWMF1
93%

GARFIELD WRIGHT BOULEVARD

BLOCK 2
MATERIAL TRANSFER & RECOVERY FACILITY
9.03 ha
SWMF1
44%

SWMF1

INTERMITTENT SWALE (SWALE)
8.56 ha
SWALE
0%

BLOCK 3
7.83 ha
SWMF2
80%

BALES DRIVE EAST

JOINT COMMUNICATION CENTRE
7.54 ha
SWMF2
88%

TRANSPORTATION & WORKS OPERATIONS CENTRE

8.68 ha
BLACK RIVER
80%

BLOCK 4
2.90 ha
SWMF2
0%
SWMF2

1.33 ha
BLACK RIVER
0%

BLOCK 5

BLACK RIVER

9.82 ha
BLACK RIVER
EXISTING

0.50 ha
WOODBINE
87%

5.36 ha
SWMF2
87%

BALES DRIVE WEST

10.52 ha
SWALE
80%

BALES INDUSTRIAL SUBDIVISION

13.51 ha
SWALE
80%

*ALL FUTURE DEVELOPMENT TO HAVE STORMWATER QUALITY AND QUANTITY CONTROLS.

York Region

YORK REGION INDUSTRIAL SUBDIVISION

Town of East Gwillimbury, Regional Municipality of York

FIGURE 8 ULTIMATE POST-DEVELOPMENT DRAINAGE CONDITIONS

SCALE 1:5000

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3.3 Engineering Design of the Interim SWMF2

The interim SWMF2 is designed to accommodate the interim development (including the partial development in Block 4, and the areas associated with the urbanization and extension of Garfield Wright Blvd) as illustrated in **Figure 5**. The development status and drainage areas controlled by the interim SWMF2 are shown in **Figure 7**, and the major design parameters for the interim SWMF2 are detailed in **Table 2**.

Table 2. Major Design Parameters for the Interim SWMF2

SWM Facility	Development / Drainage Contributing Area	Development Status	Area (ha)	Imperviousness (%)	CN* (-)
Interim SWMF2	East portion of Block 3 located at the west side of the extension part of Bales Drive East	Undeveloped	5.23	0%	62
	Transportation and Works Operations Centre; North extension of Bales Drive East; Joint Communications Centre; and Zenon Sewage Treatment Plant in Block 4	Developed	7.54	88%	35
	The balance of Block 4 draining towards the interim SWMF2, located at the east side of Transportation and Works Operations Centre and including the interim SWMF2 area	Undeveloped except for SWMF2	5.49	0%	35
	The areas associated with the extension and urbanization of Garfield Wright Blvd to Woodbine Ave.	Developed	5.36	87%	62

Notes:

- SWM: stormwater management.
- Interim SWMF2: the interim stormwater management facility located at the southeast corner of Block 4 to provide the stormwater management control for the interim development plan (as described in **Table 1** and illustrated in **Figures 5 and 7**) for the industrial development in Block 4, the major portion of Block 3 and the areas associated with the extension and urbanization of Garfield Wright Blvd.
- CN*: modified runoff curve number for the pervious area and its calculation details are presented in **Appendix D**.
- Development status: whether or not the area is considered as the developed area for the design of the interim SWMF2.

The interim SWMF2 is located at the southeast corner of Block 4 and it is a deep extended wet pond with a sediment forebay in front. Both wet pond and forebay are situated entirely outside of the regulatory floodplain of the Black River. As illustrated in **Figure 7**, the total drainage area to the interim SWMF2 is approximately 23.6 ha, including the 12.9 ha development area with the average imperviousness of 87.5% and the 10.7 ha undeveloped area (including SWMF2 itself). SWMF2 treats and attenuates the post-development stormwater runoff from the development site and discharges the treated water into the Black River directly at the controlled rates to satisfy the desired design criteria.

Sediment Forebay: The sediment forebay is designed to facilitate operation and maintenance of the wet pond and improve pollutant removal by trapping large sediments from entering the pond. Considering the 12.9 ha development area with an average imperviousness of 87.5%, the annual sediment loading to the forebay is about 51.2 m^3/year (3.97 m^3/ha/year), according to the current MOE Stormwater Management Planning and Design Manual published in March 2003.

The procedure recommended in the MOE Stormwater Management Planning and Design Manual was followed to design the sediment forebay as detailed in **Appendix D**. According to the current

design, the 2.0 m deep sediment forebay provides a total storage volume over 1,631 m^3 with an average cleanout frequency exceeding 10 years.

Storage Requirement: Based on the desired design criteria, the storage required for the interim SWMF2 should satisfy the following criteria:

- Storage required for *water quality control:* in accordance with the current MOE standards, the storage required to provide *Enhanced* water quality protection under the interim development conditions should be the maximum of the following storage volume requirements:
    1) for the 12.9 ha development area with 87.5% imperviousness:
       permanent pool required: 2,763 m^3 (214.2 m^3/ha)
       extended detention required: 516 m^3 (40.0 m^3/ha)
       total storage volume required: 3,279 m^3 (254.2 m^3/ha)
    2) for the 23.62 ha drainage area to SWMF2 with 47.8% imperviousness:
       permanent pool required: 3,118 m^3 (132.0 m^3/ha)
       extended detention required: 945 m^3 (40.0 m^3/ha)
       total storage volume required: 4,063 m^3 (172.0 m^3/ha)
- Storage required for *erosion control:* the post-development stormwater runoff produced from the development site under the 25-mm design storm must be detained over 24 hours. Based on the hydrologic analysis, the storage requirement for erosion control is about 3,120 m^3.
- Storage required for *flood control:* the post-development peak flows released from SWMF2 is to be controlled to or below the pre-development equivalents for the 1:2 to 1:100 year design storms. Based on the hydrologic analysis, the storage requirement for flood control up to the 1:100 year design storm is about 10,110 m^3.

Therefore, the total storage required for the interim SWMF2 is approximately 13,228 m^3, including the permanent pool of 3,118 m^3 and the extended detention of 10,110 m^3 (excluding the storage created by the free board). Based on the current design, the interim SWMF2 provides a total storage over 24,884 m^3, including the permanent pool of 10,066 m^3 and the active storage of 14,818 m^3 (including the storage created by the free board). The average depth of the wet pond is 4.60 m, including the 3.0 m permanent pool as requested by the LSRCA with bottom draws for the coldwater fisheries and the 1.6 m deep active storage.

To maintain the permanent pool within the wet pond and the sediment forebay, a 1.0 m thick clay liner (that must be uniformly compacted to achieve at least 95% of its maximum Standard Proctor dry density) is suggested to be placed on their bottoms and slopes slightly above the permanent pool level and surrounded by subdrain draining toward the Black River. As requested by the LSRCA, the 300 mm thick topsoil will be placed on the slopes of the wet pond and the forebay above the permanent pool for landscaping.

Outlet Structure: The outlet structure of the interim SWMF2 is designed, through a trial-and-error approach, to satisfy the design criteria required to provide *Enhanced* water quality, erosion and flood control. According to the design, the outlet structure is located at the south end of the wet pond to increase the length of the flow path and consists of a 180 mm diameter orifice (at the outlet end of the reversed pipe to draw cold water from the bottom of the wet pond) with the invert elevation of 266.00 m; a 340 mm diameter orifice (at the inlet end of a 675 mm diameter concrete outlet pipe connected to the DICB structure) with the invert elevation of 265.60 m used only when the water level in the wet pond is above 266.60 m; and a 8.0 m wide overflow spillway crested at the elevation of 267.20 m for emergency spill. The detailed stage-discharge-storage relationship of the interim SWMF2 is presented in **Table 3**. The schematics illustrating the overall grading and outlet details of the interim SWMF2 are included **Appendix D**.

Drawdown Time: Based on the design configuration of the interim SWMF2, the drawdown time of SWMF2 under the 25-mm design storm is about 34 hours, calculated using the MOE approach as detailed in **Appendix D**, and it satisfies the minimum drawdown time of 24 hrs as required.

Operation and Maintenance: Proper operation and regular maintenance are essential to ensure optimal performance of the facility as designed. As SWMF2 consists of the sediment forebay and wet pond, operation and maintenance activities mainly include monitoring and inspections, weed control, grass cutting, upland and aquatic vegetation replanting, cleaning and adjustment of the outlet, removal of accumulated sediments, shoreline and flood fringe vegetation replanting, and trash removal for the pond, forebay and all inlet and outlet structures, excluding the operation and maintenance activities for temporary erosion and sediment controls for construction as described in **Appendix D**.

The inspections and monitoring of the facility determine required maintenance activities, and they include many aspects such as the hydraulic performance of the facility, slope stability, conditions of vegetation in and around the facility, evidence of spill and oil/grease contamination, measured sediment depth and frequency of sediment and trash build-up among others. During the first two years of operation, it is recommended inspections to be made after every significant storm to ensure proper functioning of the facility (on average about four inspections per year). After this initial period, when the designed operation and performance of SWMF2 have been achieved or confirmed, annual inspections may suffice.

Generally speaking, it is recommended to limit grass cutting and weed control (governed by local by-laws) around SWMF2 since grass growth tends to enhance water quality treatment, provide ideal wildlife habitat among other benefits for the wet pond. Grass around the wet pond and the forebay should not be cut to the edge of the permanent pool. As a safety precaution, grass cutting should be done parallel to the shoreline with grass clipping being ejected upland to reduce the potential for organic loadings to the wet pond.

Table 3. Stage-Storage-Discharge Relationship of the Interim SWMF2

Elevation (m)	Depth (m)	Permanent Pool Storage (m^3)	Active Storage (m^3)	Total Storage (m^3)	Orifice A[(2)] Outflow (m^3/s)	Orifice B[(2)] Outflow (m^3/s)	Emergency Spillway (m^3/s)	Total Outflow (m^3/s)
263.00	0.00	0	0	0	0.000	0.000	0.000	0.000
263.10	0.10	174	0	174	0.000	0.000	0.000	0.000
263.20	0.20	357	0	357	0.000	0.000	0.000	0.000
263.30	0.30	549	0	549	0.000	0.000	0.000	0.000
263.40	0.40	751	0	751	0.000	0.000	0.000	0.000
263.50	0.50	963	0	963	0.000	0.000	0.000	0.000
263.60	0.60	1,185	0	1,185	0.000	0.000	0.000	0.000
263.70	0.70	1,418	0	1,418	0.000	0.000	0.000	0.000
263.80	0.80	1,660	0	1,660	0.000	0.000	0.000	0.000
263.90	0.90	1,914	0	1,914	0.000	0.000	0.000	0.000
264.00	1.00	2,179	0	2,179	0.000	0.000	0.000	0.000
264.10	1.10	2,454	0	2,454	0.000	0.000	0.000	0.000
264.20	1.20	2,741	0	2,741	0.000	0.000	0.000	0.000
264.30	1.30	3,039	0	3,039	0.000	0.000	0.000	0.000
264.40	1.40	3,350	0	3,350	0.000	0.000	0.000	0.000
264.50	1.50	3,672	0	3,672	0.000	0.000	0.000	0.000
264.60	1.60	4,006	0	4,006	0.000	0.000	0.000	0.000
264.70	1.70	4,352	0	4,352	0.000	0.000	0.000	0.000
264.80	1.80	4,711	0	4,711	0.000	0.000	0.000	0.000
264.90	1.90	5,083	0	5,083	0.000	0.000	0.000	0.000
265.00	2.00	5,467	0	5,467	0.000	0.000	0.000	0.000
265.10	2.10	5,865	0	5,865	0.000	0.000	0.000	0.000
265.20	2.20	6,276	0	6,276	0.000	0.000	0.000	0.000
265.30	2.30	6,700	0	6,700	0.000	0.000	0.000	0.000
265.40	2.40	7,138	0	7,138	0.000	0.000	0.000	0.000
265.50	2.50	7,590	0	7,590	0.000	0.000	0.000	0.000
265.60	2.60	8,056	0	8,056	0.000	0.000	0.000	0.000
265.70	2.70	8,537	0	8,537	0.000	0.000	0.000	0.000
265.80	2.80	9,031	0	9,031	0.000	0.000	0.000	0.000
265.90	2.90	9,541	0	9,541	0.000	0.000	0.000	0.000
266.00	3.00	10,066	0	10,066	0.000	0.000	0.000	0.000
266.10	3.10	10,066	702	10,767	0.007	0.000	0.000	0.007
266.20	3.20	10,066	1,427	11,492	0.022	0.000	0.000	0.022
266.30	3.30	10,066	2,176	12,241	0.031	0.000	0.000	0.031
266.40	3.40	10,066	2,948	13,013	0.038	0.000	0.000	0.038
266.50	3.50	10,066	3,744	13,810	0.043	0.000	0.000	0.043
266.60	3.60	10,066	4,649	14,715	0.048	0.000	0.000	0.048
266.70	3.70	10,066	5,574	15,640	-	0.233	0.000	0.233
266.80	3.80	10,066	6,519	16,584	-	0.245	0.000	0.245
266.90	3.90	10,066	7,484	17,549	-	0.257	0.000	0.257
267.00	4.00	10,066	8,469	18,535	-	0.268	0.000	0.268
267.10	4.10	10,066	9,475	19,540	-	0.278	0.000	0.278
267.20	4.20	10,066	10,501	20,567	-	0.289	0.000	0.289
267.30	4.30	10,066	11,548	21,614	-	0.298	0.430	0.729
267.40	4.40	10,066	12,617	22,682	-	0.308	1.216	1.524
267.50	4.50	10,066	13,707	23,772	-	0.317	2.235	2.552
267.60	4.60	10,066	14,818	24,884	-	0.326	3.441	3.767

Design Specifications of the Interim SWMF2:

(1) *Extended Wet Pond:* top of berm elevation of 267.60 m, bottom elevation of 263.00 m, permanent pool level of 266.00 m, average wet pond depth of 4.60 m (including 3.00 m for the permanent pool as requested by the LSRCA and 1.60 m for the active storage), and the average side slope of 5:1 (Horizontal:Vertical).

(2) *Outlet Structure:* one 180 mm diameter orifice (Orifice A) at the invert elevation of 266.00 m at the outlet end of the reversed pipe, one 340 mm diameter orifice (Orifice B) at the invert elevation of 265.60 m at the inlet end of the outflow pipe from the DICB structure, and one 8.0 m wide emergency overflow spillway crested at the elevation of 267.20 m to discharge the treated water directly into the Black River.

(3) Orifice flow equation: $Q = C_d A\sqrt{2gH}$ where Q is the discharge (m^3/s); C_d the orifice discharge coefficient (C_d = 0.6); A the orifice area (m^2); g the gravitational acceleration constant (9.81 m/s^2); and H the effective water head above the orifice (m).

(4) Weir flow equation: $Q = CBH^{1.5}$ where Q is the discharge (m^3/s); C the weir flow coefficient (C = 1.7); B the weir width (m); and H the effective head of water above the weir crest (m).

Trash removal is an integrated part of regular maintenance activities, and it is recommended that a "spring cleanup" is as least required to remove trash from the facility, and is then performed as required based on observations during regular inspections.

One of the most important maintenance requirements for the effective performance of SWMF2 is the removal of accumulated sediment, particularly in the forebay. Because the sediment forebay is in front of the wet pond to trap large sediments from entering the pond, the minimum sediment removal is required for the wet pond, except for the portion connected to the outlet structure as the sediment accumulation at the inlet end of the reversed pipe can block the flow from entering the pipe and the flow control orifice. Based on the current design, the sediment forebay has to be cleaned at least once in every 10 years on average, though the sediment removal for the forebay may be required shortly after the completion of the construction activities.

The typical excavation equipment such as the backhoes and hydraulic dredging may be used to remove sediment from the forebay and the wet pond. Because SWMF2 is designed to collect the stormwater runoff from the industrial subdivisions, it is recommended all sediment removed from the wet pond and the sediment forebay to be tested, confirm whether or not it is classified as the hazardous waste and determine alternative disposal options. The current MOE sediment disposal requirements should be consulted for information pertaining to exact parameters and acceptable levels for different disposal options.

3.4 Engineering Design of the Ultimate SWMF2

The ultimate SWMF2 is designed to accommodate the ultimate development plan (see **Figure 6**) due to the full development in Blocks 3 and 4, and in the areas associated with the urbanization and extension of Garfield Wright Blvd. The development status and drainage areas controlled by the ultimate SWMF2 are shown in **Figure 8**, and the major design parameters for the ultimate SWMF2 are detailed in **Table 4**.

The ultimate SWMF2 is a deep extended wet pond with a sediment forebay both of which are situated outside of the regulatory floodplain of the Black River. As shown in **Figure 8**, the total drainage area to the ultimate SWMF2 is about 32.3 ha, including the 29.4 ha development area with the average imperviousness of 83.3%. SWMF2 treats and attenuates the stormwater runoff from the development site and discharges the treated water back into the Black River directly at the controlled rates to satisfy the desired design criteria.

Sediment Forebay: Considering the 29.4 ha development area with an average imperviousness of 83.3%, the annual sediment loading to the forebay is about 108.5 m^3/year (3.69 m^3/ha/year) according to the current MOE Stormwater Management Planning and Design Manual.

The procedure recommended in the MOE Stormwater Management Planning and Design Manual was followed to design the ultimate sediment forebay as given in **Appendix D**. According to the current design, the 2.0 m deep sediment forebay provides a total storage volume over 3,187 m^3 with an average cleanout frequency exceeding 11 years.

Table 4. Major Design Parameters for the Ultimate SWMF2

SWM Facility	Development / Drainage Contributing Area	Development Status	Area (ha)	Imperviousness (%)	CN* (-)
Ultimate SWMF2	Major portion of Block 3 at the west side of the extension part of Bales Drive East	Developed	7.83	80%	62
	Transportation and Works Operations Centre; North extension of Bales Drive East; Joint Communications Centre; and Zenon Sewage Treatment Plant in Block 4	Developed	7.54	88%	35
	The balance of Block 4 draining towards the ultimate SWMF2, located at the east half of Block 4 and excluding the ultimate SWMF2 site	Developed	8.68	80%	35
	The site to accommodate the ultimate SWMF2 in Block 4	Undeveloped except for SWMF2	2.90	0%	35
	The areas associated with the extension and urbanization of Garfield Wright Blvd to Woodbine Ave, including the small area to its south	Developed	5.36	87%	62

Notes:

- SWM: stormwater management.
- Ultimate SWMF2: the ultimate stormwater management facility located at the southeast corner of Block 4 to provide the stormwater management control for the ultimate development plan (as described in **Table 1** and illustrated in **Figures 6 and 8**) for the industrial development in Block 4, the major portion of Block 3 and the areas associated with the extension and urbanization of Garfield Wright Blvd.
- CN*: modified runoff curve number for the pervious area and its calculation details are presented in **Appendix D.**
- Development status: whether or not the area is considered as the developed area for the design of the ultimate SWMF2.

Storage Requirement: Based on the desired design criteria and other design assumptions, the storage requirement for the ultimate SWMF2 should satisfy the following criteria:

- Storage required for *water quality control:* in accordance with the current MOE criteria, the storage requirement to provide *Enhanced* (Level 1) water quality protection for the 29.4 ha development area with 83.3% imperviousness is 7,270 m^3 (247.2 m^3/ha), including the permanent pool storage of 6,094 m^3 (207.2 m^3/ha) and the extended detention storage of 1,176 m^3 (40.0 m^3/ha).
- Storage required for *erosion control:* the post-development stormwater runoff produced from the development site under the 25-mm design storm must be detained over 24 hours. Based on the hydrologic analysis, the storage requirement for erosion control is about 6,388 m^3.
- Storage required for *flood control:* the post-development peak flows released from SWMF2 is to be controlled to or below the pre-development equivalents for the 1:2 to 1:100 year design storms. Based on the hydrologic analysis, the storage requirement for flood control up to the 1:100 year design storm is about 20,170 m^3.

Therefore, the total storage required for the ultimate SWMF2 is about 26,264 m^3, including the permanent pool of 6,094 m^3 and the extended detention of 20,170 m^3 (excluding the storage created by the free board). Based on the current design, the ultimate SWMF2 provides a total

storage over 56,629 m^3, including the permanent pool of 26,956 m^3 and the active storage of 29,674 m^3 (including the storage created by the free board). The average depth of the wet pond is 4.60 m, including the 3.0 m permanent pool as requested by the LSRCA with bottom draws for the coldwater fisheries and the 1.6 m deep active storage.

Outlet Structure: The outlet structure of the ultimate SWMF2 is designed to satisfy the design criteria required to provide *Enhanced* water quality, erosion and flood control under the ultimate development condition. According to the current design, the proposed outlet structure consists of a 260 mm diameter orifice (at the outlet end of the reversed pipe to draw cold water from the bottom of the wet pond) with the invert elevation of 266.00 m; a 390 mm diameter orifice (at the inlet end of a 675 mm diameter concrete outlet pipe connected to the DICB structure) with the invert elevation of 265.60 m used only when the water level in the wet pond is above 266.60 m; and a 13.0 m wide overflow spillway crested at the elevation of 267.20 m for emergency spill. The detailed stage-discharge-storage relationship of the ultimate SWMF2 is presented in **Table 5.**

The schematics illustrating grading and outlet details of the ultimate SWMF2 are presented in **Appendix D**, and the outlet structure of the ultimate SWMF2 will be constructed through minor modifications of the interim outlet structure as described below:

- at the outlet end of the reversed concrete pipe, install a larger 260 mm diameter orifice at the same location of the 180 mm diameter interim orifice with the same invert elevation of 266.0 m at the permanent pool level;
- at the inlet end of a 675 mm diameter concrete outlet pipe connected to the DICB structure, install a larger 390 mm diameter office at the same location of the 340 mm diameter interim orifice with the same invert elevation of 265.6 m; and
- widen the emergency spillway from the interim length of 8.0 m to the ultimate length of 13.0 m at the same weir invert elevation of 267.20 m. As requested by the LSRCA, a 13.0 m long concrete weir should be installed in the berm under the ultimate condition.

It should be noted that the site plans for the future industrial development areas located within Blocks 3 and 4 are not available at this time. When the blocks are developed, they will require site plan approval and the preparation of a storm drainage report to provide a detailed engineering design of the major and minor storm drainage systems and retrofit the interim SWMF2, in accordance with the drainage design criteria outlined in this report, to safely convey runoff into SWMF2 and provide the desired Level 1 (*enhanced*) water quality, erosion and water quantity control for the development.

Drawdown Time: According to the design configuration of the ultimate SWMF2 and its outlet, the drawdown time under the 25-mm storm is about 32 hours, calculated using the MOE approach detailed in **Appendix D**, and it satisfies the minimum drawdown time of 24 hrs required.

Table 5. Stage-Storage-Discharge Relationship of the Ultimate SWMF2

Elevation (m)	Depth (m)	Permanent Pool Storage (m^3)	Active Storage (m^3)	Total Storage (m^3)	Orifice A[(2)] Outflow (m^3/s)	Orifice B[(2)] Outflow (m^3/s)	Emergency Spillway (m^3/s)	Total Outflow (m^3/s)
263.00	0.00	0	0	0	0.000	0.000	0.000	0.000
263.10	0.10	597	0	597	0.000	0.000	0.000	0.000
263.20	0.20	1,214	0	1,214	0.000	0.000	0.000	0.000
263.30	0.30	1,849	0	1,849	0.000	0.000	0.000	0.000
263.40	0.40	2,504	0	2,504	0.000	0.000	0.000	0.000
263.50	0.50	3,178	0	3,178	0.000	0.000	0.000	0.000
263.60	0.60	3,872	0	3,872	0.000	0.000	0.000	0.000
263.70	0.70	4,586	0	4,586	0.000	0.000	0.000	0.000
263.80	0.80	5,320	0	5,320	0.000	0.000	0.000	0.000
263.90	0.90	6,074	0	6,074	0.000	0.000	0.000	0.000
264.00	1.00	6,849	0	6,849	0.000	0.000	0.000	0.000
264.10	1.10	7,644	0	7,644	0.000	0.000	0.000	0.000
264.20	1.20	8,460	0	8,460	0.000	0.000	0.000	0.000
264.30	1.30	9,298	0	9,298	0.000	0.000	0.000	0.000
264.40	1.40	10,156	0	10,156	0.000	0.000	0.000	0.000
264.50	1.50	11,037	0	11,037	0.000	0.000	0.000	0.000
264.60	1.60	11,938	0	11,938	0.000	0.000	0.000	0.000
264.70	1.70	12,862	0	12,862	0.000	0.000	0.000	0.000
264.80	1.80	13,808	0	13,808	0.000	0.000	0.000	0.000
264.90	1.90	14,776	0	14,776	0.000	0.000	0.000	0.000
265.00	2.00	15,767	0	15,767	0.000	0.000	0.000	0.000
265.10	2.10	16,780	0	16,780	0.000	0.000	0.000	0.000
265.20	2.20	17,817	0	17,817	0.000	0.000	0.000	0.000
265.30	2.30	18,876	0	18,876	0.000	0.000	0.000	0.000
265.40	2.40	19,959	0	19,959	0.000	0.000	0.000	0.000
265.50	2.50	21,065	0	21,065	0.000	0.000	0.000	0.000
265.60	2.60	22,195	0	22,195	0.000	0.000	0.000	0.000
265.70	2.70	23,349	0	23,349	0.000	0.000	0.000	0.000
265.80	2.80	24,527	0	24,527	0.000	0.000	0.000	0.000
265.90	2.90	25,729	0	25,729	0.000	0.000	0.000	0.000
266.00	3.00	26,956	0	26,956	0.000	0.000	0.000	0.000
266.10	3.10	26,956	1,516	28,471	0.014	0.000	0.000	0.014
266.20	3.20	26,956	3,066	30,022	0.037	0.000	0.000	0.037
266.30	3.30	26,956	4,652	31,608	0.058	0.000	0.000	0.058
266.40	3.40	26,956	6,274	33,230	0.073	0.000	0.000	0.073
266.50	3.50	26,956	7,932	34,887	0.086	0.000	0.000	0.086
266.60	3.60	26,956	9,754	36,710	0.097	0.000	0.000	0.097
266.70	3.70	26,956	11,607	38,563	-	0.302	0.000	0.302
266.80	3.80	26,956	13,490	40,446	-	0.318	0.000	0.318
266.90	3.90	26,956	15,404	42,359	-	0.334	0.000	0.334
267.00	4.00	26,956	17,349	44,304	-	0.349	0.000	0.349
267.10	4.10	26,956	19,324	46,280	-	0.363	0.000	0.363
267.20	4.20	26,956	21,331	48,286	-	0.376	0.000	0.376
267.30	4.30	26,956	23,369	50,324	-	0.389	0.699	1.088
267.40	4.40	26,956	25,439	52,394	-	0.402	1.977	2.379
267.50	4.50	26,956	27,540	54,496	-	0.415	3.631	4.046
267.60	4.60	26,956	29,674	56,629	-	0.427	5.591	6.017

Design Specifications of the Ultimate SWMF2:

(1) *Extended Wet Pond:* top of berm elevation of 267.60 m, bottom elevation of 263.00 m, permanent pool level of 266.00 m, average wet pond depth of 4.60 m (including 3.00 m for the permanent pool and 1.60 m for the active storage), and the average side slope of 5:1 (Horizontal:Vertical).

(2) *Outlet Structure*: one 260 mm diameter orifice (Orifice A) at the invert elevation of 266.00 m at the outlet end of the reversed pipe, one 390 mm diameter orifice (Orifice B) at the invert elevation of 265.60 m at the inlet end of the outflow pipe from the DICB structure, and one 13.0 m wide emergency overflow spillway crested at the elevation of 267.20 m to discharge the treated water directly into the Black River.

(3) Orifice flow equation: $Q = C_d A\sqrt{2gH}$ where Q is the discharge (m^3/s); C_d the orifice discharge coefficient (C_d = 0.6); A the orifice area (m^2); g the gravitational acceleration constant (9.81 m/s^2); and H the effective water head above the orifice (m).

(4) Weir flow equation: $Q = CBH^{1.5}$ where Q is the discharge (m^3/s); C the weir flow coefficient (C = 1.7); B the weir width (m); and H the effective head of water above the weir crest (m).

SWMF2 will be receiving Zenon Sewage Treatment Plant effluent discharge. The plant will be producing water suitable and used for recycling within the building, with only that not required being discharged. The effluent is of a high quality, normally better than that of receiving streams. The ultimately expected design discharge from the plant is 6,750 l/day, with the interim condition being about half. The ultimate discharge of 6,750 l/day corresponds to 0.0781 l/s (or 0.0000781 m^3/s) that is well below the level of significance of the design inflow to SWMF2, and therefore implicitly included in the design flows.

It should be noted that several safety signs are suggested around the SWMF2 site and contain the warning, for example: "Warning of Hazardous Conditions: This is a stormwater management facility and contains features which may become potentially hazardous under certain condition. Hazards include pollutants, fluctuating water levels and thin ice within the facility. Please exercise extreme caution within this area. For further information, please contact the Town of East Gwillimbury at (905) 478-4282".

4.0 HYDROLOGIC ANALYSIS

4.1 Hydrologic Model

Both pre- and post-development hydrologic analyses were conducted by using the OTTHYMO model. The model has been widely used in similar analyses for stormwater management across Ontario and is recognized as a reliable modelling tool to estimate the hydrologic response to both rural and urban watersheds.

The inputs to the OTTHYMO model include meteorological and physiographic data to describe the hydraulic and hydrologic response of the watershed or the stormwater management facilities to the design storms. The major input of the model includes the drainage area, rainfall intensity, soil cover complex curve number, time to peak, an average slope of the catchment and channel, the Manning's roughness coefficient, imperviousness and so on.

4.2 Design Storms

The design storms were determined based on the intensity-duration-frequency (IDF) curves using the rainfall data obtained from the Atmosphere Environment Service Station (AES) at Oak Ridges located at the latitude of 43° 58', longitude of 79° 28', and the altitude of 320 m. A summary of the rainfall depths for the complete range of the design storm events is presented in **Table 6**, and the coefficients of the Chicago distribution for the complete range of the design storms are given in **Table 7**. The six-hour Chicago storms were used for the hydrologic analysis. To be conservative, the storage volume requirement of SWMF2 for the water quantity control were checked using the hurricane Hazel and 24-hour SCS Type II distributions under the various return periods.

Table 6. Rainfall Depths (mm) under Different Design Storm Events

Storm Duration	1:2 Year Storm	1:5 Year Storm	1:10 Year Storm	1:25 Year Storm	1:50 Year Storm	1:100 Year Storm
5 min	8.7	11.2	12.8	14.8	16.3	17.8
10 min	13.0	17.8	21.0	25.1	28.1	31.1
15 min	16.0	22.6	26.9	32.4	36.4	40.5
30 min	20.3	29.3	35.3	42.9	48.5	54.1
1 hour	23.9	34.6	41.7	50.7	57.4	64.0
2 hours	27.9	38.3	45.2	53.9	60.3	66.7
6 hours	36.1	51.3	61.4	74.1	83.6	92.9
12 hours	42.1	57.2	67.2	79.9	89.3	98.6
24 hours	49.3	67.5	79.6	94.9	106.2	117.5
Source: Atmosphere Environment Service (AES) Oak Ridges Station						

Table 7. Main Parameters for Different Design Storm Events

Return Interval (-)	Coefficient A (mm)	Coefficient B (min)	Coefficient C (-)	Peak Intensity (mm/hr)
1:2	686.505	5.262	0.800	106.58
1:5	1172.811	7.969	0.833	138.73
1:10	1516.904	9.188	0.847	160.43
1:25	1960.671	10.512	0.858	186.56
1:50	2282.269	10.910	0.865	208.41
1:100	2630.188	11.602	0.870	228.27

Source: Atmosphere Environment Service (AES) Station at Oak Ridges

4.3 Pre-Development Peak Flows

As illustrated in **Figure 4**, the entire study area is divided into several catchments under the pre-development conditions for the hydrologic analysis. Because the post-development runoff from all developments interested drains into the facility SWMF2 located at the southeast corner of Block 4, the pre-development hydrologic analysis focused on Catchment 103 that includes Block 4 and the east portion of Block 3 with a total area of approximately 25.7 ha.

Several parameters such as the weighted modified soil cover complex number, catchment slope, and time to peak were used to simulate the peak flow and the runoff volume under the different design storms. The catchment slope (1.7% for Catchment 103) is calculated using the Equivalent Slope Method suggested in the MTO Drainage Management Manual with the following equation:

$$S_w = 100 \cdot \left[n / \Sigma \left(S_n^{0.5} \right) \right]^2$$

where: S_w is the watershed slope (%).
S_n is the slope of an individual reach of the channel (m/m).
n is the number of reaches of approximately equal length (-).

To estimate time to peak (0.24 hours for Catchment 103), the following three-parameter equation is used for catchments with slopes less than 2% and the two-parameter equation for catchments with slopes greater than 2% as suggested in the MTO Drainage Management Manual:

Three-parameter equation: $t_p = 0.0086 * A^{0.422} * S^{-0.46} * (L/W)^{0.133}$

Two-parameter equation: $t_p = 0.016 * A^{0.31} * S^{-0.5}$

where: t_p is the time to peak (hour).
A is the drainage area (ha).
S is the slope (m/m).
L is the catchment length (m).

W is the catchment width (m).

Table 8 presents the pre-development peak flows for Basin 103 under the 1:2 to 1:100 year Chicago and SCS II design storms. A copy of the complete pre-development OTTHYMO output under the 25 mm, 1:2, 1:5, 1:10, 1:25, 1:50 and 1:100 year Chicago and SCS II design storms is included in **Appendix B**.

Table 8. Pre-Development Peak Flows under Different Design Storms

Items and Specifications	Peak Flows (m^3/s)					
	1:2 Year Storm	1:5 Year Storm	1:10 Year Storm	1:25 Year Storm	1:50 Year Storm	1:100 Year Storm
Basin 103 for a total area of 25.67 ha						
under the Chicago Storms	0.15	0.30	0.42	0.61	0.76	0.94
under the SCS II Storms	0.18	0.33	0.46	0.64	0.79	0.95

Notes:
- Locations of different catchments under the pre-development conditions are illustrated in **Figure 4**.
- Design Storm Events: six-hour Chicago storms and 24-hour SCS II storms at the AES Oak Ridges Station.
- A hard copy of the pre-development OTTHYMO output is included in **Appendix B**.

4.4 Performance of the Interim and Ultimate SWMF2

Figures 7 and 8 present the interim and ultimate drainage conditions. In accordance with the interim and ultimate development plans and design assumptions described in **Table 2** and **Table 4**, the OTTHYMO model was used to simulate the uncontrolled and controlled post-development peak flows and the performance of SWMF2 under the Hurricane Hazel, Chicago and SCS II rainfall storms. The results of the post-development peak flows and the performance of SWMF2 under the different design storms are summarized in **Table 9** and **Table 10** for the interim and ultimate conditions respectively. A copy of the post-development OTTHYMO output for the 25 mm, 1:2, 1:5, 1:10, 1:25, 1:50 and 1:100 year Chicago and SCS II storms and the Hurricane Hazel is included in **Appendix C** under both interim and ultimate development conditions.

Table 9. Performance of Interim SWMF2 under Different Design Storms

Technical Parameter Specifications	Rainfall Storm Events						
	1:2 Year	1:5 Year	1:10 Year	1:25 Year	1:50 Year	1:100 Year	Hazel
PERFORMANCE OF INTERIM SWMF2 UNDER 6-HOUR CHICAGO DESIGN STORMS							
Peak inflow to SWMF2 (m^3/s)	2.74	3.78	4.49	5.39	6.12	6.81	3.07
Peak outflow from SWMF2 (m^3/s)	0.05	0.18	0.24	0.26	0.27	0.29	2.85
Allowable peak flow (m^3/s)*	*0.11*	*0.21*	*0.30*	*0.43*	*0.54*	*0.67*	-
Max water level in SWMF2 (m)	266.54	266.67	266.76	266.93	267.05	267.18	267.53
Max storage used in SWMF2 (m^3)	4,110	5,320	6,180	7,770	8,950	10,290	13,990
Max W/L above the PP (m)	0.54	0.67	0.76	0.93	1.05	1.18	1.53
Max W/depth above the PB (m)	3.54	3.67	3.76	3.93	4.05	4.18	4.53
PERFORMANCE OF INTERIM SWMF2 UNDER 24-HOUR SCS TYPE II STORMS							
Peak inflow to SWMF2 (m^3/s)	1.11	1.59	1.94	2.37	2.73	3.07	-
Peak outflow from SWMF2 (m^3/s)	0.06	0.24	0.25	0.27	0.28	0.45	-
Allowable peak flow (m^3/s)*	*0.13*	*0.24*	*0.32*	*0.45*	*0.56*	*0.68*	-
Max water level in SWMF2 (m)	266.61	266.72	266.84	267.01	267.14	267.24	-
Max storage used in SWMF2 (m^3)	4,720	5,750	6,920	8,550	9,870	10,930	-
Max W/L above the PP (m)	0.61	0.72	0.84	1.01	1.14	1.24	-
Max W/depth above the PB (m)	3.61	3.72	3.84	4.01	4.14	4.24	-

Notes:

- The interim post-development drainage conditions are illustrated in **Figure 7**.
- W/L: water level; Max: maximum; PP: permanent pool; W/depth: water depth; PB: the bottom of the wet pond.
- *: allowable peak flows are estimated by multiplying the peak flows presented in **Table 8** by an area reduction factor of 18.25/25.67 = 0.71 because there is a small area (7.42 ha) out of 25.67 ha draining directly into the Black River rather than into SWMF2 under the interim development condition.
- A hard copy of the interim OTTHYMO output is included in **Appendix C**.

Table 10. Performance of Ultimate SWMF2 under Different Design Storms

Technical Parameter / Specifications	Rainfall Storm Events						
	1:2 Year	1:5 Year	1:10 Year	1:25 Year	1:50 Year	1:100 Year	Hazel
PERFORMANCE OF ULTIMATE SWMF2 UNDER 6-HOUR CHICAGO DESIGN STORMS							
Peak inflow to SWMF2 (m^3/s)	5.31	7.78	9.26	11.10	12.61	14.03	4.49
Peak outflow from SWMF2 (m^3/s)	0.09	0.24	0.31	0.34	0.35	0.37	4.09
Allowable peak flow (m^3/s)*	*0.14*	*0.28*	*0.40*	*0.58*	*0.72*	*0.89*	-
Max water level in SWMF2 (m)	266.52	266.67	266.76	266.92	267.03	267.15	267.50
Max storage used in SWMF2 (m^3)	8,300	11,030	12,820	15,800	17,910	20,300	27,610
Max W/L above the PP (m)	0.52	0.67	0.76	0.92	1.03	1.15	1.50
Max W/depth above the PB (m)	3.52	3.67	3.76	3.92	4.03	4.15	4.50
PERFORMANCE OF ULTIMATE SWMF2 UNDER 24-HOUR SCS TYPE II STORMS							
Peak inflow to SWMF2 (m^3/s)	2.30	3.24	3.89	4.72	5.41	6.05	-
Peak outflow from SWMF2 (m^3/s)	0.10	0.30	0.32	0.35	0.36	0.48	-
Allowable peak flow (m^3/s)*	*0.17*	*0.31*	*0.43*	*0.60*	*0.75*	*0.90*	-
Max water level in SWMF2 (m)	266.59	266.72	266.84	267.00	267.12	267.22	-
Max storage used in SWMF2 (m^3)	9,520	11,970	14,240	17,270	19,630	21,810	-
Max W/L above the PP (m)	0.59	0.72	0.84	1.00	1.12	1.22	-
Max W/depth above the PB (m)	3.59	3.72	3.84	4.00	4.12	4.22	-

Notes:

- The ultimate post-development drainage conditions are illustrated in **Figure 8**.
- W/L: water level; Max: maximum; PP: permanent pool; W/depth: water depth; PB: the bottom of the wet pond.
- *: allowable peak flows are estimated by multiplying the peak flows presented in **Table 8** by an area reduction factor of 24.34/25.67 = 0.95 because there is a small area (1.33 ha) out of 25.67 ha draining directly into the Black River rather than into SWMF2 under the ultimate development condition.
- A hard copy of the interim OTTHYMO output is included in **Appendix C**.

The results of the interim and ultimate hydrologic analysis support the following conclusions:

- Due to the Garfield Wright Blvd extension to Woodbine Avenue and industrial development, quantity of runoff will increase significantly in terms of peak flow and volume under the interim and ultimate conditions. Water quantity control, therefore, is required to alleviate the increase.
- Under the 25-mm design storm, it is expected that the maximum water level may reach 266.4 m within the interim SWMF2. Since over 95% of daily precipitation events in southern Ontario are less than 25 mm, this reflects normal operational conditions of the interim SWMF2.
- It is expected that the maximum water level in the interim SWMF2 will reach 266.5, 266.7 and 267.2 m under the 1:2, 1:5 and 1:100 year Chicago design storms respectively (that is 0.5, 0.7 and 1.2 m above the permanent pool; and 3.5, 3.7 and 4.2 m above the wet pond bottom respectively), in comparison with 266.6, 266.7 and 267.2 m under the 24-hour SCS II design storms respectively. Under the Hurricane Hazel, the maximum water level within the interim SWMF2 can reach as high as 267.5 m.

- Under the interim conditions, the controlled peak outflow from SWMF2 to the Black River is 0.05, 0.18, 0.24, 0.26, 0.27 and 0.29 m^3/s under the 1:2, 1:5, 1:10, 1:25, 1:50 and 1:100 year Chicago storms respectively, below the corresponding allowable peak flows of 0.11, 0.21, 0.30, 0.43, 0.54 and 0.67 m^3/s respectively.
- Under the interim conditions, the controlled peak outflow from SWMF2 to the Black River is 0.06, 0.24, 0.25, 0.27, 0.28 and 0.45 m^3/s under the 1:2, 1:5, 1:10, 1:25, 1:50 and 1:100 year SCS II design storms respectively, below the corresponding allowable peak flows of 0.13, 0.24, 0.32, 0.45, 0.56 and 0.68 m^3/s respectively.
- Under the ultimate conditions, the controlled peak outflow from SWMF2 to the Black River is 0.09, 0.24, 0.31, 0.34, 0.35 and 0.37 m^3/s under the 1:2, 1:5, 1:10, 1:25, 1:50 and 1:100 year Chicago storms respectively, below the corresponding allowable peak flows of 0.14, 0.28, 0.40, 0.58, 0.72 and 0.89 m^3/s respectively.
- Under the ultimate conditions, the controlled peak outflow from SWMF2 to the Black River is 0.10, 0.30, 0.32, 0.35, 0.36 and 0.48 m^3/s under the 1:2, 1:5, 1:10, 1:25, 1:50 and 1:100 year SCS II design storms respectively, below the corresponding allowable peak flows of 0.17, 0.31, 0.43, 0.60, 0.75 and 0.90 m^3/s respectively.
- The results of the hydrologic analysis indicate that the drawdown time of the ultimate SWMF2 is over 42 hours under the 25-mm design storm and satisfies the target minimum drawdown time of 24 hours as required.
- Based on the current design of the ultimate SWMF2, the easement Block 9 (4.2 ha including the area within the regulatory floodplain) is designated for the construction of the ultimate SWMF2, by expanding the interim SWMF2 using same inlet/outlet structures with only minor adjustments. It should be noted that the size and land requirement for the ultimate SWMF2 presented in this Report are subject to the design assumptions made for future development in York Region Industrial Subdivision and the area for the extension of Garfield Wright Blvd.
- As the post-development stormwater runoff from the areas associated with the extension of Garfield Wright Blvd to Woodbine Ave. is to be drained to SWMF2, not toward the intermittent swale as it is now, it is expected that there will be no increase of peak flows at the north limit of York Region Industrial Subdivision under both interim and ultimate conditions.

5.0 CONCLUSIONS AND RECOMMENDATIONS

The detailed results of the hydraulic and hydrologic analysis support the following conclusions and recommendations:

1. Because only a small portion of Block 4 is subject to the immediate development in addition to the extension and urbanization of Garfield Wright Blvd to Woodbine Ave, the technical design brief for the interim SWMF2 is presented in this report to accommodate the interim development plan for enhanced water quality, erosion and water quantity controls for a total drainage area of 23.6 ha.

2. The interim SWMF2 is a deep extended wet pond with a sediment forebay, located at the southeast corner of Block 4 and entirely outside of the regulatory floodplain of the Black River. As designed, the interim SWMF2 provides a total storage of 24,884 m^3, including the permanent pool of 10,066 m^3 and the active storage of 14,818 m^3. The average depth of the wet pond is 4.60 m, including the 3.0 m permanent pool as requested by the LSRCA and the 1.6 m deep active storage.

3. Under the 25-mm design storm, the maximum water level within the interim SWMF2 may reach 266.4 m approximately. Since over 95% of daily precipitation events in southern Ontario are less than 25 mm, this reflects normal operational conditions of the interim SWMF2.

4. The maximum water level within the interim SWMF2 will reach 266.5, 266.7 and 267.2 m under the 1:2, 1:5 and 1:100 year Chicago storms respectively (that is 0.5, 0.7 and 1.2 m above the permanent pool; and 3.5, 3.7 and 4.2 m above the wet pond bottom respectively), in comparison with 266.6, 266.7 and 267.2 m under the 24-hour SCS II storm events respectively. Under the Hurricane Hazel, the maximum water level within the interim SWMF2 can reach as high as 267.5 m.

5. Under the interim conditions, the controlled peak outflow from SWMF2 is 0.05, 0.18, 0.24, 0.26, 0.27 and 0.29 m^3/s under the 1:2, 1:5, 1:10, 1:25, 1:50 and 1:100 year Chicago storms respectively, below the allowable peak flows of 0.11, 0.21, 0.30, 0.43, 0.54 and 0.67 m^3/s respectively.

6. Under the interim conditions, the controlled peak outflow from SWMF2 is 0.06, 0.24, 0.25, 0.27, 0.28 and 0.45 m^3/s under the 1:2, 1:5, 1:10, 1:25, 1:50 and 1:100 year SCS II design storms respectively, below the allowable peak flows of 0.13, 0.24, 0.32, 0.45, 0.56 and 0.68 m^3/s respectively.

7. Based on the current design, the ultimate SWMF2 needs a total storage of 56,629 m^3, including the permanent pool of 26,956 m^3 and the active storage of 29,674 m^3 with the average depth of the wet pond of 4.60 m (including the 3.0 m permanent pool and the 1.6 m active storage). As a result, Block 9 (4.2 ha including the area within the regulatory floodplain of the Black River) is reserved and will be

transferred to the Town of East Gwillimbury. The block has been sized to accommodate the ultimate SWMF2, through expanding the interim SWMF2 using the same inlet and outlet structures with minor adjustments to the outlet control structure and emergency overflow weir.

8. Under the ultimate conditions, the controlled peak outflow from SWMF2 is 0.09, 0.24, 0.31, 0.34, 0.35 and 0.37 m^3/s under the 1:2, 1:5, 1:10, 1:25, 1:50 and 1:100 year Chicago storms respectively, below the allowable peak flows of 0.14, 0.28, 0.40, 0.58, 0.72 and 0.89 m^3/s respectively.

9. Under the ultimate conditions, the controlled peak outflow from SWMF2 is 0.10, 0.30, 0.32, 0.35, 0.36 and 0.48 m^3/s under the 1:2, 1:5, 1:10, 1:25, 1:50 and 1:100 year SCS II design storms respectively, below the allowable peak flows of 0.17, 0.31, 0.43, 0.60, 0.75 and 0.90 m^3/s respectively.

10. As the post-development stormwater runoff generated from the areas associated with the extension and urbanization of Garfield Wright Blvd to Woodbine Ave is to be drained into SWMF2, not toward the intermittent swale as it is under existing conditions, it is expected that there will be no increase of peak flows at the north limit of the York Region Industrial Subdivision under both interim and ultimate development conditions.

11. It should be noted that the site plans for the future industrial development areas located within Blocks 3 and 4 are not available at this time. When the blocks are developed, they will require site plan approval and the preparation of a storm drainage report to provide a detailed engineering design of the major and minor storm drainage systems and retrofit the interim SWMF2, in accordance with the drainage design criteria outlined in this report, to safely convey runoff into SWMF2 and provide the desired Level 1 (*enhanced*) water quality, erosion and water quantity control for the development.

Appendix A. Correspondence and Review Comments Received

Appendix A1: Review Comments Received from the LSRCA Dated June 25, 2004

JUN. 25. 2004 12:53PM LSRCA NO. 149 P. 1/3

Tel: 905-895-1281
1-800-465-0437
Fax: 905-853-5881
E-Mail: info@lsrca.on.ca
Web: www.lsrca.on.ca

120 Bayview Parkway
Box 282
Newmarket, Ontario
L3Y 4X1

Sent by Facsimile 1-905-763-9983

June 25, 2004

File No.: 19T-94016
IMS No.: PSDC112C10

Mr. Jaime E. Acosta, P.Eng.
Cumming Cockburn Limited
9133 Leslie Street
Richmond Hill, ON L4B 4N1

Dear Mr. Acosta:

Re: York Region Industrial Subdivision
Technical Design Brief
Dated May 2004
Engineering Drawings
Dated May 21, 2004
Part of Lot 2, Concession 4
Town of East Gwillimbury

We have completed our review of the above noted submission which we received on May 31, 2004 and comment as follows. These comments are numbered in accordance with those in our letter dated February 2, 2004:

1.0) Fisheries Comments:

1.1) The design of the Black River storm outfall channel for Pond SWMF2 is to be revised such that rounded granite rock is used rather than the rip rap which is currently proposed.

1.2) Pond SWMF1 will not be constructed. Pond SWMF3 has already been approved by the Authority. As such, this comment can be considered addressed.

2.0) Technical Design Brief Comments

2.1) We will accept the phased approach suggested in the report for the construction of Pond SWMF2.

2.2) Addressed.

Leaders In

2.3) Addressed. Please note that the proposed revision to the pond design in your fax dated June 9, 2004 would be acceptable to the Authority. Please revise all related drawings and the report accordingly.

Watershed

2.4) The 24 hour event is to be run for the pre-development condition as well. The flows predicted for this event are the target flows for the post-development 24 hour storm scenario.

2.5) Addressed.

Health

2.6) Addressed.

2.7) Please provide us with the calculations done to produce CN*.

2.8) Addressed.

2.9) Addressed.

2.10) Addressed.

2.11) Addressed.

The following are comments arising from our review of the revised SWM brief.

2.12) Page 10. The required water quality storage should be double checked using the total drainage area draining to the pond under the interim condition and the total imperviousness during this interim phase.

2.13) Figure 8. The 8.68 ha. area beside SWMF2 will drain to the pond, not to the river as shown on this figure.

2.14) Table 8. The allowable flows in this table are different than those in Table 9.

2.15) Table 9 shows increases in peak flows (post versus pre) for several of the storm events which is not permissible.

3.0 Design Drawing Comments

3.1) Addressed.

3.2) No longer applicable.

3.3) Addressed.

3.4) SWM2 is to show the location of anti-seepage collars on the outlet pipes.

3.5) The landscaping plans have been received by the Authority and are currently under review. Comments will be provided in the near future.

3.6) Notes regarding the pond berm construction are to be added to SWM1.

3.7) Addressed. Due to the infrequent use of the maintenance path, we recommend that it be topsoiled and seeded (on top of the gravel base) in order to provide a more natural boundary to the permanent pool.

3.8) Addressed. Please note that galvanized steel plate orifices are acceptable for use in municipally owned and operated SWM facilities.

June 25, 2004
Mr. Jaime Acosta, P.Eng.
York Industrial Subdivision
Town of East Gwillimbury
Page 3 of 3

3.9) Under the 24 hour 1:100 year storm condition, the overflow weir will be used for flow control (0.45 cms). As such, we will require that a concrete weir be installed in the berm as requested previously.

3.10) Addressed.

3.11) Addressed.

3.12) Erosion and Sediment Control Plan Comments

a-f) Due to the limited development proposed during the interim condition, the level of detail on this plan is acceptable.

The silt control fence east of SWMF2 is to be extended past the north limit of the pond.

3.13) Addressed.

3.14) Addressed.

The following are additional comments resulting from our review of the latest design drawings.

3.15) A permit is required for the culvert extensions proposed at station 0+660 on Garfield Wright Blvd. In order to reduce the potential for a HADD, it is suggested that a headwall be fitted on the end of the existing culverts rather than extending them.

3.16) The reference to sodding the pond slopes on drawing SWM1 is to be deleted. Reference should made on this drawing to the pond planting plans.

Should you have any questions regarding the above, please do not hesitate to contact the undersigned.. We request that you provide a letter with your next submission detailing how each of the above comments has been addressed. Please refer to the above noted file numbers in all future correspondence.

Yours truly,

Tom Hogenbirk, CMM, P.Eng.
Manager, Engineering and Technical Services

TH/ph

c Mr. Don Allan, Town of East Gwillimbury, 905-478-2808

S:\Tom\REG York Bales LTR.wpd

Appendix A2: Review Comments Received from the Region Dated June 9, 2004

Transportation and Works Department
Infrastructure Design and Construction
Fax No. 905-954-4611

June 9, 2004

Mr. Jaime Acosta, P.Eng.
Cumming Cockburn Limited
9133 Leslie Street, Suite 200
Richmond Hill, ON L4B 4N1

Dear Mr. Acosta:

Re: York Industrial Subdivision
Storm Sewers
NE Davis Drive an Woodbine Avenue
Town of East Gwillimbury, 19T-94016
York Region Approval No. EG.05.04

Attached please find the following marked up 1st submission documents:

- Partial set of engineering drawings
- Storm sewer design sheets
- Application for Approval of Sewage Works for proposed storm sewers
- Two applications for Approval of Sewage Works for proposed stormwater management pond
- Sample MOE project description for storm sewers and stormwater management pond

In addition, Stormwater Management Report shall be revised to include figures/schematics presenting grading and outlet details for proposed SWM pond under interim and ultimate conditions including description of proposed outlet structure modifications under ultimate conditions. Stage-Storage-Discharge Curves (Table 3 and Table 5) shall be updated to clearly present actual orifice and weir coefficients used in the hydraulic calculations.

Please resubmit revised documents, including Stormwater Management Report to my attention. If you have any questions, please contact me at 905-830-4444 ext. 5749.

Sincerely,

Eva Pulnicki, M.Eng., P.Eng.
Environmental Servicing Engineer

EP\in
Attachments
Copy to: Don Allan, Town of East Gwillimbury

IDC\W03\2004\EG-005-04\EG-005-04let_June09_04.doc

The Regional Municipality of York, 17250 Yonge Street, Newmarket, Ontario L3Y 6Z1
Tel: 905-895-1200, 1-877-G04-YORK, Fax: 905-830-6927
Internet: www.region.york.on.ca

Appendix A3: Review Comments Received from the LSRCA Dated Feb. 2, 2004

Tel: 905-895-1281
1-800-465-0437
Fax: 905-853-5881
E-Mail: info@lsrca.on.ca
Web: www.lsrca.on.ca

20 Bayview Parkway
Box 282
Newmarket, Ontario
L3Y 4X1

Sent By Facsimile 1-905-763-9983

February 2, 2004

File No.: 19T-94016
IMS No.: PSDC112C4

Mr. Kevin Walters, P.Eng.
Cumming Cockburn Limited
9133 Leslie St., Ste. 200
Richmond Hill, ON L4B 4N1

Dear Mr. Walters:

Re: York Region Industrial Subdivision
Technical Design Brief
Dated November 19/03
Engineering Drawings
Dated November 1/03
Part of Lot 2, Concession 4
Town of East Gwillimbury

We have completed our review of the aforementioned design brief (received November 24/03) and engineering drawings (received December 4/03). Please be advised that effective March 1, 1998 the Board of Directors of the Conservation Authority adopted Staff Report 3-98-BOD which provided for the collection of fees for the review of planning and engineering submissions to the Conservation Authority. As such, we will require a review fee in the amount of $2,500.00 for this development. Please remit this payment with your next submission.

1.0) Fisheries Comments

As part of our Level III agreement with Department of Fisheries and Oceans (DFO), our fisheries biologist, Jeff Anderson, has reviewed the above noted submission and provides the following comments:

1.1) Additional details are required for the outfall from SWMF2 into the Black River.

1.2) SWM F1 and SWM F3, are noted as discharging to or being placed on line of an "Intermittent Swale". This swale was electrofished approximately 600 metres downstream of the subject property by the Ontario Ministry of Natural Resources (OMNR) in 1995. This effort exposed the presence of blacknose dace (*Rhynicthys atratulus*), northern redbelly dace (*Phoxinus eos*) and mottled sculpin (*Cottus bairdi*). The presence of mottled sculpin is significant as they are a coldwater fish that are indicators of groundwater activity.

Due to this, it is suggested that the intermittent swale represents fish habitat and an on-line pond would represent a HADD.

The DFO could support off-line treatment draining to this watercourse if stream temperatures were respected and maintained or enhanced (e.g. riparian plantings).

We would be pleased to meet with you on this matter at your earliest convenience.

Leaders In

Watershed

Health

2.0) Technical Design Brief Comments

2.1) In general, the Authority prefers that SWM facilities be built out to their ultimate design capacity in order to minimize disturbance in the future. It also would simplify the development of the remaining lots in the subdivision as the builder on these lots would not need to perform any off site works. It is recommended that the design of the ponds be revised accordingly.

2.2) If addressing the above noted comment is not feasible at the present time, we will require the following revisions in the report.
a) A separate section is required on the ultimate design parameters for ponds F2 and F3 including total upstream areas and assumed imperviousness. This section should include a figure showing the extent of the fully developed drainage areas to be serviced by the ponds along with the final pond sizes.
b) Figure 5 is to be revised to clearly identify the areas (developed and undeveloped) that will be serviced by the interim ponds.
c) Figure 5 should include dashed-in outlines of the estimated ultimate foot prints of SWM F2 and F3. There must be sufficient land set aside for the expansion of these ponds in the future.

2.3) As the Black River and its tributaries in this area are considered coldwater, we will require that the SWM ponds be designed as deep wet ponds (3 metres) with bottom draws. The shape of the pond should be designed in such a manner to facilitate shading by bank vegetation.

2.4) The quantity control volumes for the SWM ponds are to be checked using the 24 hour SCS storm distributions for the various storm events.

2.5) A disk of the OTTHYMO input / output files is to be provided.

2.6) The hydrologic modelling for the site is to include the modelling completed for Blocks 1 and 2 by Marshall Macklin Monaghan. The modelling needs to demonstrate that there will not be an increase in peak flows at the north limit of the subdivision.

2.7) Information is to be provided justifying the use of 75 as the curve number for the subject property.

2.8) A table should be provide listing the input parameters for each of the catchment areas (pre and post development) and how these were derived.

2.9) Draw down calculations (as per the equations in the 2003 SWMPP Design Manual) are required to demonstrate that 24 hour detention is provided for the run off from a 25 mm event.

2.10) Emergency overflow weirs and supporting calculations are required for the SWM facilities.

2.11) The report should include a section on the operation and maintenance requirements for the SWM pond including standard operation methods, recommended inspection program, expected frequency of forebay clean outs and recommended methodology for removal of sediment, grass cutting and weed control.

February 2, 2004
Mr. Kevin Walters, P.Eng.
York Region Industrial Subdivision
File No.: 19T-94016
IMS No.: PSDC112C4
Town of East Gwillimbury
Page 3 of 4

3.0) Design Drawing Comments

3.1) Emergency overflow weirs are required on the SWM ponds.

3.2) Please verify the sizing of the outlet swale from Street B (1:100 year?) The rip rap in this swale should be underlain with filter fabric.

3.3) The lowest part of the reverse sloped pipes are to be anchored securely.

3.4) Anti seepage collars are to be provided on the outlet pipes from all SWM facilities.

3.5) A detailed landscaping plan is required for each of the SWM ponds. Please note that a topsoil thickness of 300 mm is required through all pond areas and that creeping red fescue should not be included in ground cover seed mixtures specified for the ponds. Native species of trees and shrubs should be used. In addition, shade trees should be planted near the flood fringe around the permanent pool and thicker groupings of these should be concentrated at the south and west ends of the pond.

3.6) Notes on the construction of the pond berms (i.e. acceptable soils with low permeability to be used, inspection by a geo-tech and compaction %) are to be included on the SWM pond drawings.

3.7) The proposed 4.0 metre wide gravel access road around the permanent pools in the SWM ponds would inhibit the pond's ability to naturalize. In addition, it would make it more difficult to shade the water using trees and shrubs on the banks. As such, we will require that the extent of these roads be reduced to a minimum.

3.8) Details are required for the proposed outlet control structures.

3.9) As it is proposed to use the weir structures as flow control devices for the less frequent events, we will require that a concrete weir be installed in the berm to more precisely set the weir shape and elevation. A section should be provided detailing the shape of each weir.

3.10) The clay liner in the SWM pond should be extended to above the permanent pool water level.

3.11) The plan for SWMF2 should show the regional flood line (265.13 masl).

3.12) Erosion and Sediment Control Plan Comments:

The Sediment and Erosion Control Plan must include the following:

a) Topsoil stockpile locations.

b) Stone mud mats at all construction entrances.

c) The SWM ponds should be temporarily fitted with filter fabric / clear stone wrapped Hickenbottom riser outfalls (with anti seepage collars) and rip rap overflow weirs. The riser should be surrounded by stone and this stone wrapped in filter fabric. A final layer of stone should then be placed on the filter fabric. This substantially increases the fabric surface area and thus reduces the potential for clogging. These ponds are to be sized to provide a minimum of 125 m3/ha. 24 hr. extended detention and 125 m3/ha. "permanent" pool storage. Larger ponds may be required depending on soil type and erosion potential.

d) Notes on the installation timing, inspection and maintenance of sediment controls. Sediment controls must be inspected on a regular basis and after every rain fall event. Repairs must be done in a timely manner to prevent movement of sediment into the water.

e) Lines delineating the limit of cut and fill areas

f) Notes requiring the stabilization of all areas which will remain disturbed for more than thirty days.

3.12) The storm drainage plan (STM1) appears to delineate only the drainage areas tributary to the road storm sewers. This should be clearly stated on this plan.

3.13) The drainage areas for the developed portions of Block 4 are labelled but not delineated on plan STM1.

3.14) The legend for plan STM1 has incorrect labels for the drainage catchment areas.

Should you have any questions regarding the above, please do not hesitate to contact the undersigned. Please reference the above file numbers in all future correspondence.

Yours truly,

Tom Hogenbirk, P.Eng.
Manager, Engineering and Technical Services

TH/ph

c Mr. Don Allan, Town of East Gwillimbury, 905-478-2808

S:\TomH\EG York Bales LTR.wpd

Appendix A4: Review Comments Received from the LSRCA Dated April 16, 2004

APR. 16. 2004 3:21PM LSRCA NO. 497

Tel: 905-895-1281
1-800-465-0437
Fax: 905-853-5881
E-Mail: info@lsrca.on.ca
Web: www.lsrca.on.ca

120 Bayview Parkway
Box 282
Newmarket, Ontario
L3Y 4X1

Sent By Facsimile 1-905-763-9983

April 16, 2004

File No.: 19T-94016
IMS No.: PSDC112C7

Mr. David Bradley, P.Eng.
Cumming Cockburn Limited
9133 Leslie Street
Richmond Hill, ON L4B 4N1

Dear Mr. Bradley:

Re: York Region Industrial Subdivision
Technical Design Brief
Dated November 19/03
Engineering Drawings
Dated November 1/03
Part of Lot 2, Concession 4
Town of East Gwillimbury

Further to our previous letter dated February 2, 2004, staff of the Authority visited the site on April 16, 2004. The results of this site visit, which was conducted by our Senior Fisheries Biologist and our Aquatic Ecologist, are summarized as follows:

The noted intermittent "swale" was flowing the day of investigation. Fish were found at a culvert approximately 188 metres downstream of Bales Drive wherein Brook Stickleback (*Culaea inconstans*) were observed and captured. Upstream of Bales Drive the tributary flowed through a small wetland (west of the pipe under Bales Drive) and continued upstream to cross Bales Drive second time (see attached Map).

Regardless of existing development, this "swale" represents the headwaters of a fully functioning cold to coolwater tributary. The waters of this tributary would not require stormwater treatment.

For these reasons, Authority staff can not support the proposed on-line pond as it would constitute a HADD. We would fully support a properly designed off-line facility that would take stormwater flows from both Bales Drive and the eastern swale.

Should you have any questions regarding the above, please do not hesitate to contact the undersigned or Jeff Andersen of our office. Please refer to the above noted file numbers in all future correspondence.

Leaders In

Yours truly,

Watershed

Tom Hogenbirk, P.Eng.
Manager, Engineering and Technical Services

Health

TH/ph

c Mr. Don Allan, Town of East Gwillimbury, 905-478-2808

S:\Tom\H\EG York Bales LTR.wpd


APR. 16. 2004

Appendix A5: CCL Letter to the LSRCA on Revised SWM Plan Dated May 14, 2004

CCL
Cumming Cockburn Limited
Kingston • London • Ottawa • Toronto • Waterloo
www.cclconsultants.com
consulting engineering | planning | environmental approvals

File: 5390-10

May 14, 2004

Lake Simcoe Region Conservation Authority
Engineering and Technical Services
120 Bayview Parkway, Box 282
Newmarket, ON L3Y 4X1

ATTENTION: Mr. Tom Hogenbirk, P. Eng.
Manager, Engineering and Technical Services

Dear Sir:

Re: Revised Drainage Areas for the Stormwater Management Plan
York Region Industrial Subdivision 19T-94016
Northeast of Woodbine Avenue and Davis Drive
Town of East Gwillimbury, Regional Municipality of York

In accordance with our telephone conversation on May 3, 2004, enclosed please find the revised drainage areas for the stormwater management plan of the York Region Industrial Subdivision.

The intent of the revised stormwater management plan is to maximize useable lands, minimize the number of the stormwater management facilities, and maintain the existing drainage pattern to the intermittent swale as much as possible for the existing fish habitat.

Under the revised stormwater management plan, previously proposed facilities SWMF4 and SWMF5 (located at the northwest and northeast corners of the intersection of Garfield Wright Boulevard and the swale respectively) are eliminated, and all the developments within Blocks 3 and 4 and the areas associated with the expansion and urbanization of Garfield Wright Blvd will be accommodated by SWMF2 located at the southeast corner of Block 4.

Since the Authority has classified the intermittent swale as the headwater of a fully functioning cold to coolwater tributary that would not require stormwater treatment regardless the existing development, the current drainage conditions within the existing Bales Industrial Subdivision and the majority of the area to its west will remain and continue draining toward the intermittent swale as the source of water supply for the existing fish habitat. Only the

Consulting Engineers of Ontario
9133 Leslie Street, Suite 200 Richmond Hill, Ontario L4B 4N1 | T: 905-763-2322 | F: 905-763-9983

minimum area associated with the immediate development for the expansion and urbanization of Garfield Wright Boulevard will be drained into SWMF2 for erosion, water quality and water quantity control. Since the extension part of Garfield Wright Boulevard and the small area to its south belong to the new development, the peak flows up to the 1:100 year design storm from this area will be conveyed through the storm sewer system into SWMF2 for water quantity control.

Since only a part of Blocks 3 and 4 is subject to the immediate industrial development in addition to the expansion and urbanization of Garfield Wright Blvd, SWMF2 will be designed to accommodate the interim development, but one stormwater management block will be reserved and designated for the future expansion or retrofit of SWMF2 to accommodate the ultimate development of the subdivision.

Based on the assumptions mentioned above, we are proceeding with the detailed engineering design of SWMF2 and the extension and urbanization of Garfield Wright Blvd and Bales Drive East, and addressing your comments expressed in the letters dated Feb. 2 and April 16 of 2004. Should you have any question or concern with regard to the revised stormwater management plan, please do not hesitate to contact the undersigned.

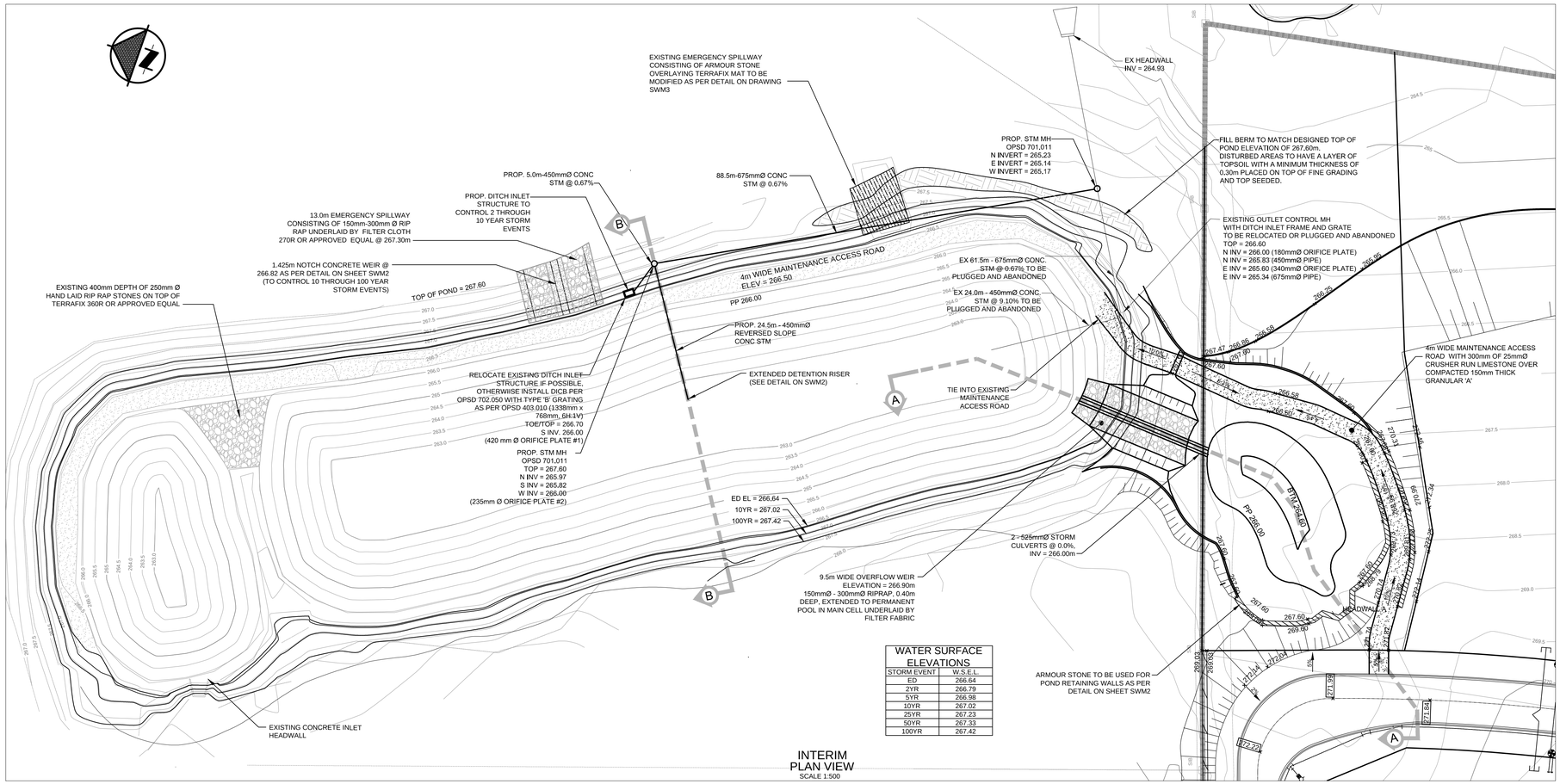
Yours very truly,
CUMMING COCKBURN LIMITED

Nicky Chang

cc: Marvin Finkel, Matrix Management Corp.
Barry Crowe, Regional Municipality of York
Don Allan, Town of East Gwillimbury
Paul Vincent, URS-Cole Sherman
Richard Knight, Marshal Macklin Monaghan Limited

JB/nc

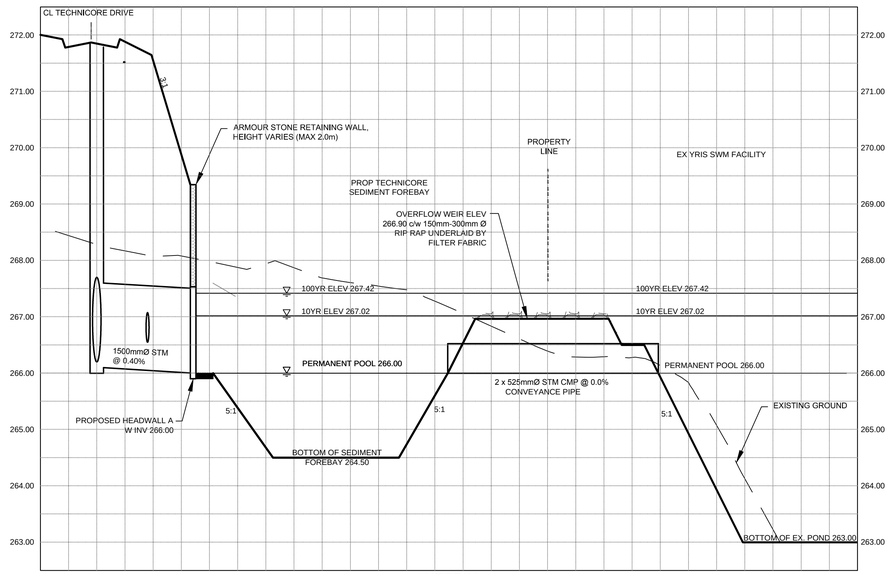
CCL
Cumming Cockburn Limited



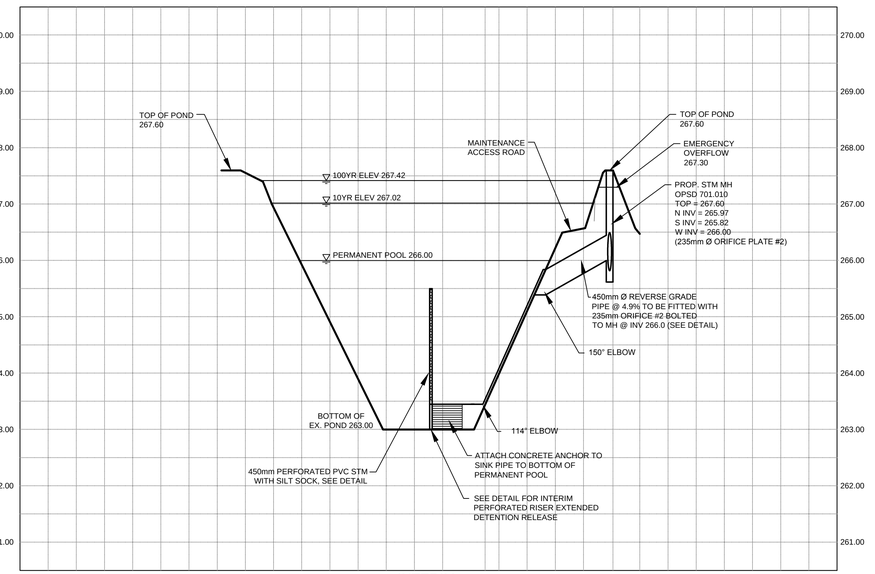
WATER SURFACE ELEVATIONS

STORM EVENT	W.S.E.L.
ED	266.64
2YR	266.79
5YR	266.98
10YR	267.02
25YR	267.23
50YR	267.33
100YR	267.42

INTERIM
PLAN VIEW
SCALE 1:500



INTERIM
SECTION A-A
SCALE H 1:500 V 1:50



INTERIM
SECTION B-B
SCALE H 1:500 V 1:50

LEGEND

WM	EXISTING WATERMAIN
SAN	EXISTING SANITARY SEWER
STM	EXISTING STORM SEWER
CB	EXISTING CATCHBASIN LEAD
GAS	EXISTING GAS MAIN
BELL	EXISTING U/G BELL
HYDRO	EXISTING U/G HYDRO
CATV	EXISTING U/G CABLE TELEVISION
BELL	EXISTING BELL PEDESTAL
	EXISTING HYDRO TRANSFORMER & PAD
GW HP BP P	EXISTING UTILITY POLE WITH GUY WIRE
HYD	EXISTING HYDRANT AND VALVE
VC	EXISTING VALVE CHAMBER
VB	EXISTING VALVE & BOX
GV	EXISTING GAS VALVE
MH	EXISTING MH STORM OR SANITARY
CB	EXISTING CATCHBASIN SINGLE
DCB	EXISTING CATCHBASIN DOUBLE
IB	IRON BAR
SIB	STANDARD IRON BAR
	EXISTING CURB & GUTTER
	EXISTING CULVERT
P&W CL P&B	EXISTING FENCE
	EXISTING DECIDUOUS TREE
	EXISTING CONIFEROUS TREE
	EXISTING VEGETATION TO BE REMOVED
SIGN	EXISTING SIGN
MH1	PROPOSED STORM MAINTENANCE HOLES
CBMH1	PROPOSED CATCHBASIN MAINTENANCE HOLES
MH1	PROPOSED SANITARY MAINTENANCE HOLES
25m - 250mm Ø	PROPOSED SEWER
	POSSIBLE PIPE DISCHARGE TO EXISTING DITCH
200 DIA. PVC W/M	PROPOSED WATERMAIN
BCB	PROPOSED BOULEVARD CATCHBASIN
CB	PROPOSED CATCHBASIN
DCB	PROPOSED DOUBLE CATCHBASIN
	PROPOSED HYDRANT & SECONDARY VALVE
VC	PROPOSED VALVE & CHAMBER
	PROPOSED CURB & GUTTER & DEPRESSION
1.5m CONC. S/W	PROPOSED SIDEWALK
	RESTORE DRIVEWAY WITH GRAVEL
	RESTORE DRIVEWAY WITH ASPHALT
	RESTORE DRIVEWAY WITH CONCRETE
	RESTORE DRIVEWAY WITH PAVING STONE
	DIRECTION OF DRIVEWAY APRON DRAINAGE
232.55 x	PROPOSED ELEVATION
232.43 x	EXISTING ELEVAITON
	EXISTING STRUCTURE TO BE REMOVED
W W EX. SAN. E E	EXISTING SAN LATERAL CONNECTIONS
	CONNECTIONS TO EXISTING WATER SERVICE AT PROP. AND EX. WATERMAINS

No.	Revision	Date	By	Appr'd
4				
3				
2				
1	1ST ENGINEERING SUBMISSION	JULY 24/13	FJB	

Benchmarks

No.	Elevation	Description
1.	283.981m	ELEVATIONS SHOWN HEREON ARE GEODETIC AND ARE DERIVED FROM MINISTRY OF TRANSPORTATION BENCHMARK No. 008196R473. LOCATED ON THE WEST SIDE OF WOODINE AVENUE ON A 2-STOREY FRAME HOUSE WITH ALUMINUM SIDING. 1.1 KM SOUTH OF THE JUNCTION OF DAVIS DRIVE AND WOODBINE AVENUE.

CONSULTANT

LICENSED PROFESSIONAL ENGINEER 07/24/2013 K.W. HARRINGTON 90480739 PROVINCE OF ONTARIO

REVIEWED
TOWN OF E.G. ENGINEERING DEPT

SIGNATURE DATE

Town of East Gwillimbury

BURNSIDE

R.J. Burnside & Associates Limited
6990 Creditview Road, Unit 2
Mississauga, Ontario, L5N 8R9
telephone (905) 821-1800
fax (905) 821-1809
web www.rjburnside.com

TECHNICORE INDUSTRIAL SUBDIVISION

STORMWATER MANAGEMENT FACILITY

Surveyed by:		Checked by: FB	Project No. PID018673
Drawn by:	RA	Approved by: FB	
Designed by:	DT	Date: NOV. 28, 2012	Drawing No. SWM1
Scale 1: 400	0m 1m 2m		Sheet No. 8 OF 12

File Name: G:\RJ\...\SWM.dwg
Date Plotted: Jul 23, 2013 - 4:53pm

APPENDIX B

Sanitary Demand Calculations

Percolation Test Report

Septic System Design Information

counterpoint ENGINEERING

A SUBSIDIARY OF DILLON CONSULTING LIMITED

Sanitary Design Calculations

Project:	**350 Garfield Wright Boulevard**
Project No:	24015
Client:	York Regional Police
Location:	East Gwillmbury, Ontario
Site Area:	0.67 ha (development area only)
Date:	29-Aug-24

Daily Sanitary Design Flow

Ontario Building Code Non-Residential Design Flow Rates					
Occupancy		Unit	Daily Volume, Litres per unit *	Site Units	Daily Design Volume (Litres)
Office Building					
	Per each 9.3 m^2 of floor space	9.3 sq.m	75	450	3,629
Per 2012 OBC Code, Table 8.2.1.3.B					
			Average Flow =	0.04 L/s	
			=	2.52 L/min	

System Diagram – Baskets in Concrete Tank

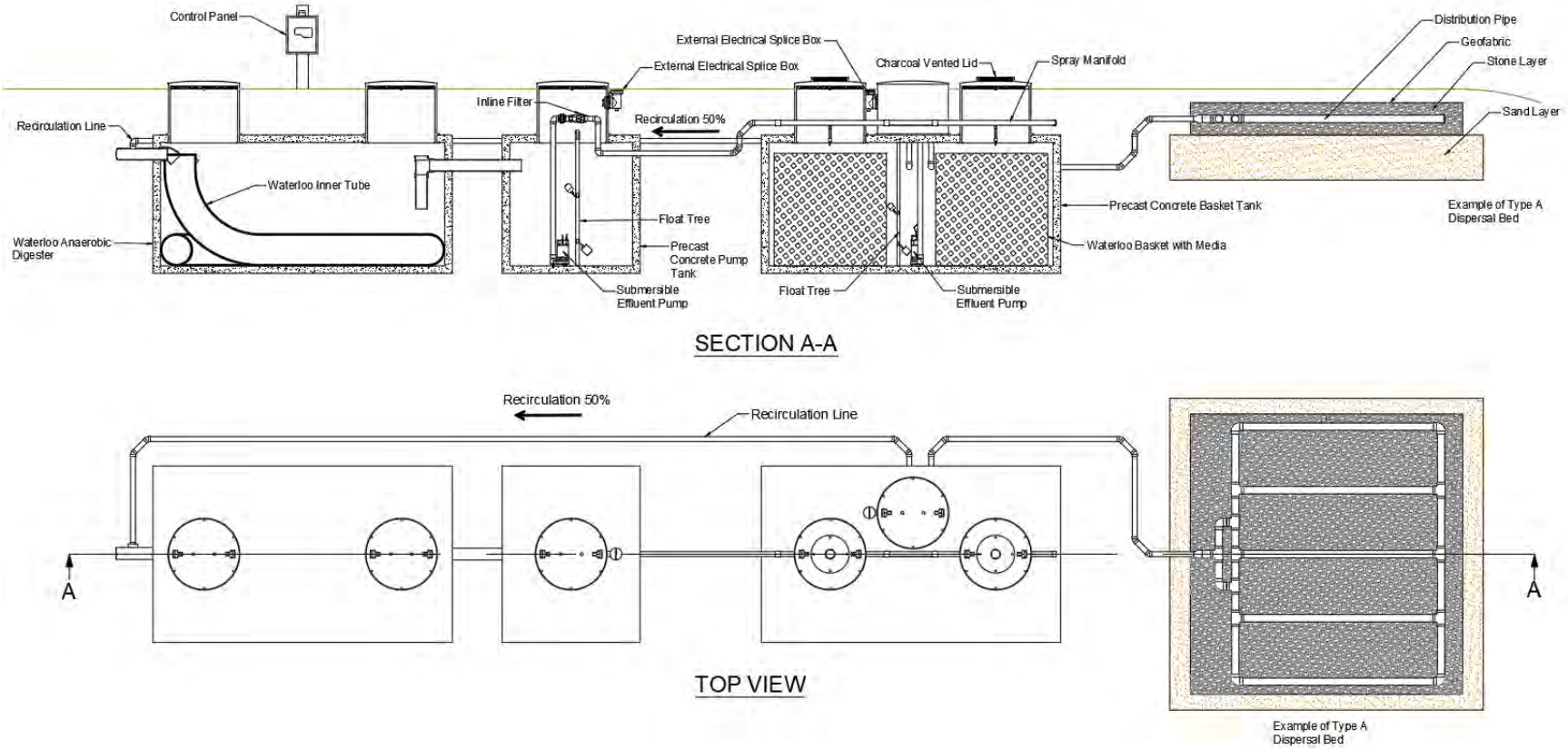


Figure 51. Anaerobic digester, pump tank, and baskets in concrete tank system diagram

System Diagram – Baskets in Concrete Tank

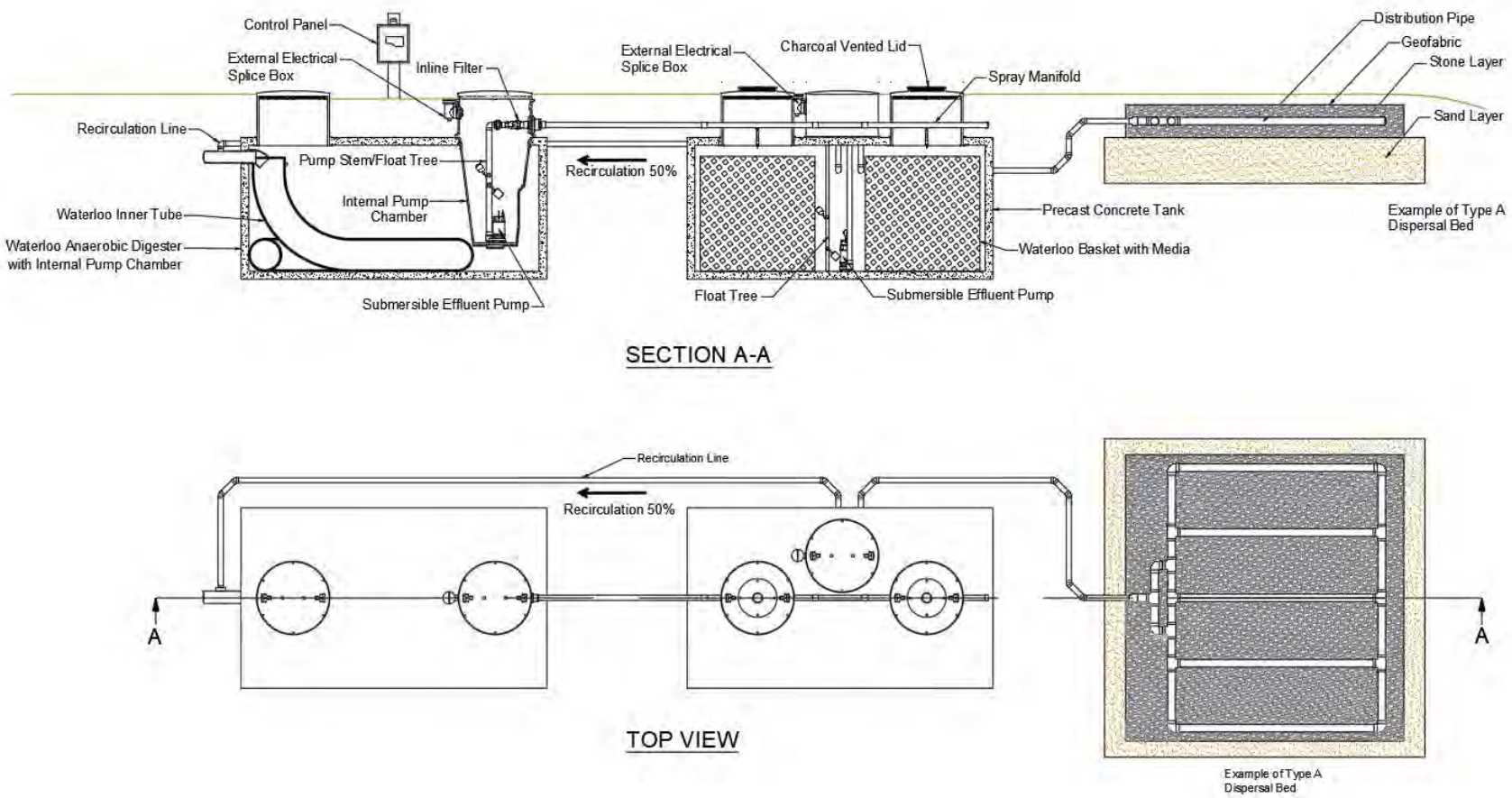
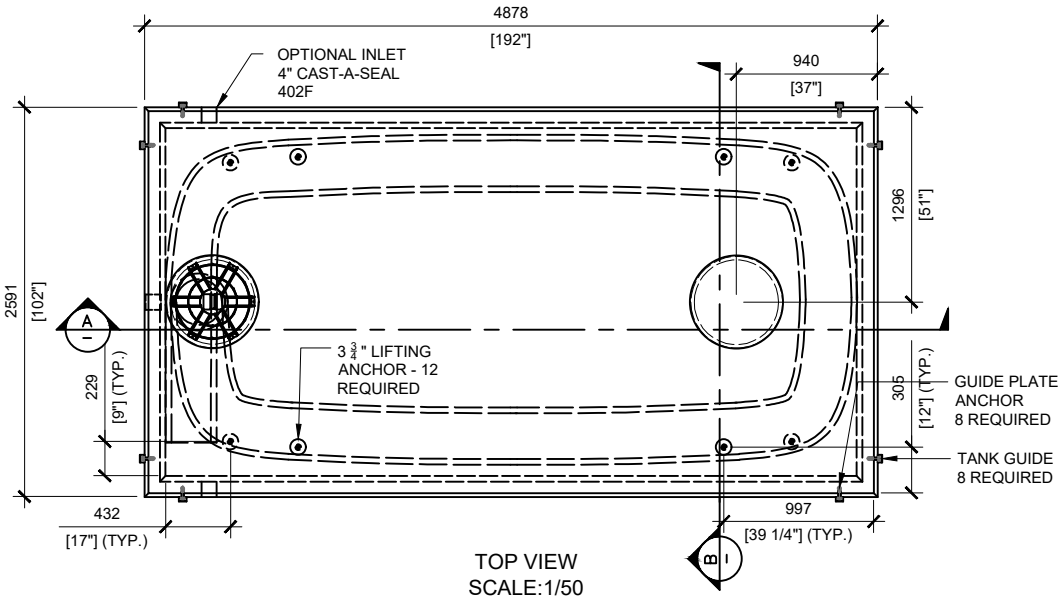


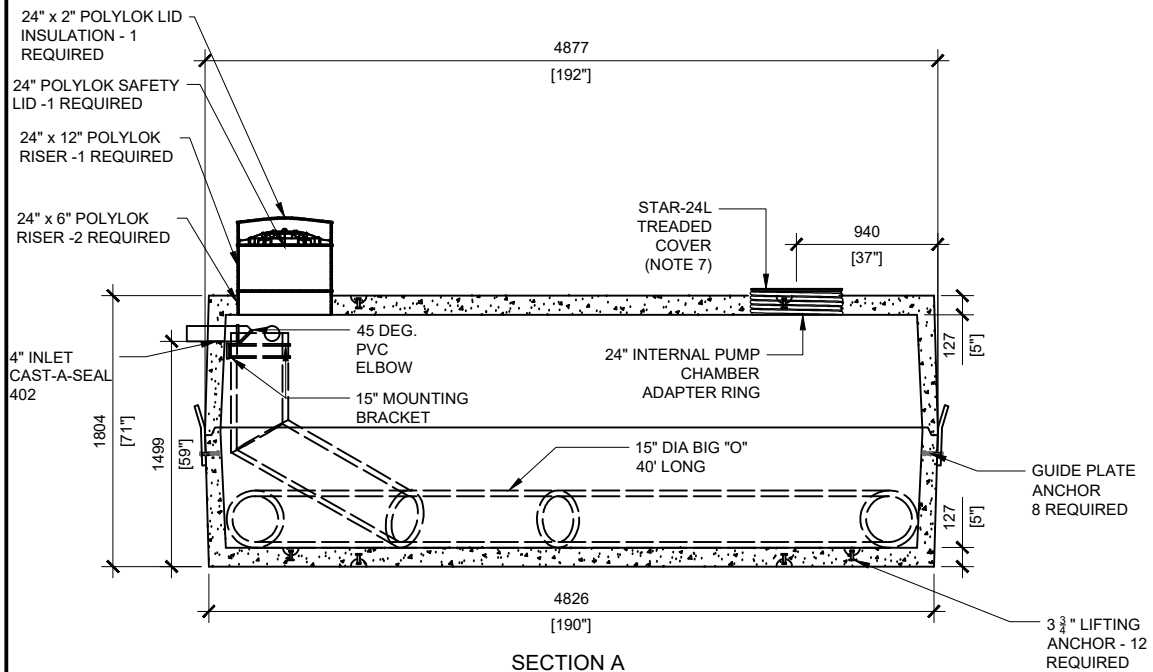
Figure 50. Anaerobic digester with internal pump chamber and baskets in concrete tank system diagram



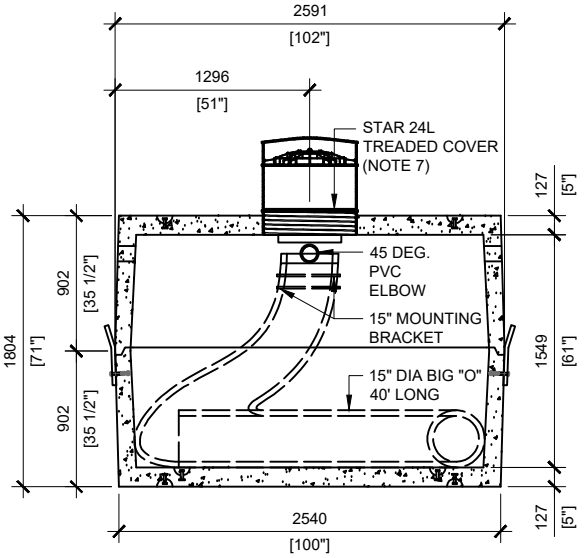
TOP VIEW
SCALE:1/50

GENERAL NOTES:

1. UNITS ARE SEALED WITH BUTYL TAPE AT THE JOINTS
2. DELIVERY IS MADE BY CRANE-EQUIPPED TRUCKS
3. EXCAVATION MUST BE READY, SAFE AND ACCESSIBLE FOR UNLOADING FROM THE REAR OF THE TRUCK.
4. MIN OVERHEAD CLEARANCE OF 18FT (5.5 METRES) IS REQUIRED
5. ALL UNITS MUST BE HANDLED WITH PROPER LIFTING EQUIPMENT (I.E. SPREADER BAR)
6. MAXIMUM BURIAL DEPTH = 1 METRE IN FIRM SOIL AWAY FROM ANY VEHICULAR TRAFFIC
7. THREADED COVER TO BE REMOVED AND REPLACED BY INTERNAL PUMP CHAMBER (PROVIDED BY WATERLOO) ON SITE



SECTION A
SCALE:1/50



SECTION B
SCALE:1/50

BROOKLIN CONCRETE PRODUCTS

MANUFACTURED:
LINDSAY, ON
1-800-655-3430

CONCRETE TYPE: SCC
CONCRETE: 45MPa at 28 days / 6,500PSI
AIR ENTRAINMENT: 5-8%
REINFORCEMENT: STEEL TO CSA CAN A23.1 /A23.3 G30.18 Fy=400MPa

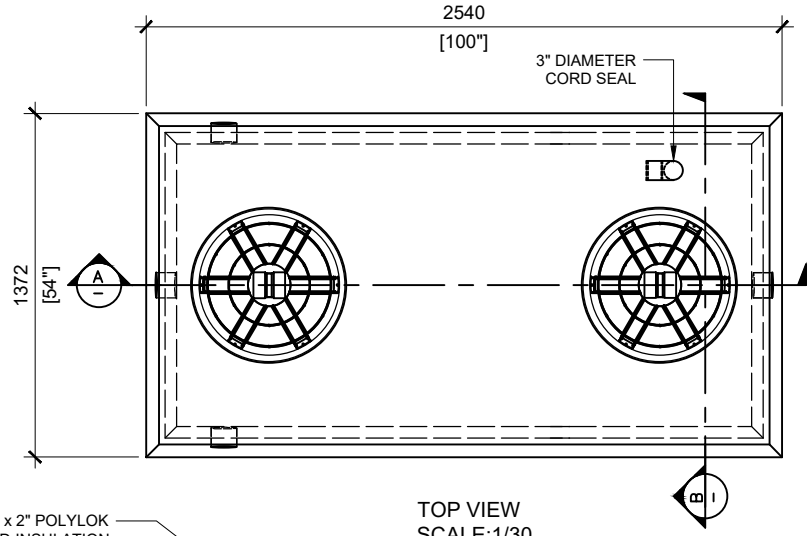
WEIGHT:
BOTTOM - 17,712lbs / 8,050kg
TOP - 17,571lbs / 7,989kg

DRAWN BY: PRASHAN

WATERLOO ADIPC-14000

DATE: DEC/2023

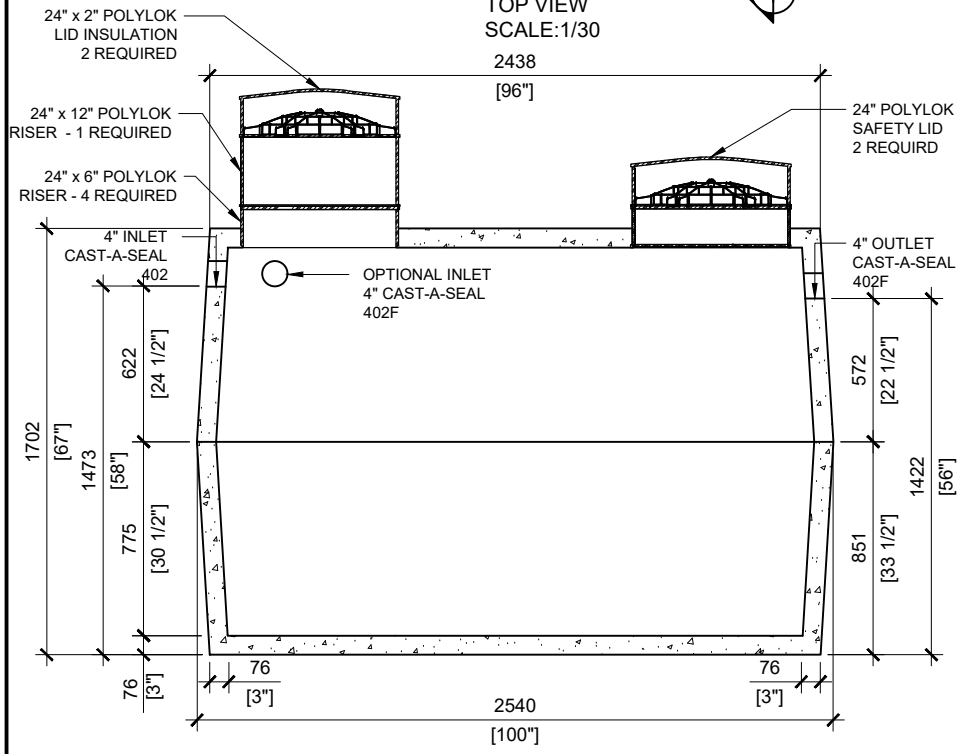
14,000 LITRES



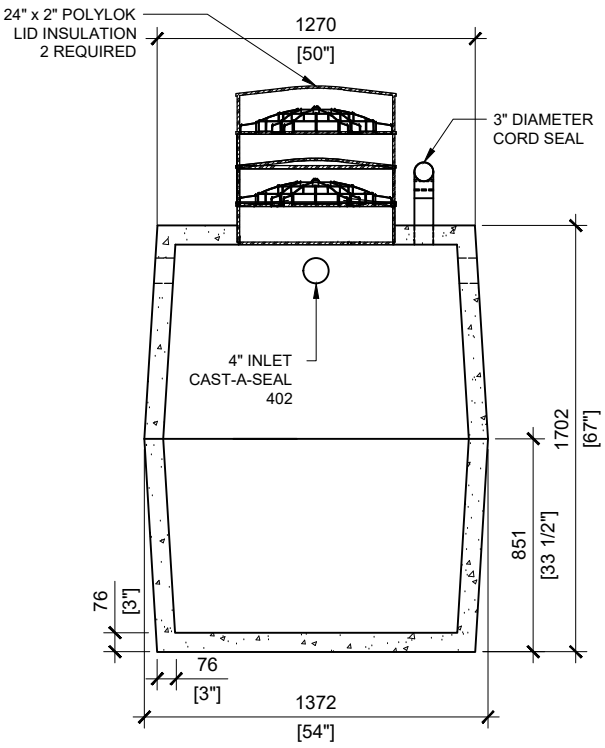
TOP VIEW
SCALE:1/30

GENERAL NOTES:

1. UNITS ARE SEALED WITH "NON-TOXIC" BUTYL TAPE AT THE JOINTS
2. DELIVERY IS MADE BY CRANE-EQUIPPED TRUCKS
3. EXCAVATION MUST BE READY, SAFE AND ACCESSIBLE FOR UNLOADING FROM THE REAR OF THE TRUCK.
4. MIN OVERHEAD CLEARANCE OF 18FT (5.5 METRES) IS REQUIRED
5. ALL UNITS MUST BE HANDLED WITH PROPER LIFTING EQUIPMENT
6. MAXIMUM BURIAL DEPTH = 1 METRE IN FIRM SOIL AWAY FROM ANY VEHICULAR TRAFFIC
7. POLYLOK SAFETY LIDS INSTALLED IN BOTH OPENINGS AS PER CSA-B66-21
8. 24"X12" POLYLOK RISER WITH ELECTRICAL SPLICE BOX SUPPLIED BY WATERLOO AT THE OUTLET



SECTION A
SCALE:1/30



SECTION B
SCALE:1/30

MANUFACTURED:
LINDSAY, ON
1-800-655-3430

CONCRETE: 35MPa at 28 days / 5000PSI
AIR ENTRAINMENT: 5-8%
REINFORCEMENT: STEEL TO CSA CAN A23.1 /A23.3 G30.18 Fy=400MPa
UNIT WEIGHT: 6,520lbs / 2,963kg

DRAWN BY: PRASHAN
DATE: FEB/2024

WATERLOO PT-3600

3,600 LITRES

GEI Consultants

July 31, 2024

Azimuth Environmental Consulting Inc.
642 Welham Road
Barrie, Ontario
L4N 9A1

Attn: Brendan MacNaughton

RE: Job No. 24-054
Determination of Estimated T-Time

GEI Consultants Ltd. (GEI) was provided with three (3) soil samples on July 23, 2024 to complete grain size analyses to determine the percolation rate of the tested soils (T-Time analysis).

The delivered samples were identified as shown below.

- TP-24-1-2, YRP Hanger
- TP-24-6-4, YRP Hanger
- TP-24-3-2, YRP Hanger

Three grain size distribution curves were developed by testing the above referenced soil samples in accordance with ASTM D6913 Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis and ASTM D7928 (sedimentation / hydrometer analysis). The result of the laboratory test and graphical representation of the grain size analyses are enclosed.

Determination of percolation rate is based on the "*Ministry of Municipal Affairs and Housing (MMAH) Supplementary Guidelines SB-6, Percolation Time and Soil Descriptions, September 14, 2012*". Based on this document, a summary of the result and the estimated percolation rates of the soil are as follows:

Client Reference	Soil Description (MIT)	USCS Soil Classification	Coefficient of Permeability (K- cm/sec)	Estimated Percolation Rate or "*T-Time*" (mins/cm)
TP-24-1-2	SILT, Some Clay, Trace Sand	M.L.	$<10^{-6}$	>50 mins/cm
TP-24-6-4	SILT, Some Sand, Some Clay, Trace Gravel	M.L.	10^{-6}	50 mins/cm
TP-24-3-2	SANDY SILT, Some Clay, Trace Gravel	M.L.	10^{-6}	50 mins/cm

*Reference MMAH Supplementary Standard SB-6, Table 2

It is noted that percolation time not only varies based on the grain size distribution but is also influenced by other soil characteristics such as the density of the soil, the structure of the soil, the percentage/mineralogy of clay, the plasticity of the soil, the organic content of the soil, and the groundwater table level which are not expressly calculated as part of a grain size analysis.

No field investigation was conducted by GEI in conjunction with the above testing and did not witness the depth or location in which these samples were obtained. GEI is providing the percolation rates as factual information, to be used in design by a qualified professional with due regard to the limitations as indicated above.

We trust this information is sufficient for your present purposes. Should you have any questions concerning the above, or if we can be of any further assistance, please do not hesitate to contact the undersigned.

Yours truly,
GEI Consultants Ltd.

Donna Davidson-Gorry
Laboratory Supervisor
(705) 718-6604
ddavidsongorry@geiconsultants.com

Andrew Jones
Materials Testing and Inspection Practice Lead
(705) 220-0060
ajones@geiconsultants.com

Enclosures (3)

Grain Size Analysis (T-Time)

ENCLOSURE 1

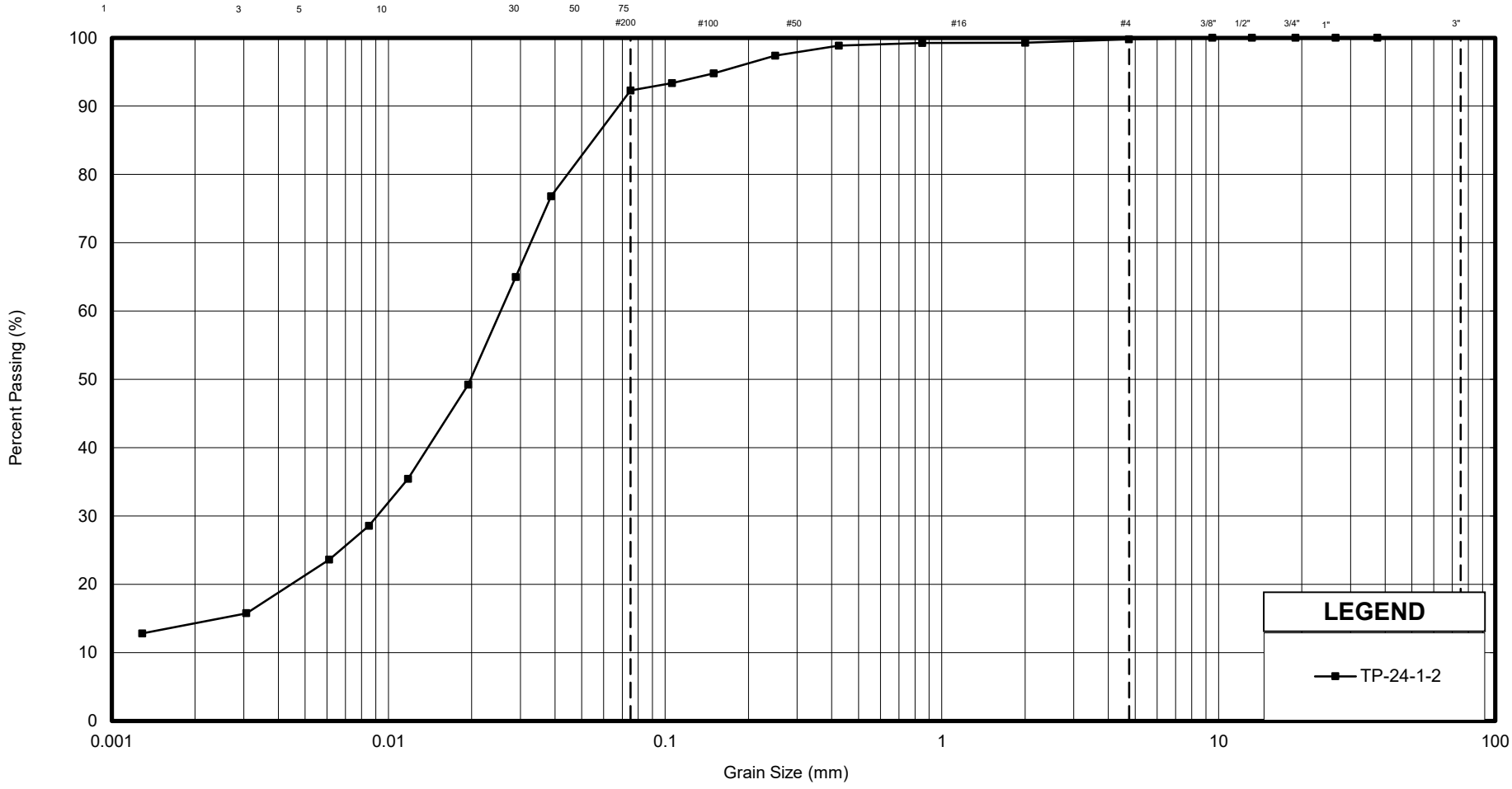
Grain Size Analysis (T-Time)

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY AND SILT	SAND			GRAVEL	
	Fine	Medium	Coarse	Fine	Coarse

GRAIN SIZE IN MICROMETERS

SIEVE DESIGNATION (IMPERIAL)



GEI Lab No.	Description	Gr.	Sa.	Si.	Cl.	D_{10}	D_{30}	D_{60}	C_u	C_c
7836	SILT, Some Clay, Trace Sand	-	7	78	15	-	0.009	0.025	-	-

GEI Consultants

Azimuth Environmental - Job No. 24-054, YRP Hanger

SILT

FIGURE No.

REF. No. 2005133

DATE July 2024

ENCLOSURE 2

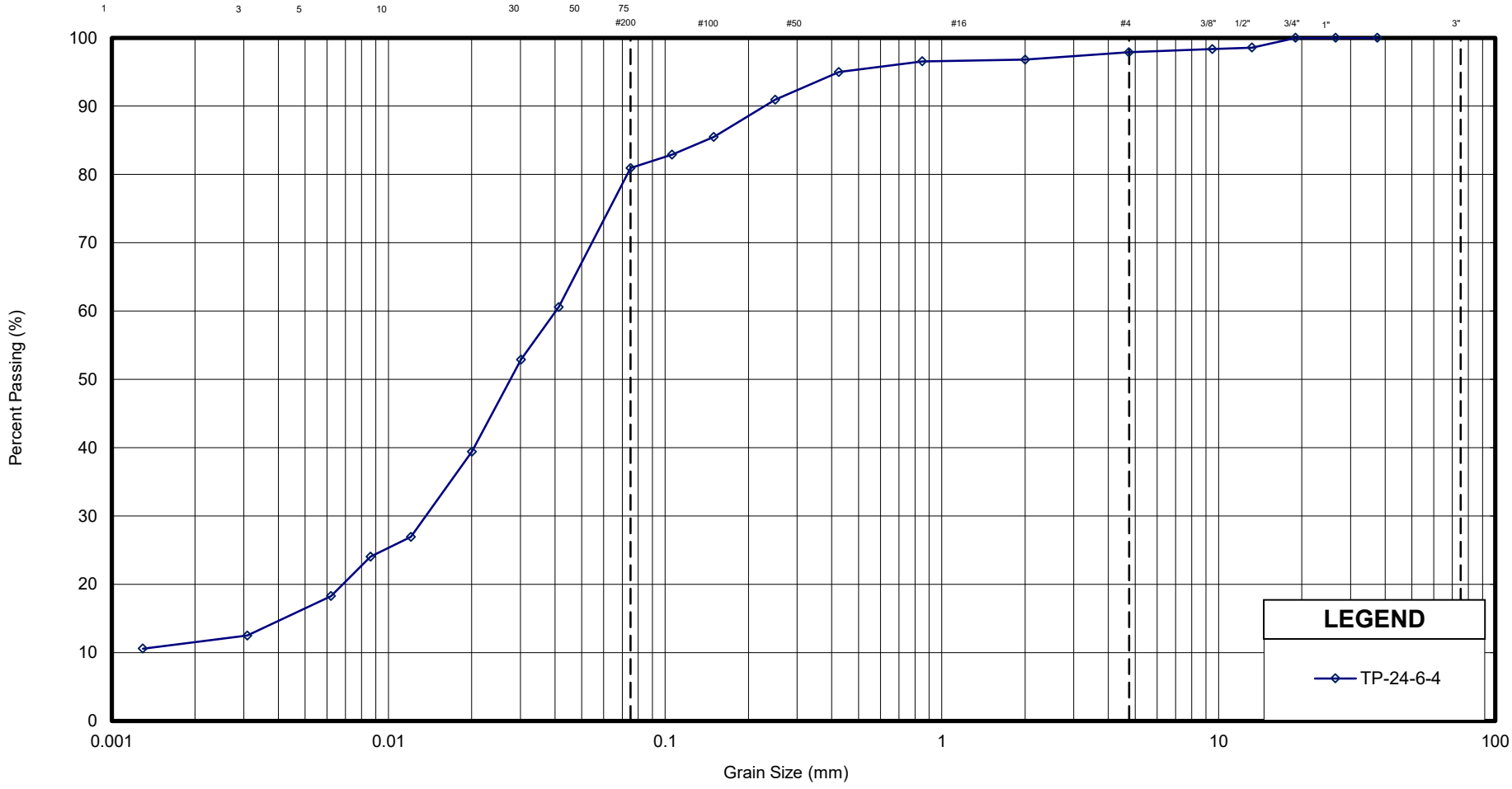
Grain Size Analysis (T-Time)

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY AND SILT	SAND			GRAVEL	
	Fine	Medium	Coarse	Fine	Coarse

GRAIN SIZE IN MICROMETERS

SIEVE DESIGNATION (IMPERIAL)



GEI Lab No.	Description	Gr.	Sa.	Si.	Cl.	D_{10}	D_{30}	D_{60}	C_u	C_c
7837	SILT, Some Sand, Some Clay, Trace Gravel	2	17	69	12	-	0.014	0.040	-	-

GEI Consultants

GRAIN SIZE DISTRIBUTION - Azimuth Environmental - YRP Hanger

SILT

FIGURE No.

REF. No. 2005133

DATE July 2024

ENCLOSURE 3

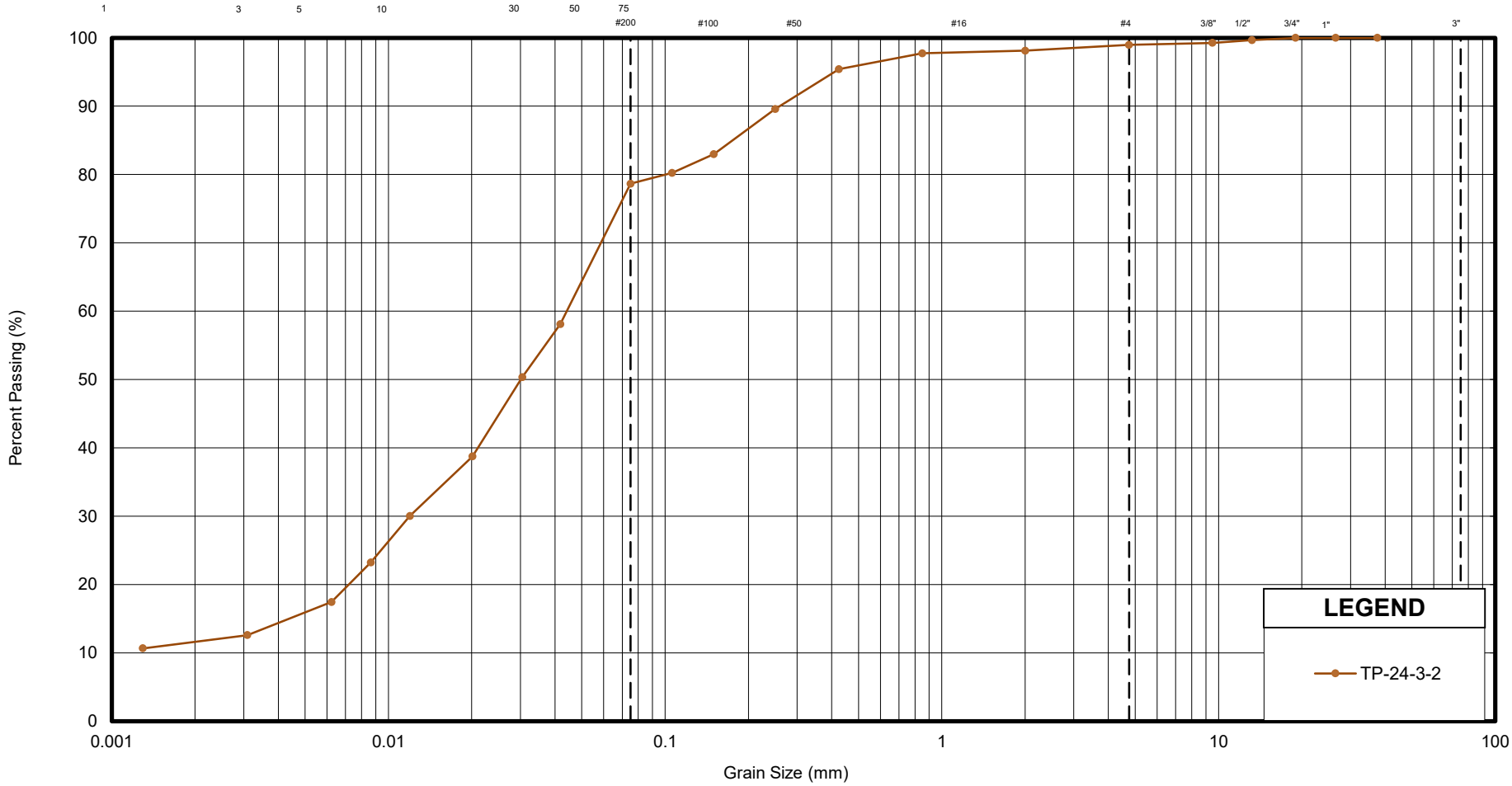
Grain Size Analysis (T-Time)

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY AND SILT	SAND			GRAVEL	
	Fine	Medium	Coarse	Fine	Coarse

GRAIN SIZE IN MICROMETERS

SIEVE DESIGNATION (IMPERIAL)



GEI Lab No.	Description	Gr.	Sa.	Si.	Cl.	D_{10}	D_{30}	D_{60}	C_u	C_c
7838	SANDY SILT, Some Clay, Trace Gravel	1	20	67	12	-	0.012	0.044	-	-

GEI Consultants

GRAIN SIZE DISTRIBUTION - Azimuth Environmental - YRP Hanger

SANDY SILT

FIGURE No.

REF. No. 2005133

DATE July 2024

AZIMUTH ENVIRONMENTAL CONSULTING, INC.

Environmental Assessments & Approvals

TEST PIT LOG

Project Name/ Project Client	YRP Hanger/ York Regional Police	**Project Address**	90 Bales Drive East, Sharon, ON	**Date**	July 23, 2024
Test Pit Number	TP24-1	**Contractor**	Provided by Proponent	**Elevation**	NA
Operator / Equipment	Brock Excavation / Track Mounted Excavator	**Test Pit Size**	1m x 3m	**Datum**	Ground Surface
Temperature	25°C	**Weather**	Sunny	**Sample Type**	Soil

Depth		**Soil description**	**Samples**		**pH**	**Remarks / Chemical Analysis**
From (m)	**To (m)**		**No.**	**Depth (mbgs)**		
0.00	0.30	Brown, dry, loose sandy topsoil with organics and rootlets.	1	-	-	-
0.30	2.10	*Fill:* Light brown, dry, compact silt w/ some fine sand and clay. Some mottling after 50 cm. Becoming moist at 70 cm.	2	-	-	Sample submitted for grain size and T-time assessment.
		Test Pit Terminated at 2.1 mbgs				

Comments	***Water Conditions in Test Pit***	
Standpipe not installed in test pit prior to backfilling.	☐ Wet upon completion ☑ Dry upon completion	

JOB No.	24-054
TEST PIT No.	TP24-1
FIELD STAFF	B.Pettersone

AZIMUTH ENVIRONMENTAL CONSULTING, INC.

Environmental Assessments & Approvals

TEST PIT LOG

Project Name/ Project Client	YRP Hanger/ York Regional Police	**Project Address**	90 Bales Drive East, Sharon, ON	**Date**	July 23, 2024
Test Pit Number	TP24-2	**Contractor**	Provided by Proponent	**Elevation**	NA
Operator / Equipment	Brock Excavation / Track Mounted Excavator	**Test Pit Size**	1m x 3m	**Datum**	Ground Surface
Temperature	25°C	**Weather**	Sunny	**Sample Type**	Soil

Depth		**Soil description**	**Samples**		**pH**	**Remarks / Chemical Analysis**
From (m)	**To (m)**		**No.**	**Depth (mbgs)**		
0.00	0.20	Brown, dry, loose sandy topsoil with organics and rootlets.	1	-	-	-
0.20	2.10	*Fill:* Light brown, dry, compact silt w/ some fine sand and clay. Some mottling after 50 cm. Becoming moist at 70 cm.	2	-	-	-
		Test Pit Terminated at 2.1 mbgs				

Comments	***Water Conditions in Test Pit***	
Standpipe not installed in test pit prior to backfilling.	☐ Wet upon completion ☑ Dry upon completion	

JOB No.	24-054
TEST PIT No.	TP24-2
FIELD STAFF	B.Pettersone

AZIMUTH ENVIRONMENTAL CONSULTING, INC.

Environmental Assessments & Approvals

TEST PIT LOG

Project Name/ Project Client	YRP Hanger/ York Regional Police	**Project Address**	90 Bales Drive East, Sharon, ON	**Date**	July 23, 2024
Test Pit Number	TP24-3	**Contractor**	Provided by Proponent	**Elevation**	NA
Operator / Equipment	Brock Excavation / Track Mounted Excavator	**Test Pit Size**	1m x 3m	**Datum**	Ground Surface
Temperature	25°C	**Weather**	Sunny	**Sample Type**	Soil

Depth		**Soil description**	**Samples**		**pH**	**Remarks / Chemical Analysis**
From (m)	**To (m)**		**No.**	**Depth (mbgs)**		
0.00	0.20	Brown, dry, loose sandy topsoil with organics and rootlets.	1	-	-	-
0.20	0.40	*Fill:* Light brown, dry, compact silt w/ fine sand and some stone and clay.	2	-	-	Sample submitted for grain size and T-time assessment.
0.40	0.50	*Buried Organics* : Dark brown to black, lots of organic material and woody debris.	3	-	-	-
0.50	1.95	*Fill:* Light brown, dry, compact to dense silt w/ some fine sand and clay. Some mottling after 50 cm. Becoming moist at 1.1 cm.	4	-	-	-
		Test Pit Terminated at 1.95 mbgs				

Comments	***Water Conditions in Test Pit***	
Standpipe not installed in test pit prior to backfilling.	☐ Wet upon completion ☑ Dry upon completion	

JOB No.	24-054
TEST PIT No.	TP24-3
FIELD STAFF	B.Pettersone

AZIMUTH ENVIRONMENTAL CONSULTING, INC.

Environmental Assessments & Approvals

TEST PIT LOG

Project Name/ Project Client	YRP Hanger/ York Regional Police	**Project Address**	90 Bales Drive East, Sharon, ON	**Date**	July 23, 2024
Test Pit Number	TP24-4	**Contractor**	Provided by Proponent	**Elevation**	NA
Operator / Equipment	Brock Excavation / Track Mounted Excavator	**Test Pit Size**	1m x 3m	**Datum**	Ground Surface
Temperature	25°C	**Weather**	Sunny	**Sample Type**	Soil

Depth		**Soil description**	**Samples**		**pH**	**Remarks / Chemical Analysis**
From (m)	**To (m)**		**No.**	**Depth (mbgs)**		
0.00	0.20	Brown, dry, loose sandy topsoil with organics and rootlets.	1	-	-	-
0.20	0.80	*Fill:* Light brown, dry, compact silt w/ fine sand and some stone and clay.	2	-	-	-
0.80	1.40	*Fill:* Dark grey, moist silty clay w/ some organics and trace sand. Refuse present (i.e., wood debris, concrete, wire, plastic, etc.).	3	-	-	-
1.40	2.30	*Fill:* Light brown, dry, compact silt w/ some fine sand and clay; trace organics. Refuse present (i.e., wood, concrete, plastic, etc.). Pocket of medium-coarse sand at 45 cm.	4	-	-	-
		Test Pit Terminated at 2.1 mbgs				

Comments	***Water Conditions in Test Pit***	
Standpipe not installed in test pit prior to backfilling.	☐ Wet upon completion ☑ Dry upon completion	

JOB No.	24-054
TEST PIT No.	TP24-4
FIELD STAFF	B.Pettersone

AZIMUTH ENVIRONMENTAL CONSULTING, INC.

Environmental Assessments & Approvals

TEST PIT LOG

Project Name/ Project Client	YRP Hanger/ York Regional Police	**Project Address**	90 Bales Drive East, Sharon, ON	**Date**	July 23, 2024
Test Pit Number	TP24-5	**Contractor**	Provided by Proponent	**Elevation**	NA
Operator / Equipment	Brock Excavation / Track Mounted Excavator	**Test Pit Size**	1m x 3m	**Datum**	Ground Surface
Temperature	25°C	**Weather**	Sunny	**Sample Type**	Soil

Depth		**Soil description**	**Samples**		**pH**	**Remarks / Chemical Analysis**
From (m)	**To (m)**		**No.**	**Depth (mbgs)**		
0.00	0.30	Brown, dry, loose sandy topsoil with organics and rootlets.	1	-	-	-
0.30	2.10	*Fill:* Light brown, dry, compact silt w/ some fine sand and clay; trace organics. Refuse present (i.e., wood, concrete, plastic, etc.). Pocket of medium-coarse sand at 45 cm.	2	-	-	-
		Test Pit Terminated at 2.1 mbgs				

Comments	***Water Conditions in Test Pit***
Standpipe not installed in test pit prior to backfilling.	☐ Wet upon completion ☑ Dry upon completion

JOB No.	24-054
TEST PIT No.	TP24-5
FIELD STAFF	B.Pettersone

AZIMUTH ENVIRONMENTAL CONSULTING, INC.

Environmental Assessments & Approvals

TEST PIT LOG

Project Name/ Project Client	YRP Hanger/ York Regional Police	**Project Address**	90 Bales Drive East, Sharon, ON	**Date**	July 23, 2024
Test Pit Number	TP24-6	**Contractor**	Provided by Proponent	**Elevation**	NA
Operator / Equipment	Brock Excavation / Track Mounted Excavator	**Test Pit Size**	1m x 3m	**Datum**	Ground Surface
Temperature	25°C	**Weather**	Sunny	**Sample Type**	Soil

Depth		**Soil description**	**Samples**		**pH**	**Remarks / Chemical Analysis**
From (m)	**To (m)**		**No.**	**Depth (mbgs)**		
0.00	0.20	Brown, dry, loose sandy topsoil with organics and rootlets.	1	-	-	-
0.20	0.96	*Fill:* Light brown, dry, compact silt w/ fine sand and some stone and clay.	2	-	-	-
0.96	1.60	*Fill:* Dark grey, moist silty clay w/ some organics and trace sand. Refuse present (i.e., wood debris, concrete, wire, plastic, etc.).	3	-	-	-
1.60	2.40	*Fill:* Light brown, dry, compact silt w/ some fine sand and clay; trace organics. Refuse present (i.e., wood, concrete, plastic, etc.). Pocket of medium-coarse sand at 45 cm.	4	-	-	Sample submitted for grain size and T-time assessment.
		Test Pit Terminated at 2.1 mbgs				

Comments	***Water Conditions in Test Pit***	
Standpipe not installed in test pit prior to backfilling.	☐ Wet upon completion ☑ Dry upon completion	

JOB No.	24-054
TEST PIT No.	TP24-6
FIELD STAFF	B.Pettersone

YRP Hanger - Servicing Assessment

Test Pit Location Plan

Part 1 General

1.1 SECTION INCLUDES

.1 Adjustments of existing manholes, catch basins and water valves.

1.2 RELATED SECTIONS

.1 Section 33 05 16 – Maintenance Holes and Catch Basin Structures.

.2 Section 32 12 16 – Asphalt Paving

1.3 REFERENCES

.1 [ASTM C139-11 - Standard Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes.]

.2 [CAN/CSA-A165 Series-04 (R2009) - Standards on Concrete Masonry Units.]

.3 [CAN/CSA-A179-04 (R2009) - Mortar and Grout for Unit Masonry.]

.4 [CSA-A257 Series-09 - Standards for Concrete Pipe and Manhole Sections.]

.5 CAN/CSA-A3000-08 - Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

.6 OPSS 407 - Maintenance Hole, Catch Basin, Ditch Inlet and Valve Chamber Installation

.7 OPSS 408 Adjusting or Rebuilding Maintenance Holes, Catch Basins, Ditch Inlets, and Valve Chambers

.8 OPSS 1351 - Precast Reinforced Concrete Components for Maintenance Holes, Catch Basins, Ditch Inlets and Valve Chambers

.9 OPSS 1351 - Precast Reinforced Concrete Components for Maintenance Holes, Catch Basins, Ditch Inlets and Valve Chambers

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Project management and coordination procedures.

.2 Schedule work to minimize interruptions to existing services during construction.

1.5 SUBMITTALS FOR INFORMATION

.1 Section 01 33 00: Submission procedures.

.2 Sustainable Design:

.1 Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

.3 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with a minimum of three (3) years of documented experience.

.4 Installer Qualifications: Company specializing in performing the work of this section with a minimum of three (3) years of documented experience and approved by the manufacturer.

1.6 REGULATORY REQUIREMENTS

.1 Conform to applicable Ontario Provincial Standards and Specifications (OPSS) and Ontario Provincial Standard Drawings (OPSD).

Part 2 Products

2.1 MANUFACTURERS

.1 Acceptable manufacturers offering functionally and aesthetically equivalent products.

2.2 MATERIALS

.1 Precast Manhole Section:

.1 OPSD 701.01, circular profile.

.2 Top sections eccentric cone or flat slab top type with opening offset based on the requirements of each specific manhole shown on the provided plans.

.2 Reinforced Precast Catch Basin Sections: to OPSD 705, with slotted cast iron cover to OPSD 400.10.

.3 Mortar:

.1 Aggregate: CAN/CSA-A179.

.2 Cement: CAN/CSA-A3000

.4 Manhole Ladder Rungs: Preformed galvanized steel or aluminum rungs.

.5 Adjusting Rings: CSA-A257, configured to suit and fit the top ring and lid.

.6 Concrete Brick: CAN/CSA-A165 Series, of dimensions to suit coursing and concrete rings.

Part 3 Execution

3.1 EXAMINATION

.1 Verify existing conditions before starting work.

.2 Verify existing manholes, catch basins, and water valves are ready to receive work in this section.

3.2 MANHOLES AND CATCH BASINS

.1 Remove the existing frame and cover. Identify and store for re-use at locations designated.

.2 Adjust the manhole barrel to the required elevation by removing or installing precast concrete ring sections.

.3 Set manhole frame and cover to required elevation using no more than three (3) concrete rings and one (1) course of brick – each set in a full bed of mortar.

.4 Recess the catch basin frame and cover 10 mm below the gutter elevation and 10 mm behind the face of the curb.

.5 Join the brick course to the frame with cement mortar, and parge and make it smooth and watertight using a bituminous gasket.

.6 Install additional ladder rungs in manholes as specified in the OPSD drawings and OPSS 408.

3.3 WATER VALVES

.1 Excavate and expose the adjustable portion of the water valve casing.

.2 Adjust the water valve casing to the required elevation.

.3 Recess the top of the water valve 5 mm below the finished surface elevation.

.4 Backfill and compact areas surrounding valve and fittings.

.5 Ensure the water valve casing will not move or settle.

3.4 FIELD QUALITY CONTROL

.1 Section 01 45 00: Quality Control

.2 Operate valve in presence of the Consultant to verify it is operational following adjustment.

.3 All work to adhere to OPSS 408.

END OF SECTION

SEE ADD#12
Q#326

Part 1 General

1.1 SCOPE

.1 This specification covers the requirements for the installation of maintenance holes, catch basins, ditch inlets, and valve chambers.

1.2 RELATED SECTIONS

.1 Section 31 23 33.01- Excavating, Trenching and Backfilling

1.3 REFERENCES

.1 OPSS 402 Excavating, Backfilling, and Compacting for Maintenance Holes, Catch Basins, Ditch Inlets, and Valve Chambers

.2 OPSS 407 Maintenance Hole, Catch Basin, Ditch Inlet and Valve Chamber Installation

.3 OPSS 408 Adjusting or Rebuilding Maintenance Holes, Catch Basins, Ditch Inlets, and Valve Chambers

.4 OPSS 510 Removal

.5 OPSS 517 Dewatering of Pipeline, Utility, and Associated Structure Excavation

1.4 SUBMITTALS FOR REVIEW

.1 Section 01 33 00: Submission procedures.

.2 Shop Drawings: Indicate manhole locations, elevations, piping sizes and elevations of penetrations.

.3 Product Data: Provide manhole covers, component construction, features, configuration, and dimensions.

1.5 SUBMITTALS FOR INFORMATION

.1 Section 01 33 00: Submission procedures.

.2 Sustainable Design:

.1 Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.6 CLOSEOUT SUBMITTALS

.1 Section 01 78 10: Submission procedures.

.2 Sustainable Design Closeout Documentation: As constructed survey including RIM and INVERT elevations.

1.7 QUALITY ASSURANCE

.1 Products of This Section: Manufactured to OPSS 407.

.2 Manufacturer: Company specializing in manufacturing products specified in this section with a minimum of three (3) years of documented experience.

Part 2 Products

2.1 MANUFACTURERS

.1 Acceptable manufacturers offering functionally and aesthetically equivalent products.

2.2 MATERIALS

.1 Manhole Sections: Reinforced precast concrete in accordance with OPSD 701.01.

.2 Manhole Sections: Reinforced cast-in-place concrete.

.3 Manhole Sections and Integral Steps: Fibre reinforced plastic to ASTM D3753.

.4 Mortar and Grout: As per OPSS 407.05.06.

2.3 COMPONENTS

.1 Lid and Frame: As per OPSD 401.01.

.2 Manhole Steps: Formed integrally with manhole sections galvanized steel or aluminum as per provincial & local municipal standards.

.3 Manhole Steps: Steps and ladders shall be according to OPSS 1351 and as specified in the Contract Documents.

.4 Base Pad: Cast-in-place concrete and levelled top surface.

.5 Strap Anchors: Bent steel shape galvanized to ASTM A123/A123M.

.6 Adjustment Units: Precast concrete adjustment units shall be according to OPSS 1351.

2.4 CONFIGURATION

.1 Shaft Construction: Concentric with eccentric cone top section; lipped male/female joints; sleeved to receive pipe and conduit sections.

.2 Shape: Cylindrical.

.3 Clear Inside Dimensions: 1200 mm diameter or as indicated on plans.

.4 Design Depth: As indicated on contract documents.

.5 Clear Lid Opening: 600 mm minimum diameter in all directions.

.6 Pipe Entry: Provide openings as indicated on plans.

.7 Steps: Design to be specified on the OPSD drawings. The top step must be a maximum of 450 mm below the finished top of grade elevation.

.8 Adjustment Units: Installation of adjustment units shall be according to OPSS 408.

.9 Steps: As required by OPSS 1351.

.10 Storm and Sanitary Manhole Benching: Per OPSD 701.021.

.11 Where the difference in elevation between the obvert of the inlet and outlet pipes exceeds 0.60m, a drop pipe as indicated on OPSD 1003.010.

Part 3 Execution

3.1 EXAMINATION

.1 Verify existing conditions before starting work.

.2 Verify items provided by other sections of Work are properly sized and located.

.3 Verify that built-in items are in the proper location, and ready for roughing into Work.

.4 Verify excavation for manholes is correct.

3.2 PREPARATION

.1 Coordinate placement of inlet and outlet pipe or duct sleeves required by other sections.

3.3 PLACING MANHOLE SECTIONS

.1 Place base pad and trowel on top surface level.

.2 Place manhole sections plumb and level, trim to correct elevations and anchor to the base pad.

.3 Form and place manhole cylinder plumb and level, to correct dimensions and elevations.

.4 Cut and fit for pipes.

.5 Grout the base of shaft sections to achieve slope to exit piping. Trowel evenly. Contour as required.

.6 Set cover frames and covers level without tipping, to correct elevations.

.7 Coordinate with other sections of work to provide the correct size, shape, and location.

.8 Manhole frames shall be grouted to the concrete structure. The grout shall be so rounded on a radius of not less than 150 mm from the top of the frame to the outer edge of the concrete structure. All grouting of frames and moduloc risers is to be completed on the outside of the structure only.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Pipe and fittings for site water line including fire water line and domestic water line.

.2 Fire hydrants and Valves.

1.2 RELATED SECTIONS

.1 Section 31 05 10 - Corrected Maximum Dry Density for Fill

.2 Section 31 05 16 – Aggregates for Earthwork

.3 31 23 33.01- Excavating, Trenching and Backfilling

.4 Section 33 05 16 - Maintenance Holes and Catch Basin Structures

1.3 REFERENCES

.1 ASTM D1785-12 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.

.2 ASTM D2241-09 - Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).

.3 ASTM D2466-06 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.

.4 ASTM D2855-96(2010) - Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings.

.5 ASTM D3139-98(2011) - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.

.6 ASTM D3035-12e1 - Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.

.7 ASTM D6938-10 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

.8 AWS A5.8/A5.8M-2011-AMD 1 - Specification for Filler Metals for Brazing and Braze Welding.

.9 AWWA C104/A21.4-08 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.

.10 AWWA C105/A21.5-10 - Polyethylene Encasement for Ductile-Iron Pipe Systems.

.11 AWWA C111/A21.11-12 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

.12 AWWA C151/A21.51-09 - Ductile-Iron Pipe, Centrifugally Cast.

.13 AWWA C500-09 - Metal-Seated Gate Valves for Water Supply Service

.14 AWWA C502-05 - Dry-Barrel Fire Hydrants

.15 AWWA C504-10 - Rubber-Sealed Butterfly Valves, 3 in (74 mm) through 72 in (1800 mm).

.16 AWWA C508-09 - Swing-Check Valves for Waterworks Service, 2-In. Through 24-In. (50-mm Through 600-mm) NPS.

.17 [AWWA C509-09 - Resilient-Seated Gate Valves for Water Supply Service.]

.18 [AWWA C600-10 - Installation of Ductile-Iron Water Mains and Their Appurtenances.]

.19 AWWA C606-11 - Grooved and Shouldered Joints.

.20 AWWA C900-07 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Transmission and Distribution.

.21 AWWA C901-08 - AWWA Standard for Polyethylene (PE) Pressure Pipe and Tubing, 1/2 In. (13 mm) through 3 In. (76 mm), for Water Service.

.22 UL 246-2011 - Standard for Hydrants for Fire-Protection Service (8th Edition).

.23 Town of East Gwillimbury Engineering Standards and Design Criteria

.24 OPSS 401 Trenching, Backfilling, And Compacting

.25 OPSS 441 Watermain Installation in Open Cut.

.26 OPSS 517 Dewatering

.27 OPSS 1351: Precast Reinforced Concrete Components for Maintenance Holes, Catch Basins, Ditch Inlets and Valve Chambers.

.28 OPSS 1359 Unshrinkable Backfill

1.4 SUBMITTALS FOR REVIEW

.1 Section 01 33 00: Submission procedures.

.2 Product Data: Provide data on pipe materials, pipe fittings, valves and accessories.

1.5 SUBMITTALS FOR INFORMATION

.1 Section 01 33 00: Submission procedures.

.2 Sustainable Design:

.1 Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.6 CLOSEOUT SUBMITTALS

.1 Section 01 78 10: Submission procedures.

.2 Manufacturer's Certificate: Certify that Products meet or exceed Provincial and local requirements.

.3 Record actual locations of piping mains, valves, connections, thrust restraints, and invert elevations.

.4 Identify and describe unexpected variations to subsoil conditions or the discovery of uncharted utilities.

1.7 QUALITY ASSURANCE

.1 Products of This Section: Manufactured to OPSS 441 and meet the Town of East Gwillimbury Engineering Standards and Design Criteria.

.2 Perform the Work in accordance with OPSS 441 the Town of East Gwillimbury Engineering Standards and Design Criteria.

.3 Valves: The manufacturer's name and pressure rating are marked on the valve body.

1.8 DELIVERY, STORAGE, AND PROTECTION

.1 Section 01 61 00: Transport, handle, store, and protect products.

.2 Deliver and store valves in shipping containers with labelling in place.

Part 2 Products

2.1 WATER PIPE

.1 Pipe size and class shall conform to the requirements shown on the contract drawings. Pipe material shall be selected in accordance with the Material Specifications unless otherwise specified on the contract drawings. All valves, hydrants, fittings and accessories shall be in accordance with the Material Specifications and shall be compatible with the class and type of pipe with which they will be used.

.2 All materials contacting potable water must meet NSF/ANSI 61 and all lubricants/chemicals to meet NSF/ANSI 60. Stainless steel bolt and nuts are to be used on all fittings and joint restraints. All metallic fittings, valves and joint restraints must be wrapped end to end with an approved corrosion protection system that includes petrolatum primer (paste), petrolatum moulding mastic, and low temperature petrolatum tape.

2.2 Appurtenances

.1 Detector Check In Valve: Refer to the Town of East Gwillimbury Engineering Standards and Design Criteria.

.2 Insulation: Refer to the Town of East Gwillimbury Engineering Standards and Design Criteria.

.3 Caps and Tee: Refer to the Town of East Gwillimbury Engineering Standards and Design Criteria.

2.3 BEDDING AND COVER MATERIALS

.1 Bedding: Refer to the Town of East Gwillimbury Engineering Standards and Design Criteria.

.2 Cover: Backfilling and compacting shall be according to OPSS 401.

2.4 ACCESSORIES

.1 Concrete for Thrust Restraints: Concrete for thrust blocks shall conform to the requirements of OPSS 1301 with a nominal minimum twenty-eight day compressive strength of 15 MPa. Concrete for precast valve chambers to conform to the requirements of OPSS 1351.

.2 Backflow Preventer: Refer to the Town of East Gwillimbury Engineering Standards and Design Criteria.

.3 Meter: Refer to mechanical specifications.

.4 Manhole and Cover: Refer to Section 33 05 13.

Part 3 Execution

3.1 EXAMINATION

.1 Verify existing conditions before starting work.

.2 Verify that the building service connection and municipal utility water main size, location and invert are as indicated.

3.2 PREPARATION

.1 Cut pipe ends square, ream pipe and tube ends to full pipe diameter and remove burrs.

.2 Remove scale and dirt on the inside and outside before assembly.

.3 Prepare pipe connections to equipment with flanges or unions.

3.3 BEDDING

.1 Excavate pipe trench in accordance with Section 31 23 16 for work of this Section. Hand trim excavation for accurate placement of pipe to elevations indicated.

.2 Form and place 20MPA concrete for pipe thrust restraints at any change of pipe direction. Place concrete to permit full access to pipe and pipe accessories.

.3 Place bedding material at trench bottom, level fill materials in one (1) continuous layer not exceeding 200 mm compacted depth; compact to 95%.

.4 Backfill around the sides and to the top of the pipe with cover fill, tamp in place and compact as specified.

.5 Maintain optimum moisture content of bedding material to attain required compaction density.

3.4 INSTALLATION - PIPE

.1 The contractor is to coordinate and stage watermain installation and final connections such that existing water services to existing buildings are maintained during regular business hours or as agreed with the Owner.

.2 Refer to OPSS 441 for additional specifications on watermain installation procedures and staging.

.3 Maintain separation of water main from sanitary and storm sewer piping in accordance with Provincial and local codes.

.4 Group piping with other site piping work whenever practical.

.5 Install pipe to indicated elevation to within a tolerance of 5/8 inches.

.6 Route pipe in a straight line.

.7 Install pipe to allow for expansion and contraction without stressing pipe or joints.

.8 Install access fittings to permit disinfection of the water system.

.9 Slope water pipe and position drains at low points.

.10 Form and place concrete for thrust restraints at each elbow or change of direction of the pipe main.

.11 Establish elevations of buried piping to ensure a minimum cover according to Municipality Standards.

.12 Install trace wire continuously over the top of the pipe.

.13 Backfill material under pavement, sidewalk, curb and within 1.5m of the edge of pavement to 100% Standard Proctor Density. In other areas, compact to 95% Standard Proctor Density.

.14 Unshrinkable fill is to be used when backfilling under the municipal roadway and it shall conform to OPSS 1359.

.15 Trench excavations backfilled with unshrinkable fill shall be covered with

a) Steel plates rated for a minimum of H-20 loading in paved areas, driveways and areas used by vehicles.

b) Wood planks or other approved material in areas used by pedestrians.

3.5 INSTALLATION - VALVES AND HYDRANTS

.1 Set valves on the solid bearing.

.2 Centre and plumb valve box over the valve. Set box cover flush with finished grade.

.3 Set hydrants plumb; locate pumper nozzle perpendicular to and facing the roadway.

.4 Set hydrants to grade, with nozzles at least 500 mm above ground.

.5 Paint hydrants in accordance with local municipality standards.

3.6 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

.1 Flush and disinfect system as per local municipal standards.

3.7 SERVICE CONNECTIONS

.1 Provide water service to local municipal requirements with reduced pressure backflow preventer and/or water meter with by-pass valves as shown on the provided plans.

.2 Provide sleeve in retaining wall for service main. Support with a reinforced concrete bridge. Calk enlarged sleeve watertight.

.3 Anchor service main to the interior surface of the foundation wall.

3.8 FIELD QUALITY CONTROL

.1 Section 01 45 00: Quality Control

.2 Compaction testing will be performed per OPSS 514.

.3 If tests indicate Work does not meet specified requirements, remove Work, replace, and retest.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Sanitary sewerage drainage piping, fittings, accessories, and bedding.

.2 Connection of building sanitary drainage system to municipal sewers.

.3 Clean-out access.

1.2 RELATED SECTIONS

.1 Section 31 05 10 – Corrected Maximum Dry Density for Fill

.2 Section 31 05 16 – Aggregates for Earthwork

.3 Section 31 23 33.01 – Excavating, Trenching and Backfilling

.4 Section 33 05 16 – Maintenance Holes and Catch Basin Structures

.5 Section 33 41 00 – Storm Utility Drainage Piping

1.3 REFERENCES

.1 ASTM C14M-11 - Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe.

.2 ASTM C76M-13a - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.

.3 ASTM C443M-11 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.

.4 ASTM C443-12 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.

.5 ASTM C564-12 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

.6 ASTM D2321-11 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.

.7 ASTM D2729-11 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

.8 ASTM D2751-05 - Standard Specification for Acrylonitrile Butadiene Styrene (ABS) Sewer Pipe and Fittings.

.9 ASTM D3034-08 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

.10 ASTM D6938-10 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

.11 The Town of East Gwillimbury Engineering Standards and Design Criteria.

.12 OPSS 407 New Maintenance Hole, Catch Basin, Ditch Inlet, and Valve Chamber Installation.

.13 OPSS 503 Site Preparation for Pipelines

.14 OPSS 504 Preservation, Protection and Reconstruction of Existing Facilities

.15 OPSS 514 Trenching, Backfilling, and Compacting

.16 OPSS 517 Dewatering

.17 OPSS 1359 Unshrinkable Backfill

1.4 DEFINITIONS

.1 Bedding: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations.

.2 Adjustment Unit: means circular and rectangular units used between the structure and the frame to adjust the elevation of the frame for grates and covers.

1.5 SUBMITTALS FOR REVIEW

.1 Section 01 33 00: Submission procedures.

.2 Product Data: Provide data indicating pipe, pipe accessories, and fittings.

1.6 SUBMITTALS FOR INFORMATION

.1 Section 01 33 00: Submission procedures.

.2 Installation Data: Manufacturer's special installation requirements.

.3 Certificates: Certify that products meet or exceed local municipal standards.

.4 Sustainable Design:

.1 Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.7 CLOSEOUT SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Record the location of pipe runs, connections, catch basins, clean-outs, control points, invert and rim elevations.

.3 Identify, indicate, and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.8 REGULATORY REQUIREMENTS

.1 Conform to the applicable code for installation and materials of the Work of this section.

Part 2 Products

2.1 PIPE MATERIALS (To be determined by the notes and details shown on Contract Drawings)

.1 Concrete Pipe: CSA A257.2-03 (minimum 65-D).

.2 Non-reinforced Concrete Pipe: CSA A257.2-03 Class 3.

.3 Mainline PVC Pipe: ASTM D3034-04A, DR 35 CSA B182.2-06.

.4 HDPE Pipe: Per CSA B182.8 with Type 1 water-tight joints.

.5 Service Connections: Minimum 150mm diameter DR28.

2.2 PIPE ACCESSORIES

.1 Pipe Joints: Mechanical clamp ring type, stainless steel expanding and contracting sleeve, neoprene ribbed gasket for positive seal.

.2 Fittings: Same material as pipe moulded or formed to suit pipe size and end design, in required tee, bends, elbows, clean-outs, reducers, traps and other configurations required.

.3 Trace Wire: Magnetic detectable conductor, plastic covering, imprinted with SEWER SERVICE in large letters.

2.3 BEDDING MATERIALS

.1 Bedding materials shall be placed as shown on the notes on Contract Drawings.

.2 The bedding shall be shaped true to line and grade, free from depressions and high points.

.3 Bedding materials shall be placed in the trench to the grades of the bottom of the pipe. The pipe shall then be lowered to the trench and laid on the bedding material which shall be shaped to conform to the bell end of the pipe. The remaining bedding material shall be placed simultaneously on each side of the spring line of the pipe.

.4 At pipe joints, bedding materials shall be left clear of the joints to permit their completion as specified elsewhere. After the connection has been completed, approved bedding material shall be placed under the joint and thoroughly tamped to the compaction specified.

Part 3 Execution

3.1 EXAMINATION

.1 Verify existing conditions before starting work.

.2 Verify that the excavation base and trench cut are ready to receive work and that excavations, dimensions, and elevations are as indicated on the Civil Drawings.

3.2 PREPARATION

.1 Hand trim excavations to required elevations. Correct over excavation with fine aggregate.

.2 Remove large stones or other hard matter which could damage the pipe or impede consistent backfilling or compaction.

3.3 BEDDING

.1 Excavate pipe trench as specified in the provided plans for work of this section. Hand trim excavation for accurate placement of pipe to elevations indicated.

.2 Place bedding material at the trench bottom and compact to 100% SPD.

.3 Maintain the moisture content of bedding material to plus or minus 2% of optimum to attain the required compaction density.

3.4 INSTALLATION – PIPE

.1 The contractor is to ensure sanitary services to existing buildings remain operational and are maintained at all times.

.2 Please refer to OPSS 410 for additional specifications on sanitary sewer installation procedures and staging of works.

.3 Install pipe, fittings, and accessories to ASTM C12, ASTM C14, and/or manufacturer's written instructions and local requirements. Seal joints watertight.

.4 Lay pipe to slope gradients noted on the provided plans; with maximum variation from a true slope of 1:1000.

.5 Install bedding at the sides and over the top of the pipe as shown on the notes on Contract Drawings.

.6 Refer to Section 31 23 33.01 for Excavating, Trenching and Backfilling requirements. Do not displace or damage the pipe when compacting.

.7 Refer to Section 33 05 16 for manhole requirements.

.8 Connect to the municipal sewer system and building sanitary sewer outlet as indicated on the provided plans and to the satisfaction of the Town of East Gwillimbury site inspector or the Town’s Director of Public Works.

.9 Coordinate the Work with the termination of sanitary sewer connection outside the building, connection to municipal sewer utility service, and trenching.

.10 Backfill material under pavement, sidewalk, curb and within 1.5m of the edge of pavement to 100% Standard Proctor Density. In other areas, compact to 95% Standard Proctor Density.

.11 Unshrinkable fill is to be used when backfilling under the municipal roadway and it shall conform to OPSS 1359.

.12 Trench excavations backfilled with unshrinkable fill shall be covered with

a) Steel plates rated for a minimum of H-20 loading in paved areas, driveways and areas used by vehicles.

b) Wood planks or other approved material in areas used by pedestrians.

.13 Jointing Pipes – Refer to the Town of East Gwillimbury Engineering Standards and Design Criteria.

.14

.15 Cutting of Pipes - Refer to the Town of East Gwillimbury Engineering Standards and Design Criteria.

3.5 INSTALLATION - CLEAN-OUTS

.1 Form bottom of the excavation clean and smooth to correct installation.

.2 Establish elevations and inverts for inlets and outlets as indicated.

.3 Mount clean-out surface hub level in the grout, to elevation, indicated.

.4 Form and place cast-in-place concrete base pad, with provision for sanitary sewer pipe to be installed to proper elevations. Final elevations for the top of the structure are to be set at the time of asphalt placement.

3.6 FIELD QUALITY CONTROL

.1 Section 01 45 00: Quality Control

.2 Request inspection prior to placing bedding.

.3 Compaction testing will be performed to standards identified within the geotechnical report and to meet or exceed local municipal standards.

.4 If tests indicate the Work does not meet specified requirements, remove the Work, replace and retest at no cost to the Owner.

.5 Frequency of tests, pressure testing, infiltration testing and deflection testing are all be completed as per provincial and local municipal standards.

3.7 PROTECTION OF FINISHED WORK

.1 Protect pipe and aggregate cover from damage or displacement until the backfilling operation is in progress.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Specifies requirements for construction and performance of an underground stormwater quality membrane filtration treatment device that removes pollutants from stormwater runoff through the unit operations of sedimentation, floatation, and membrane filtration.Connection of drainage system to municipal sewers.

1.2 RELATED SECTIONS

.1 Section 31 23 33.01- Excavating, Trenching and Backfilling

.2 Section 33 41 00 Storm Utility Drainage Piping

.3 Section 33 05 16 - Maintenance Holes and Catch Basin Structures

1.3 REFERENCES

.1 ASTM C 891: Specification for Installation of Underground Precast Concrete Utility Structures

.2 ASTM C 478: Specification for Precast Reinforced Concrete Manhole Sections

.3 ASTM C 443: Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets

.4 ASTM D 4101: Specification for Copolymer steps construction

.5 CAN/CSA-A257.4-M92: Joints for Circular Concrete Sewer and Culvert Pipe, Manhole Sections and Fittings Using Rubber Gaskets

.6 CAN/CSA-A257.4-M92 Precast Reinforced Circular Concrete Manhole Sections, Catch Basins and Fittings

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Coordination:

.1 Coordinate with other work having a direct bearing on the work of this Section.

.2 Coordinate the Work with the termination of storm sewer connection outside the building, trenching, connection to the foundation drainage system and the municipal sewer utility service.

1.5 SUBMITTALS FOR REVIEW

.1 Section 01 33 00: Submission procedures.

.2 Shop drawings for the structure and performance are to be submitted with each order to the contractor. Contractor shall forward shop drawing submittal to the consulting engineer for approval. Shop drawings are to detail the structure's precast concrete and call out or note the fiberglass (FRP) internals/components.

1.6 SUBMITTALS FOR INFORMATION

.1 Section 01 33 00: Submission procedures.

.2 Installation Data: Indicate special procedures required to install Products specified.

.3 Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

.4 Sustainable Design:

.1 Not Used

1.7 PRODUCT SUBSTITUTIONS

.1 No product substitutions shall be accepted unless submitted 10 days prior to project bid date, or as directed by the engineer of record.

.2 Submissions for substitutions require review and approval by the Engineer of Record, for hydraulic performance, impact to project designs, equivalent treatment performance, and any required project plan and report (hydrology/hydraulic, water quality, stormwater pollution) modifications that would be required by the approving jurisdictions/agencies.

.3 Contractor to coordinate with the Engineer of Record any applicable modifications to the project estimates of cost, bonding amount determinations, plan check fees for changes to approved documents, and/or any other regulatory requirements resulting from the product substitution.

Part 2 GENERAL

2.1 FILTRATION DEVICES

.1 The device shall be a cylindrical or rectangular, all concrete structure (including risers), constructed from precast concrete riser and slab components or monolithic precast structure(s), installed to conform to ASTM C 891 and to any required state highway, municipal or local specifications; whichever is more stringent. The device shall be watertight.

2.2 CARTRIDGE DECK

.1 The cylindrical concrete device shall include a fiberglass deck. The rectangular concrete device shall include a coated aluminum deck. In either instance, the insert shall be bolted and sealed watertight inside the precast concrete chamber. The deck shall serve as: (a) a horizontal divider between the lower treatment zone and the upper treated effluent zone; (b) a deck for attachment of filter cartridges such that the membrane filter elements of each cartridge extend into the lower treatment zone; (c) a platform for maintenance workers to service the filter cartridges (maximum manned weight = 450 pounds (204 kg)); (d) a conduit for conveyance of treated water to the effluent pipe.

2.3 MEMBRANE FILTER CARTRIDGES

.1 Filter cartridges shall be comprised of reusable cylindrical membrane filter elements connected to a perforated head plate. The number of membrane filter elements per cartridge shall be a minimum of eleven 2.75-inch (70-mm) diameter elements. The length of each filter element shall be a minimum 15 inches (381 mm). Each cartridge shall be fitted into the cartridge deck by insertion into a cartridge receptacle that is permanently mounted into the cartridge deck. Each cartridge shall be secured by a cartridge lid that is threaded onto the receptacle, or similar mechanism to secure the cartridge into the deck. The maximum treatment flow rate of a filter cartridge shall be controlled by an orifice in the cartridge lid, or on the individual cartridge itself, and based on a design flux rate (surface loading rate) determined by the maximum treatment flow rate per unit of filtration membrane surface area. The maximum design flux rate shall be 0.21 gpm/ft2 (0.142 lps/m2).

.2 Each membrane filter cartridge shall allow for manual installation and removal. Each filter cartridge shall have filtration membrane surface area and dry installation weight as follows (if length of filter cartridge is between those listed below, the surface area and weight shall be proportionate to the next length shorter and next length longer as shown below):

Filter Cartridge Length (in / mm)	Minimum Filtration Membrane Surface Area (ft2 / m2)	Maximum Filter Cartridge Dry Weight (lbs / kg)
15	106 / 9.8	10.5 / 4.8
27	190 / 17.7	15.0 / 6.8
40	282 / 26.2	20.5 / 9.3
54	381 / 35.4	25.5 / 11.6

.3 **Backwashing Cartridges:** The filter device shall have a weir extending above the cartridge deck, or other mechanism, that encloses the high flow rate filter cartridges when placed in their respective cartridge receptacles within the cartridge deck. The weir, or other mechanism, shall collect a pool of filtered water during inflow events that backwashes the high flow rate cartridges when the inflow event subsides. All filter cartridges and membranes shall be reusable and allow for the use of filtration membrane rinsing procedures to restore flow capacity and sediment capacity; extending cartridge service life.

.4 **Maintenance Access to Captured Pollutants:** The filter device shall contain an opening(s) that provides maintenance access for removal of accumulated floatable pollutants and sediment, removal of and replacement of filter cartridges, cleaning of the sump, and rinsing of the deck. Access shall have a minimum clear vertical clear space over all of the filter cartridges. Filter cartridges shall be able to be lifted straight vertically out of the receptacles and deck for the entire length of the cartridge.

2.4 BEND STRUCTURE

.1 The device shall be able to be used as a bend structure with minimum angles between inlet and outlet pipes of 90-degrees or less in the stormwater conveyance system.

2.5 DOUBLE-WALL CONTAINMENT OF HYDROCARBONS

.1 The cylindrical precast concrete device shall provide double-wall containment for hydrocarbon spill capture by a combined means of an inner wall of fiberglass, to a minimum depth of 12 inches (305 mm) below the cartridge deck, and the precast vessel wall.

2.6 Baffle

.1 The filter device shall provide a baffle that extends from the underside of the cartridge deck to a minimum length equal to the length of the membrane filter elements. The baffle shall serve to protect the membrane filter elements from contamination by floatables and coarse sediment. The baffle shall be flexible and continuous in cylindrical configurations, and shall be a straight concrete or aluminum wall in rectangular configurations.

2.7 Sump

.1 The device shall include a minimum 24 inches (610 mm) of sump below the bottom of the cartridges for sediment accumulation, unless otherwise specified by the design engineer. Depths less than 24 inches may have an impact on the total performance and/or longevity between cartridge maintenance/replacement of the device.

Part 3 PRECAST CONCRETE SECTIONS

All precast concrete components shall be manufactured to a minimum live load of HS-20 truck loading or greater based on local regulatory specifications, unless otherwise modified or specified by the design engineer, and shall be watertight.

3.1 JOINTS

.1 All precast concrete manhole configuration joints shall use nitrile rubber gaskets and shall meet the requirements of ASTM C443, Specification C1619, Class D or engineer approved equal to ensure oil resistance. Mastic sealants or butyl tape are not an acceptable alternative.

3.2 GASKETS

.1 Only profile neoprene or nitrile rubber gaskets in accordance to CSA A257.3-M92 will be accepted. Mastic sealants, butyl tape or Conseal CS-101 are not acceptable gasket materials.

2.4 FRAME AND COVER

.2 Frame and covers must be manufactured from cast-iron or other composite material tested to withstand H-20 or greater design loads, and as approved by the local regulatory body. Frames and covers must be embossed with the name of the device manufacturer or the device brand name.

3.3 DOORS AND HATCHES

.1 If provided shall meet designated loading requirements or at a minimum for incidental vehicular traffic.

3.4 CONCRETE

.1 All concrete components shall be manufactured according to local specifications and shall meet the requirements of ASTM C 478.

3.5 FIBERGLASS

.1 The fiberglass portion of the filter device shall be constructed in accordance with the following standard: ASTM D-4097: Contact Molded Glass Fiber Reinforced Chemical Resistant Tanks.

3.6 STEPS

.1 Steps shall be constructed according to ASTM D4101 of copolymer polypropylene, and be driven into preformed or pre-drilled holes after the concrete has cured, installed to conform to applicable sections of state, provincial and municipal building codes, highway, municipal or local specifications for the construction of such devices.

3.7 INSPECTION

.1 All precast concrete sections shall be inspected to ensure that dimensions, appearance and quality of the product meet local municipal specifications and ASTM C 478.

Part 4 PART 3 – PERFORMANCE

4.1 GENERAL

.1 Verification – The stormwater quality filter treatment device shall have been field tested in accordance with either TARP Tier II Protocol (TARP, 2003) and New Jersey Tier II Stormwater Test Requirements – Amendments to TARP Tier II Protocol (NJDEP, 2009) or Washington State Technology Assessment Protocol – Ecology (TAPE), 2011 or later version. The field test shall have been verified in accordance with ISO 14034:2016 Environmental Management – Environmental Technology Verification (ETV). See Section 3.2 of this specification for field test performance requirements.

.2 Function - The stormwater quality filter treatment device shall function to remove pollutants by the following unit treatment processes; sedimentation, floatation, and membrane filtration.

.3 Pollutants - The stormwater quality filter treatment device shall be ISO 14034 ETV verified to remove oil/grease, suspended solids, metals and nutrients from stormwater runoff.

.4 Bypass - The stormwater quality filter treatment device shall typically utilize an external bypass to divert excessive flows. Internal bypass systems shall be equipped with a floatables baffle, and must avoid passage through the sump and/or cartridge filtration zone.

.5 Treatment Flux Rate (Surface Loading Rate) – The stormwater quality filter treatment device shall treat 100% of the required water quality treatment flow based on a maximum design treatment flux rate (surface loading rate) across the membrane filter cartridges of 0.21 gpm/ft2 (0.142 lps/m2).

4.2 FIELD TEST PERFORMANCE

.1 At a minimum, the stormwater quality filter treatment device shall have been field tested in accordance with either TARP Tier II Protocol (TARP, 2003) and New Jersey Tier II Stormwater Test Requirements – Amendments to TARP Tier II Protocol (NJDEP, 2009) or Washington State Technology Assessment Protocol – Ecology (TAPE), 2011 or later version. The field test shall have been verified in accordance with ISO 14034:2016 Environmental Management – Environmental Technology Verification (ETV). The field test shall have monitored a minimum of twenty (20) TARP or TAPE qualifying storm events.

.2 Suspended Solids Removal - The stormwater quality filter treatment device shall have ISO 14034 ETV verified load based median TSS removal efficiency of at least 85% and load based median SSC removal efficiency of at least 98%.

.3 Runoff Volume – The stormwater quality filter treatment device shall be engineered, designed, and sized to treat a minimum of 90 percent of the annual runoff volume determined from use of a minimum 15-year rainfall data set.

.4 Fine Particle Removal - The stormwater quality filter treatment device shall have demonstrated the ability to capture fine particles as indicated by a minimum median removal efficiency of 75% for the particle fraction less than 25 microns, and an effluent d50 of 15 microns or lower for all monitored storm events.

.5 Turbidity Reduction - The stormwater quality filter treatment device shall have demonstrated the ability to reduce turbidity such that effluent turbidity is 15 NTU or lower.

.6 Nutrients:

.1 Total Phosphorus (TP) Removal - The stormwater quality filter treatment device shall have ISO 14034 ETV verified load based median TP removal efficiency of at least 49%.

.2 Total Nitrogen (TN) Removal - The stormwater quality filter treatment device shall have ISO 14034 ETV verified load based median TN removal efficiency of at least 39%.

.7 Metals:

.1 Total Zinc (Zn) Removal - The stormwater quality filter treatment device shall have ISO 14034 ETV verified load based median Zn removal efficiency of at least 69%.

.2 Total Copper (Cu) Removal - The stormwater quality filter treatment device shall have ISO 14034 ETV verified load based median Cu removal efficiency of at least 91%.

4.3 INSPECTION and MAINTENANCE

The stormwater quality filter device shall have the following features:

.1 Durability of membranes are subject to good handling practices during inspection and maintenance (removal, rinsing, and reinsertion) events, and site specific conditions that may have heavier or lighter loading onto the cartridges, and pollutant variability that may impact the membrane structural integrity. Membrane maintenance and replacement shall be in accordance with manufacturer's recommendations.

.2 Inspection which includes trash and floatables collection, sediment depth determination, and visible determination of backwash pool depth shall be easily conducted from grade (outside the structure).

.3 Manual rinsing of the reusable filter cartridges shall promote restoration of the flow capacity and sediment capacity of the filter cartridges, extending cartridge service life.

.4 The filter device shall have a minimum 12 inches (305 mm) of sediment storage depth, and a minimum of 12 inches between the top of the sediment storage and bottom of the filter cartridge tentacles, unless otherwise specified by the design engineer. Variances may have an impact on the total performance and/or longevity between cartridge maintenance/replacement of the device.

.5 Sediment removal from the filter treatment device shall be able to be conducted using a standard maintenance truck and vacuum apparatus, and a minimum one point of entry to the sump that is unobstructed by filter cartridges.

.6 Maintenance access shall have a minimum clear height that provides suitable vertical clear space over all of the filter cartridges. Filter cartridges shall be able to be lifted straight vertically out of the receptacles and deck for the entire length of the cartridge.

.7 Filter cartridges shall be able to be maintained without the requirement of additional lifting equipment.

Part 5 EXECUTION

5.1 INSTALLATION

.1 PRECAST DEVICE CONSTRUCTION SEQUENCE:

.1 The installation of a watertight precast concrete device should conform to ASTM C 891 and to any state highway, municipal or local specifications for the construction of manholes, whichever is more stringent. Selected sections of a general specification that are applicable are summarized below.

.1 The watertight precast concrete device is installed in sections in the following sequence:
.2 aggregate base
.3 base slab
.4 treatment chamber and cartridge deck riser section(s)
.5 bypass section
.6 connect inlet and outlet pipes
.7 concrete riser section(s) and/or transition slab (if required)
.8 maintenance riser section(s) (if required)
.9 frame and access cover

.2 The precast base should be placed level at the specified grade. The entire base should be in contact with the underlying compacted granular material. Subsequent sections, complete with joint seals, should be installed in accordance with the precast concrete manufacturer's recommendations.

.3 Adjustment of the stormwater quality treatment device can be performed by lifting the upper sections free of the excavated area, re-leveling the base, and re-installing the sections. Damaged sections and gaskets should be repaired or replaced as necessary to restore original condition and watertight seals. Once the stormwater quality treatment device has been constructed, any/all lift holes must be plugged watertight with mortar or non-shrink grout.

.4 Inlet and Outlet Pipes Inlet and outlet pipes should be securely set into the device using approved pipe seals (flexible boot connections, where applicable) so that the structure is watertight, and such that any pipe intrusion into the device does not impact the device functionality.

.5 Frame and Cover Installation Adjustment units (e.g. grade rings) should be installed to set the frame and cover at the required elevation. The adjustment units should be laid in a full bed of mortar with successive units being joined using sealant recommended by the manufacturer.

Frames for the cover should be set in a full bed of mortar at the elevation specified.

5.2 MAINTENANCE ACCESS WALL

.1 In some instances the Maintenance Access Wall, if provided, shall require an extension attachment and sealing to the precast wall and cartridge deck at the job site, rather than at the precast facility. In this instance, installation of these components shall be performed according to instructions provided by the manufacturer.

5.3 FILTER CARTRIDGE INSTALLATION

.1 Filter cartridges shall be installed in the cartridge deck only after the construction site is fully stabilized and in accordance with the manufacturer's guidelines and recommendations. Contractor to contact the manufacturer to schedule cartridge delivery and review procedures/requirements to be completed to the device prior to installation of the cartridges and activation of the system.

Part 6 QUALITY ASSURANCE

6.1 FILTER CARTRIDGE INSTALLATION

.1 Manufacturer shall coordinate delivery of filter cartridges and other internal components with contractor. Filter cartridges shall be delivered and installed complete after site is stabilized and unit is ready to accept cartridges. Unit is ready to accept cartridges after is has been cleaned out and any standing water, debris, and other materials have been removed. Contractor shall take appropriate action to protect the filter cartridge receptacles and filter cartridges from damage during construction, and in accordance with the manufacturer's recommendations and guidance. For systems with cartridges installed prior to full site stabilization and prior to system activation, the contractor can plug inlet and outlet pipes to prevent stormwater and other influent from entering the device. Plugs must be removed during the activation process.

6.2 INSPECTION AND MAINTENANCE

.1 The manufacturer shall provide an Owner's Manual upon request.

.2 After construction and installation, and during operation, the device shall be inspected and cleaned as necessary based on the manufacturer's recommended inspection and maintenance guidelines and the local regulatory agency/body.

6.3 REPLACEMENT FILTER CARTRIDGES

.1 When replacement membrane filter elements and/or other parts are required, only membrane filter elements and parts approved by the manufacturer for use with the stormwater quality filter device shall be installed.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Site storm sewerage drainage piping, fittings and accessories, and bedding.

.2 Connection of drainage system to municipal sewers.

.3 Catch basins, area drainage, plant area drains and detention tanks.

1.2 RELATED SECTIONS

.1 Section 31 23 33.01- Excavating, Trenching and Backfilling

.2 Section 33 31 11 - Site Sanitary Sewerage Gravity Piping

.3 Section 33 05 13 - Maintenance Holes and Catch Basin Structures

1.3 REFERENCES

.1 AASHTO M 36-03 (R2011) - Standard Specification for Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains.

.2 ASTM C14M-11 - Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe.

.3 ASTM C14-11 - Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe.

.4 ASTM C76M-13a - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.

.5 ASTM C76-13a - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.

.6 ASTM C425-04(2009) - Standard Specification for Compression Joints for Vitrified Clay Pipe and Fittings.

.7 ASTM C443-12 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.

.8 ASTM C443-12 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.

.9 ASTM C564-12 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

.10 ASTM D2321-11 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.

.11 ASTM D2729-11 - Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

.12 ASTM D2751-05 - Standard Specification for Acrylonitrile Butadiene Styrene (ABS) Sewer Pipe and Fittings.

.13 ASTM D3034-08 - Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Coordination:

.1 Coordinate with other work having a direct bearing on the work of this Section.

.2 Coordinate the Work with the termination of storm sewer connection outside the building, trenching, connection to the foundation drainage system and the municipal sewer utility service.

1.5 SUBMITTALS FOR REVIEW

.1 Section 01 33 00: Submission procedures.

.2 Product Data: Provide data indicating pipe and pipe accessories.

1.6 SUBMITTALS FOR INFORMATION

.1 Section 01 33 00: Submission procedures.

.2 Installation Data: Indicate special procedures required to install Products specified.

.3 Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

.4 Sustainable Design:

.1 Not Used

1.7 CLOSEOUT SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Accurately record actual locations of pipe runs, pipe slope, connections, catch basins, cleanouts, maintenance holes, RIM and invert elevations.

.3 Identify and describe unexpected variations to subsoil conditions or the discovery of uncharted utilities.

.4 Sustainable Design Closeout Documentation: CCTV Videos of installed services and as-constructed plan of services including pipe runs, pipe slope, connections, catch basins, cleanouts, maintenance holes, RIM and invert elevations.

1.8 REGULATORY REQUIREMENTS

.1 Conform to the applicable code for materials and installation of the Work of this section.

Part 2 Products

2.1 SEWER PIPE MATERIALS (to be determined by the notes and details shown on the provided plans)

.1 Cast Iron Pipe: Not Used

.2 Cast Iron Pipe Joint Device: Not Used

.3 Vitrified Clay Pipe: Not Used

.4 Vitrified Clay Pipe Joint Device: Not Used.

.5 Concrete Pipe: Refer to the notes and details shown on the Contract Drawings.

.6 Concrete Pipe Joint Devices: Refer to the notes and details shown on the Contract Drawings.

.7 Reinforced Concrete Pipe: Refer to the notes and details shown on the Contract Drawings.

.8 Reinforced Concrete Pipe Joint Device: Refer to the notes and details shown on the Contract Drawings.

.9 Plastic Pipe: Refer to the notes and details shown on the Contract Drawings.

.10 Plastic Pipe: ASTM D2729, polyvinyl chloride (PVC) material; bell and spigot solvent sealed joint end.

.11 Plastic Pipe: ASTM D3034, Type PSM, Poly (Vinyl Chloride) (PVC) material, bell and spigot style rubber ring sealed gasket joint.

.12 Corrugated Steel Pipe: Refer to the notes and details shown on the Contract Drawings.

.13 Coupling Bands: Refer to the notes and details shown on the Contract Drawings

2.2 ACCESSORIES

.1 Pipe Joints: Mechanical clamp ring type, stainless steel expanding and contracting sleeve, neoprene ribbed gasket for positive seal.

.2 Fittings: Same material as pipe moulded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps and other configurations required.

.3 Filter Fabric: Non-biodegradable, non-woven 270R

.4 Trace Wire: Magnetic detectable conductor, plastic covering, imprinted with [STORM SEWER SERVICE in large letters.

.5 Grout: As per local Municipal and Provincial standards.

2.3 BEDDING AND COVER MATERIALS

.1 Bedding: As per geotechnical recommendations, provincial and local municipal standards.

.2 Cover: As per geotechnical recommendations, provincial and local municipal standards.

.3 Execution

2.4 EXAMINATION

.1 Section 01 70 00: Verify existing conditions before starting work.

.2 Verify that the excavation is ready to receive work and that excavations, dimensions, and elevations are as indicated on the Contract Drawings.

2.5 PREPARATION

.1 Hand trim excavations to required elevations. Correct over excavation with compacted material.

.2 Remove large stones or other hard matter which could damage piping or impede consistent backfilling or compaction.

2.6 BEDDING

.1 Excavate pipe trench for work of this section. Hand trim excavation for accurate placement of pipe to elevations indicated.

.2 Place bedding material at trench bottom, level materials in a continuous layer not exceeding 200mm compacted depth.

.3 Maintain optimum moisture content of bedding material to attain required compaction density.

2.7 INSTALLATION – PIPE

.1 Existing storm sewers are to remain operational and maintained at all times.

.2 Install pipe, fittings, and accessories in accordance with the notes and details on the Contract Drawings. Seal joints watertight.

.3 Place the pipe on minimum deep bed granular aggregate as identified in the geotechnical report and provided plans to springline at the sides. Provide top cover to minimum compacted thickness of 300 mm and compact as specified.

.4 Refer to Section 31 23 23 for trenching requirements. Do not displace or damage the pipe when compacting.

.5 Refer to Section 31 05 16 for manhole requirements.

.6 Connect to the municipal storm sewer system, manholes, and building collection points as shown on the Contract Drawings.

2.8 INSTALLATION - CATCH BASINS AND CLEANOUTS

.1 Form bottom of the excavation clean and smooth to correct elevation.

.2 Form and place cast-in-place concrete base pad, with provision for storm sewer pipe end sections.

.3 The level top surface of the base pad; sleeve concrete shaft sections to receive storm sewer pipe sections.

.4 Establish elevations and pipe inverts for inlets and outlets as indicated.

.5 Mount lid and frame level in the grout, secured to the top cone section to elevation indicated.

2.9 FIELD QUALITY CONTROL

.1 Section 01 45 00: Quality Control

.2 Request inspection prior to placing the aggregate cover over the pipe.

.3 Compaction testing will be performed to standards identified within the geotechnical report and to meet or exceed local municipal standards.

.4 If tests indicate the Work does not meet specified requirements, remove the deficient Work, replace and retest at no cost to the Owner.

.5 Frequency of tests, pressure testing, infiltration testing and deflection testing are all completed as per Provincial and local municipal standards.

2.10 PROTECTION OF FINISHED WORK

.1 Protect pipe and aggregate cover from damage or displacement until the backfilling operation is in progress.

2.11 SCHEDULES

.1 Not Used.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 Not Used

1.2 SUMMARY

.1 Section Includes:

.1 Subdrainage systems behind retaining walls within paved areas and surrounding storm structures.

1.3 REFERENCES

.1 American Society for Testing and Materials (ASTM):

.2 ASTM D 2729 Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

.3 OPSS 405 Pipe Subdrains

.4 OPSS 1860 Geotextile

.5 OPSS 510 Removals

1.4 SUBMITTALS

A. Section 01300 - Submittals: Procedures for submittals.

Part 2 Products

2.1 PIPE MATERIALS

.1 Polyvinyl Chloride Pipe: ASTM D 2729; perforated; 100 mm inside diameter; with required fittings.

2.2 FILTER AGGREGATE

.1 Coarse Filter Aggregate: Clean well graded natural gravel or crushed stone; free from shale, clay, organic materials and debris; 9 mm to 35 mm in size, unless otherwise specified.

2.3 FILL MATERIAL

.1 The type specified for the paved areas.

2.4 ACCESSORIES

.1 Joint covers and pipe sleeves as required for installation.

.2 Subdrain shall be wrapped with a knitted sock geotextile/filter fabric: Water previous, non-woven, needle punch, geotextile polypropylene fabric weighing a minimum of 4 ounces per square yard. Subject to compliance with the above, provide the following:

.1 Trevira 1114 by AGS Canada.

.2 270R by Terrafix Geosynthetics Inc or equivalent.

Part 3 Execution

3.1 EXAMINATION

.1 Verify that the excavation base is ready to receive work, and excavations, dimensions, and elevations are as indicated on the Contract Drawings.

.2 The beginning of installation means acceptance of existing conditions.

3.2 PREPARATION

.1 Hand trim excavations to required elevations. Correct over excavation with fill material of coarse aggregate.

.2 Remove large stones or other hard matter which could damage drainage tile or impede consistent backfilling or compaction.

3.3 INSTALLATION

.1 Separate earth and filter aggregate with geotextile filter fabric.

.2 Do not disturb the drainage system in subsequent backfilling compaction operations.

.3 Subdrain is to be installed as per the detail on the Contract Drawings.

.4 Subdrain installed within the parking areas at catchbasins, catchbasin manholes, and curbs must be backfilled completely to the underside of the asphalt surface.

.5 Subdrains shall be connected to maintenance holes, catch basins, and ditch inlets by a 1 m section of nonperforated pipe. Subdrain and outlet pipe connections to concrete maintenance holes, catch basins, and ditch inlets shall be cored and grouted as specified in the Contract Documents.

.6 Management of excess material shall be according to OPSS 510.

3.4 PROTECTION

.1 Protect pipe and filter aggregate cover from damage or displacement until backfilling operation begins.

3.5 TRANSPORTATION

.1 Off-site, materials shall be transported to the project using well maintained and operating vehicles. Once on the job site, all transporting vehicles shall stay on

designated haul roads and shall at no time endanger any of the improvements by rutting, overloading or pumping the haul road.

END OF SECTION