

**March 20, 2024**

**Barrie Fire Station No. 6**  
245 Maplevue Drive East,  
Barrie, ON

**REGAL CONSULTING ENGINEERS INC.**  
208 Wyecroft Road, Suite 200  
Mississauga, ON L6K 3S3  
Phone: 905-844-3913

This addendum forms part of the contract documents and amends the original bidding requirements, drawings and specifications, as noted below.

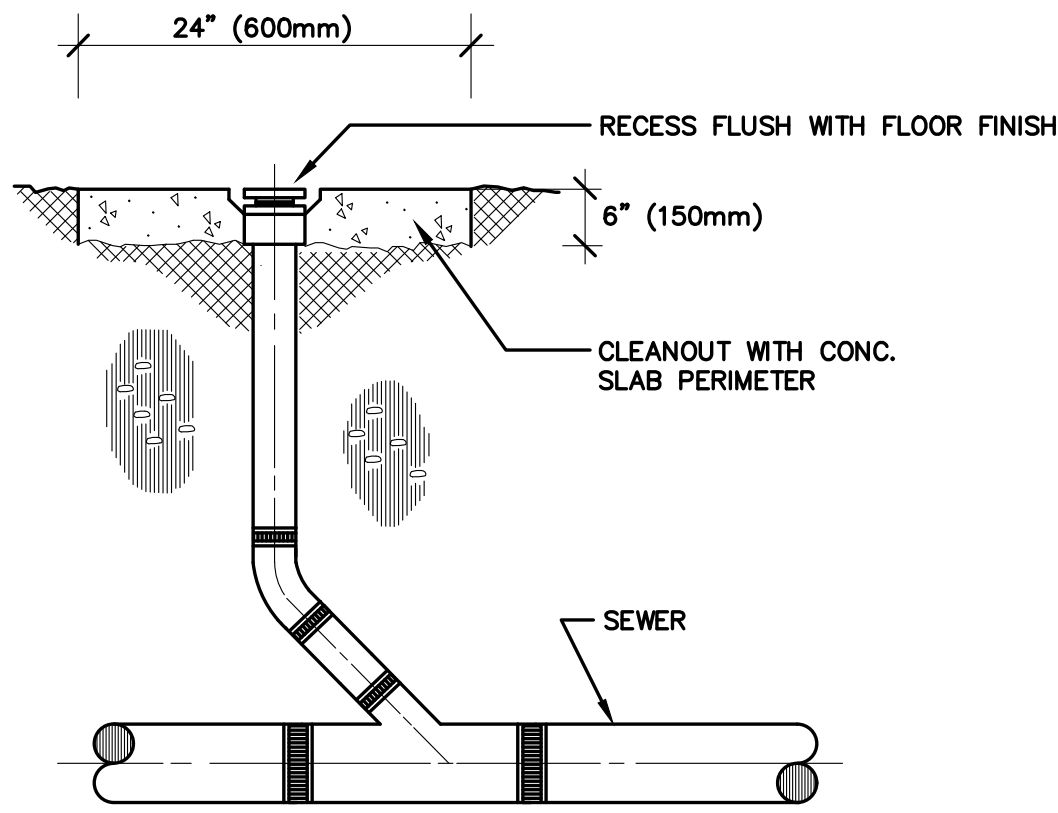
**MECHANICAL**

1. Replace/add the drawings with as under:
  1. Replace the drawing M7.1 with revised drawing M7.1-A-1(attached). Typical piping detail for Air Source Heat Pump is added.
  2. Add the drawing M7.2(attached) for mechanical equipment wiring schedule.
  3. Revised mechanical specifications section 25 90 00 attached.

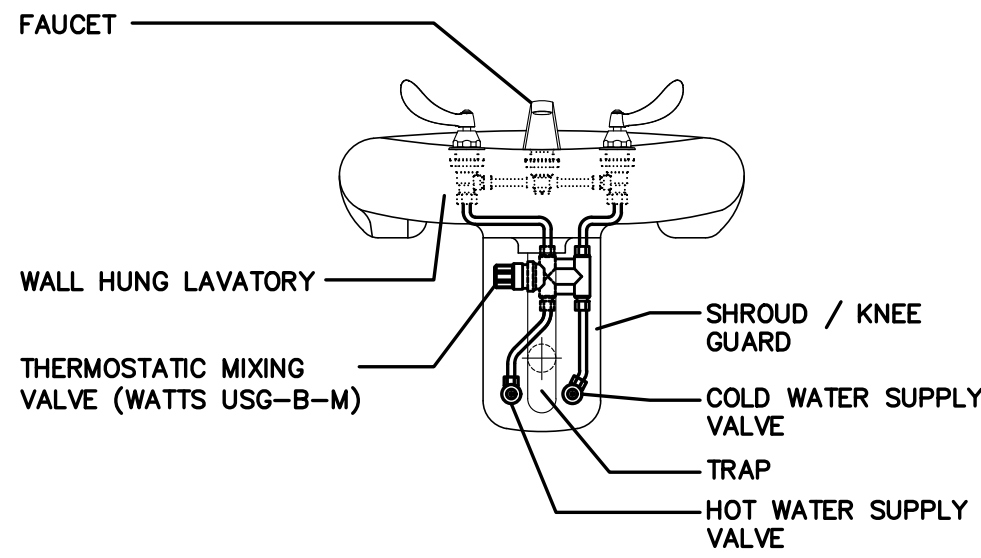
**ELECTRICAL**

1. Revised electrical specifications attached, revisions shown in red color.
2. Find attached revised electrical drawing E1.0-A-1 with changes shown as clouded.
3. Find attached revised electrical drawing E3.0-A-1 with changes shown as clouded.
4. Find attached revised electrical drawing E5.0-A-1 with changes shown as clouded.
5. Find attached revised electrical drawing E6.0-A-1 with changes shown as clouded.
6. Find attached revised electrical drawing E6.1-A-1 with changes shown as clouded.
7. Find attached revised electrical drawing E6.2-A-1 with changes shown as clouded.
8. Revised electrical specifications section 26 05 00 attached.
9. Revised electrical specifications section 26 05 06 attached.
10. Revised electrical specifications section 26 50 10 attached.
11. Revised electrical specifications section 28 13 10 attached..

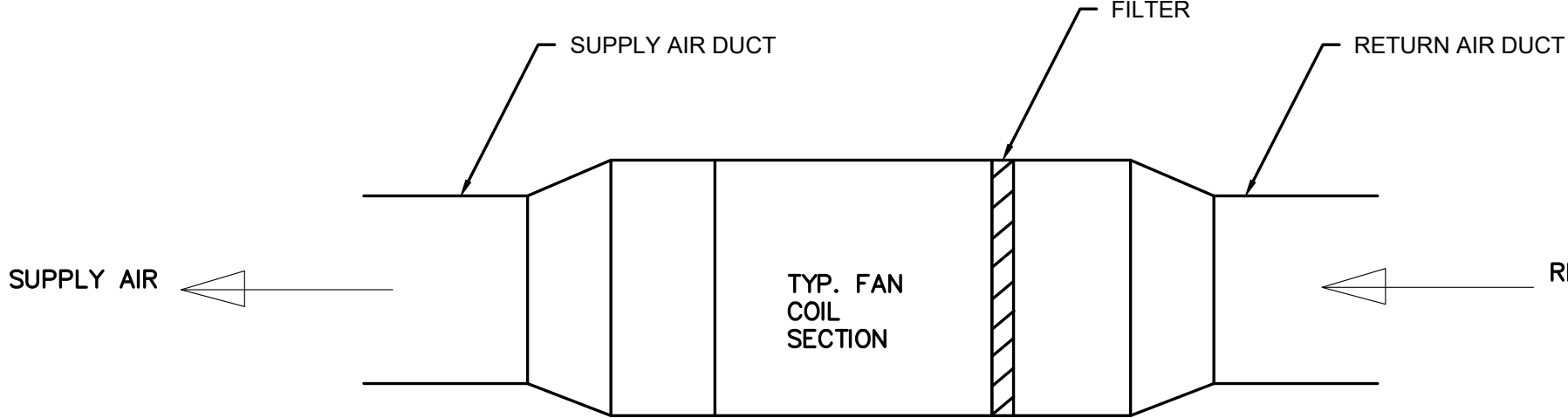
End of Addendum ME-1



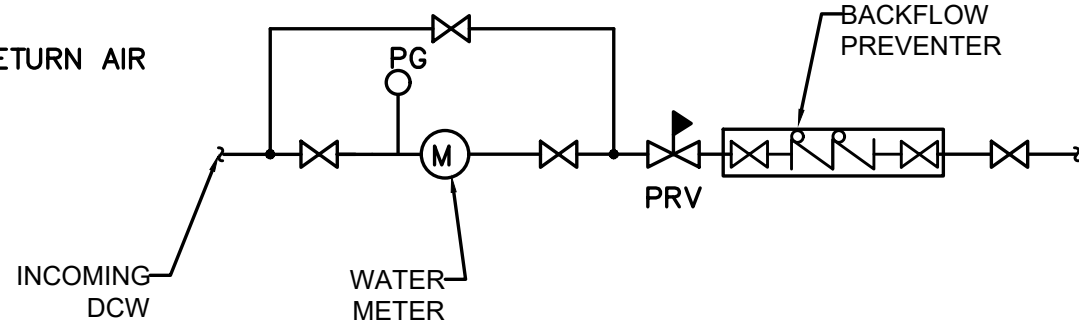
TITLE:  
DETAILS OF CLEANOUT TO GRADE



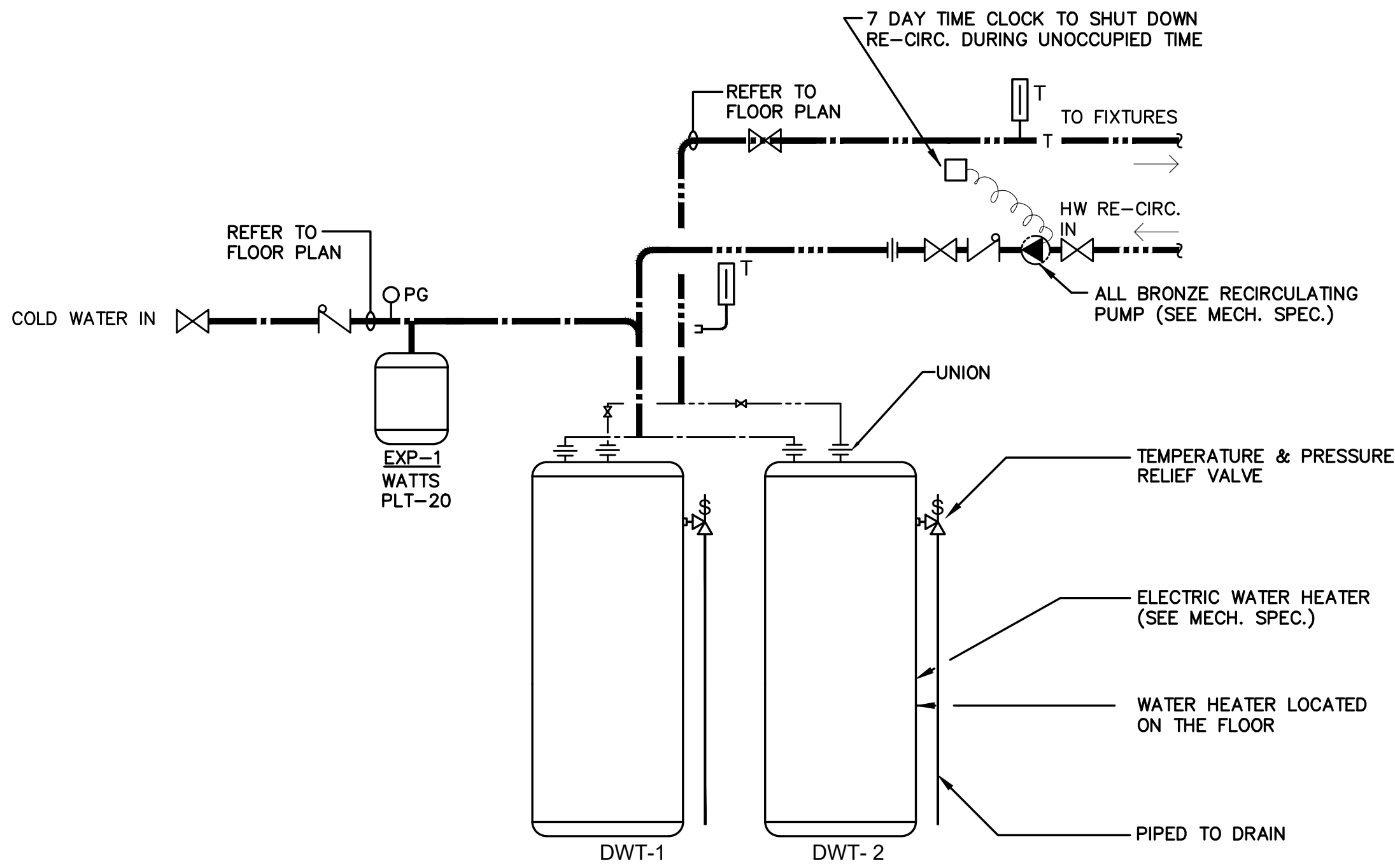
TITLE:  
DETAILS OF UNDER LAVATORY THERMOSTATIC MIXING VALVE



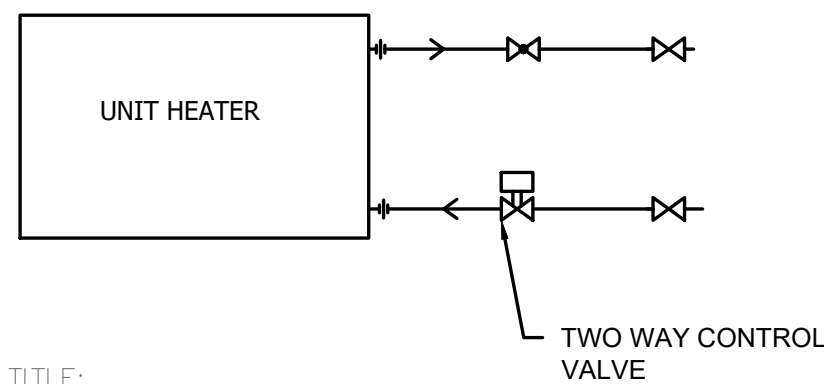
TITLE:  
DETAIL OF FAN COIL RETURN AIR FILTER



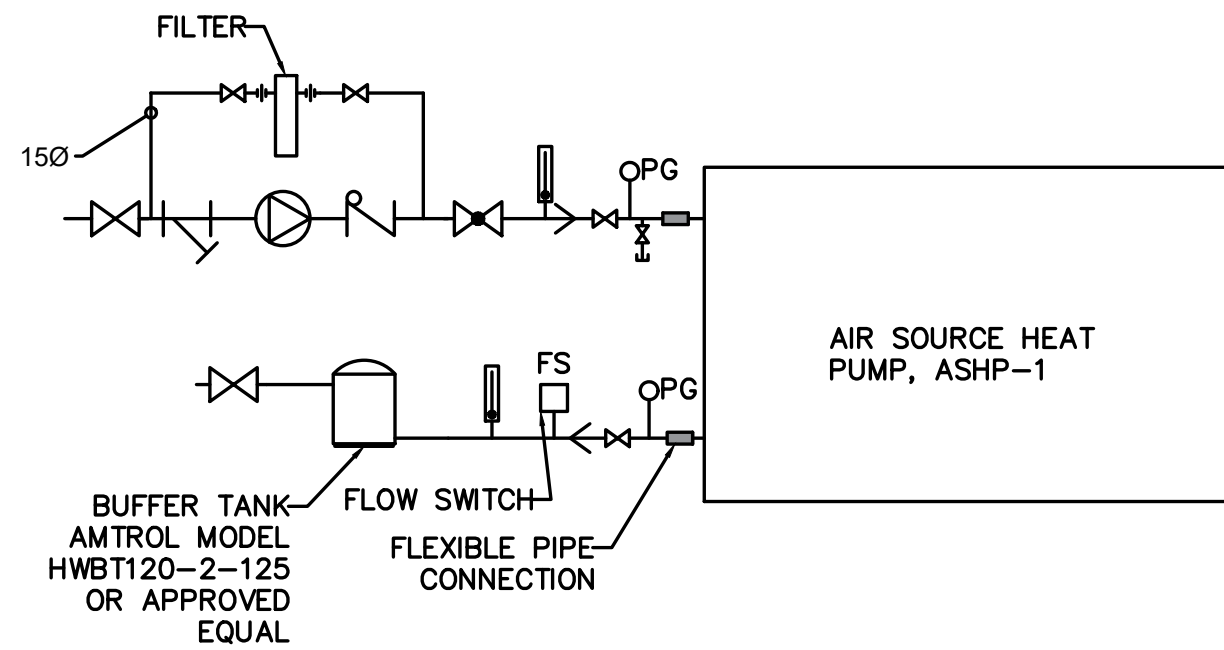
TITLE:  
DETAIL OF BACKFLOW PREVENTER AND WATER METER



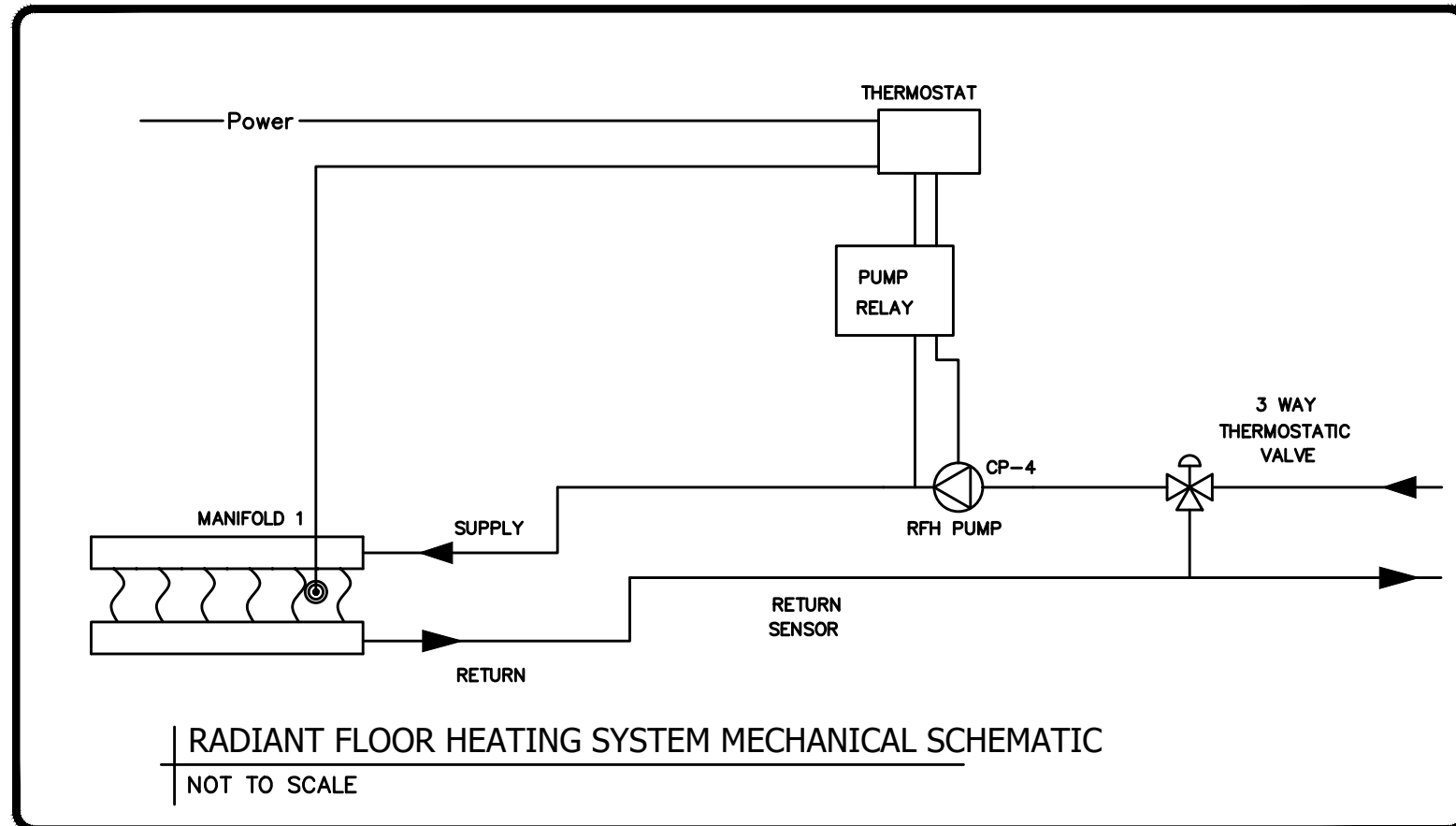
TITLE:  
SCHEMATIC OF ELECTRIC WATER HEATER



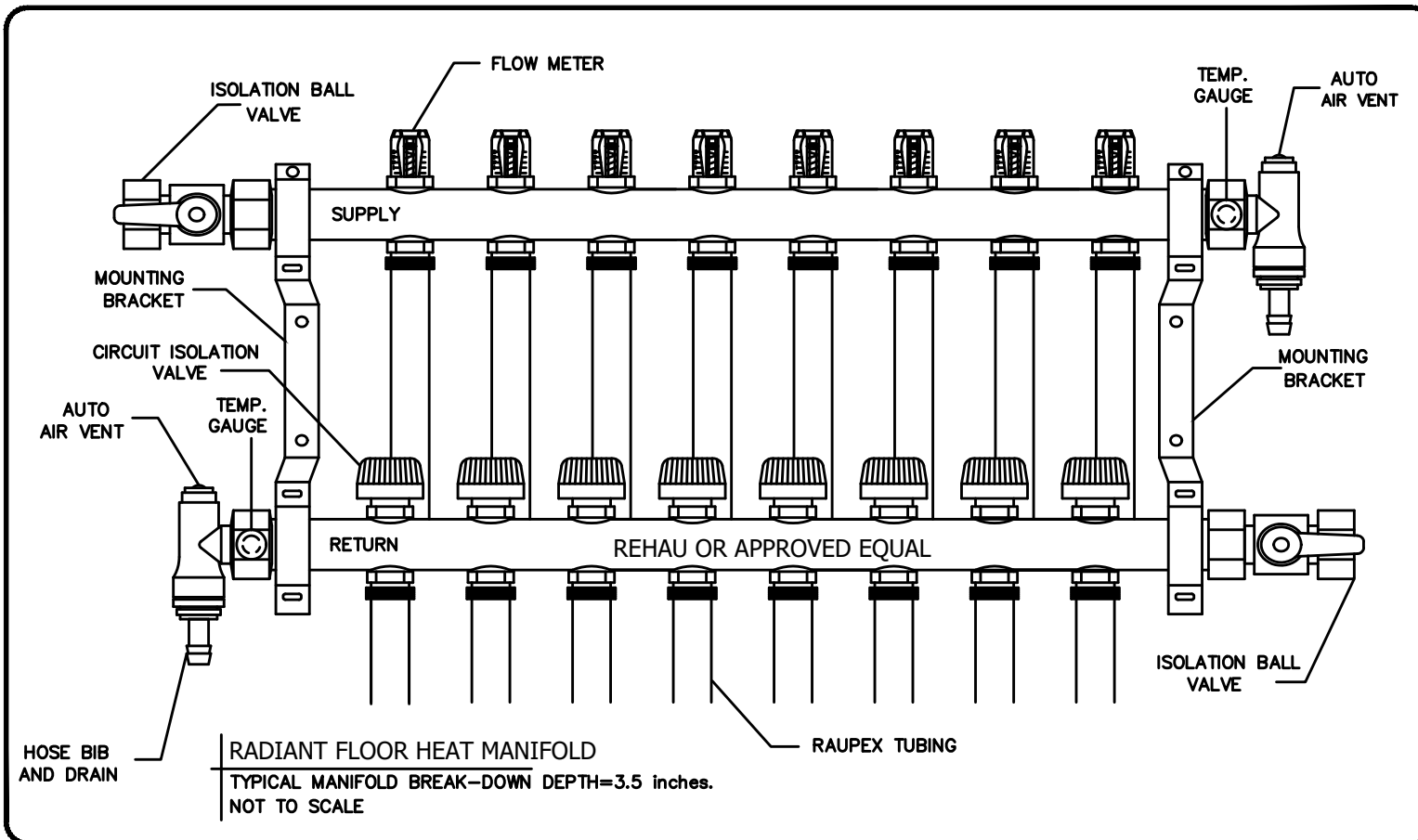
TITLE:  
UNIT HEATER PIPING DETAIL



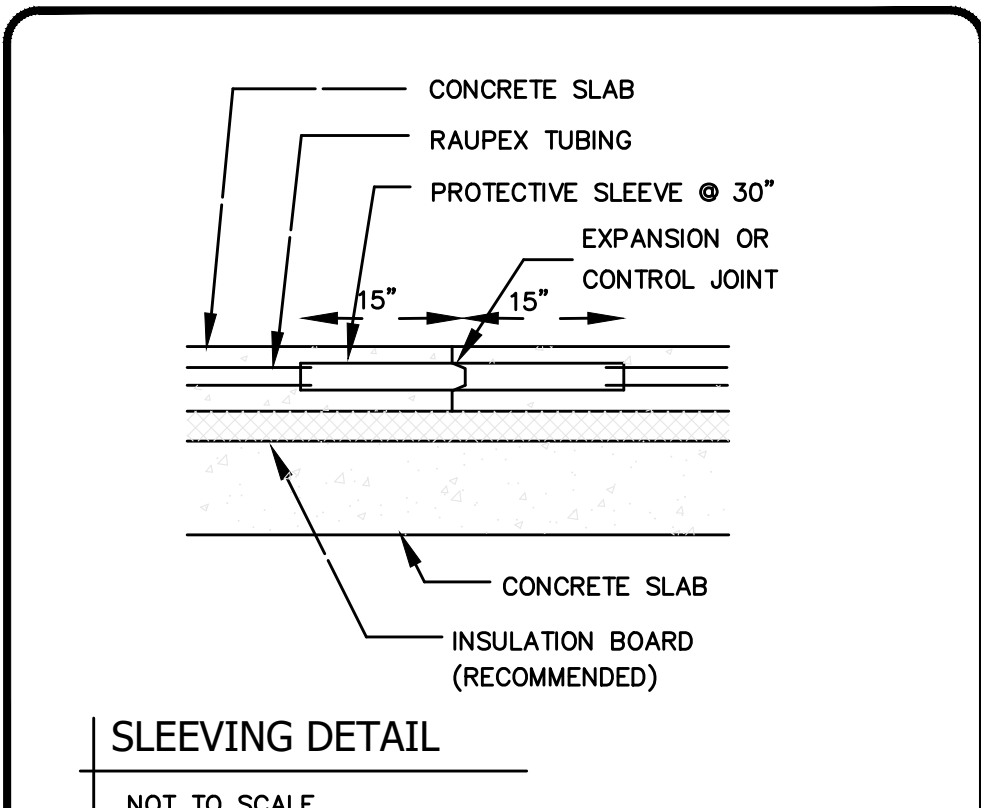
TITLE:  
TYPICAL PIPING DETAIL OF AIR SOURCE HEAT PUMP



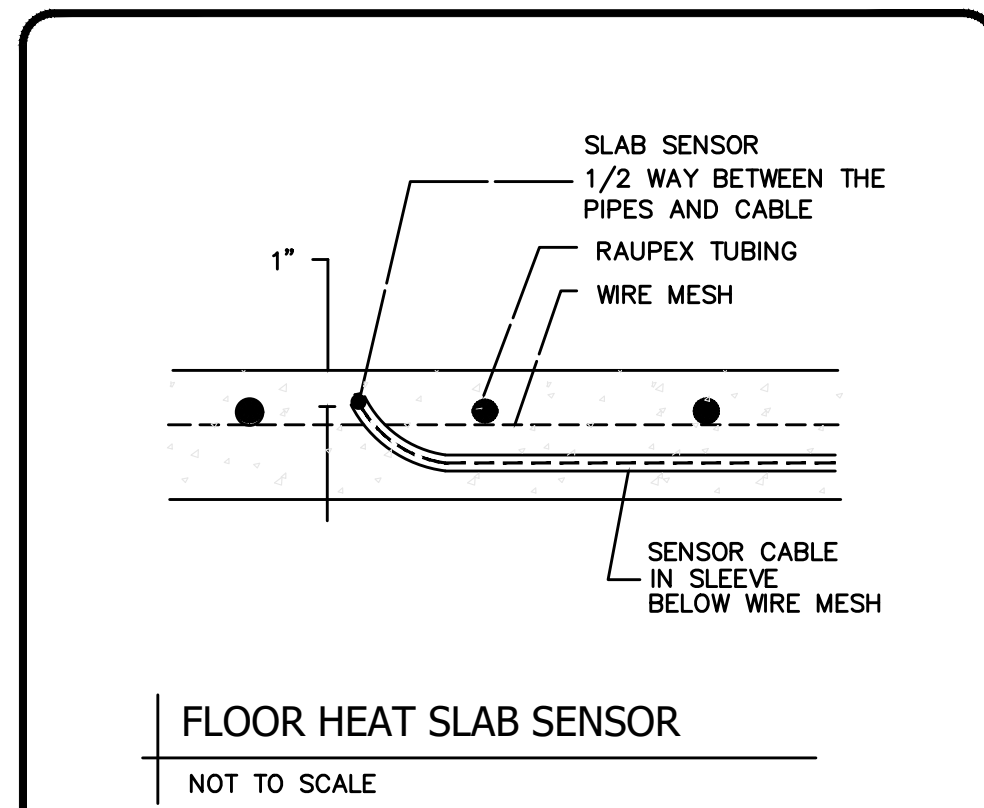
RADIANT FLOOR HEATING SYSTEM MECHANICAL SCHEMATIC  
NOT TO SCALE



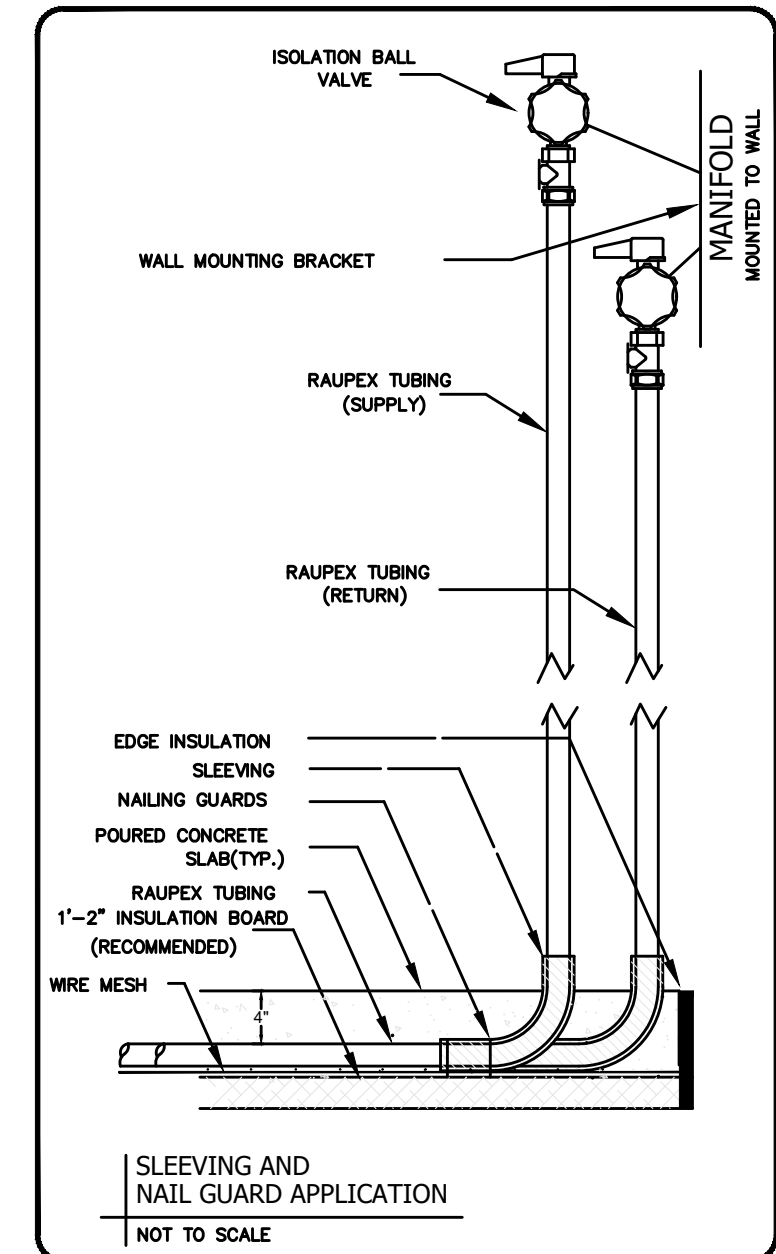
RADIANT FLOOR HEAT MANIFOLD  
TYPICAL MANIFOLD BREAK-DOWN DEPTH=3.5 inches.  
NOT TO SCALE



SLEEVING DETAIL  
NOT TO SCALE



FLOOR HEAT SLAB SENSOR  
NOT TO SCALE



SLEEVING AND NAIL GUARD APPLICATION  
NOT TO SCALE

[Required installation space (mm)]  
Figures indicate the minimum required installation space.

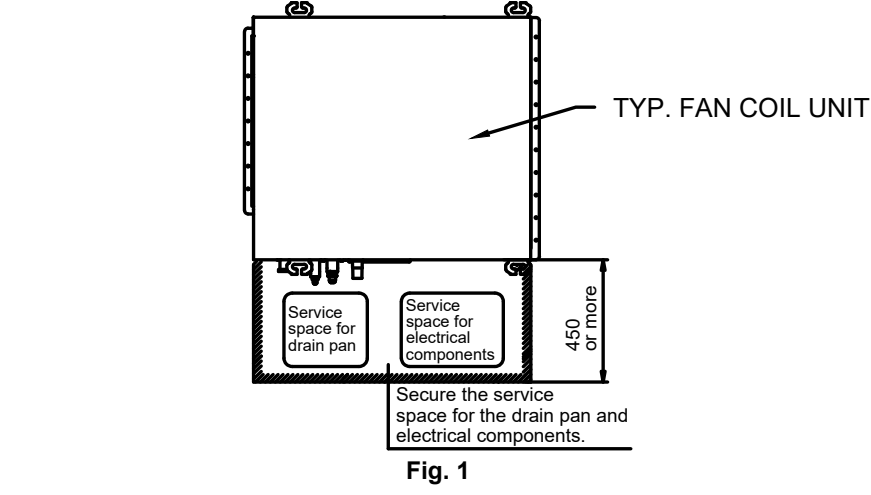


Fig. 1

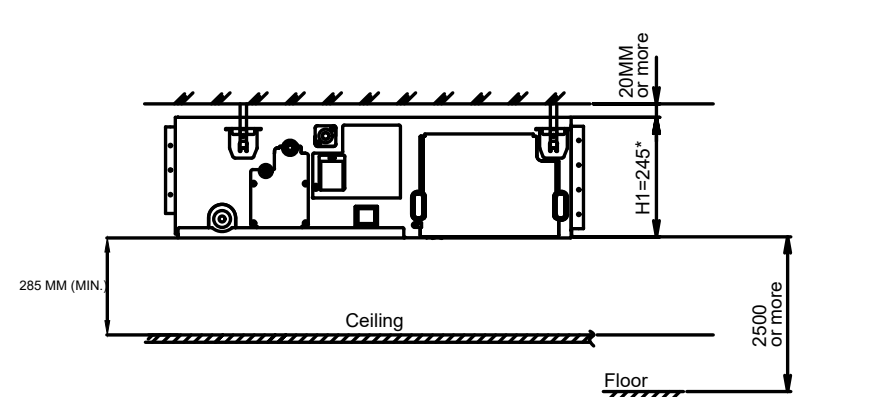


Fig. 2

\* \* Dimension H1 indicates the product height.

TITLE:  
FAN COIL CLEARANCES- DETAIL

The Contractor shall verify all dimensions prior to commencement of the work.  
All print and specifications are the property of the Architect and must be returned upon completion of the work.

#### ISSUE OR REVISION

No.	Description	Date
1	ISSUED FOR REVIEW	2023-06-22
2	ISSUED FOR REVIEW	2023-06-27
3	ISSUED FOR REVIEW	2023-07-06
4	ISSUED FOR 100% DESIGN DEVELOPMENT	2023-08-06
5	ISSUED FOR DD SIGN-OFF	2023-08-23
6	PROGRESS SET	2023-09-22
7	75% SUBMISSION	2023-10-13
8	ISSUED FOR BUILDING PERMIT	2023-11-07
9	95% SUBMISSION	2023-11-10
10	100% SUBMISSION	2023-11-24
11	100% SUBMISSION	2024-02-12
12	ISSUED FOR TENDER	2024-02-23
13	ISSUED FOR TENDER	2024-02-28
14	ISSUED FOR ADDENDUM ME-1	2024-03-12

## BARRIE FIRE STATION 6

845 MAPLEVIEW DRIVE EAST, BARRIE, ONTARIO

PROJECT :

PROFESSIONAL SEAL :

DWG TITLE :

MECHANICAL DETAILS-2



**REGAL CONSULTING ENGINEERS INC.**  
CONSULTING MECHANICAL & ELECTRICAL ENGINEERS  
208 Wycroft Road, Suite 200, Oakville, Ontario L6K 3S3  
PHONE: (905) 844-3913  
www.regal-eng.com

DATE : JUN 14, 2023

SCALE : NTS

DRAWN BY : AL

CHECKED BY : MA

DWG STATUS : TENDER

PROJECT No. : 2023-401

DRAWING No. : M7.1-A-1

REVISION

TITLE:  
DETAIL OF IN-FLOOR RADIANT HYDRONIC HEATING

MECHANICAL EQUIPMENT WIRING SCHEDULE																																		
DESCRIPTION				POWER				STARTER					ACCESSORIES			ISOLATING DEVICE		WIRED BY	CONTROL											INTERLOCKED WITH	INTERLOCKED BY	REMARKS		
NUMBER	ITEM NUMBER	ITEM	SUPPLIED BY	VOLTAGE	PHASE	H.P. / KW / AMPS	MOCF (A)	MANUAL	MAGNETIC	COMBINATION	CONTACTOR	CONTROL VOLTAGE	VFD	HAND-OFF/AUTO	ON/OFF SELECTOR	PILOT LIGHT	WEATHERPROOF DISCONNECT		DISCONNECT	MOTOR RATED SWITCH	OCCUPANCY SENSOR	VFD	TIMER	TIME CLOCK	R.A. THERMOSTAT	THERMOSTAT	SCR CONTROLLER	VARIABLE SPEED	WIRED BY					
1	DHWT-1	DOMESTIC HOT WATER TANK	23	208	3	18 KW	50A, 3P		✓					✓		✓		26	26						✓			25			INTEGRAL THERMOSTAT			
2	DHWT-2	DOMESTIC HOT WATER TANK	23	208	3	18 KW	50A, 3P		✓					✓		✓		26	26						✓			25			INTEGRAL THERMOSTAT			
3	CP-1	RE-CIRC. PUMP	23	120	1	1/25 HP	15A, 1P		✓					✓		✓		26	26			✓	✓					25			INTEGRAL TIMER AND TIME CLOCK			
4	CP-2A	RE-CIRC. PUMP	23	208	1	0.333 HP	15A, 2P		✓					✓		✓		26	26									25			PUMP CONTROLLED BY BAS. CONTROL WIRING BY DIV 25.			
5	CP-2B	RE-CIRC. PUMP	23	208	1	0.333 HP	15A, 2P		✓					✓		✓		26	26									25			PUMP CONTROLLED BY BAS. CONTROL WIRING BY DIV 25.			
6	CP-3	RE-CIRC. PUMP	23	208	1	0.124 HP	15A, 2P		✓					✓		✓		26	26									25			PUMP CONTROLLED BY BAS. CONTROL WIRING BY DIV 25.			
7	CP-4	RE-CIRC. PUMP	23	120	1	0.167 HP	15A, 1P		✓					✓		✓		26	26									25			PUMP CONTROLLED BY OEM CONTROLLER. CONTROL WIRING BY DIV 25.			
8	P-1	HYDRONIC HEATING PUMP	23	208	1	0.75 HP	15A, 2P		✓					✓		✓		26	26		Yes						Yes	25			FITTED WITH ECM. BAS WIRING BY DIV 25.			
9	P-2	HYDRONIC HEATING PUMP	23	208	1	0.75 HP	15A, 2P		✓					✓		✓		26	26		Yes						Yes	25			FITTED WITH ECM. BAS WIRING BY DIV 25.			
10	EF-1	EXH. FAN	23	120	1	1/6 HP	15A, 1P		✓					✓		✓		26	26	✓								26						
11	EF-2	EXH. FAN	23	120	1	86 WATTS	15A, 1P		✓					✓		✓		26	26		✓							26						
12	EF-3	EXH. FAN	23	120	1	86 WATTS	15A, 1P		✓					✓		✓		26	26		✓							26						
13	EF-4	EXH. FAN	23	120	1	86 WATTS	15A, 1P		✓					✓		✓		26	26		✓							26						
14	EF-5	EXH. FAN	23	120	1	86 WATTS	15A, 1P		✓					✓		✓		26	26		✓							26			CONTROLLED VIA BOILER			
15	EF-6	EXH. FAN	23	120	1	86 WATTS	15A, 1P		✓					✓		✓		26	26		✓							26						
16	EF-7	EXH. FAN	23	120	1	86 WATTS	15A, 1P		✓					✓		✓		26	26		✓							26						
17	EF-8	EXH. FAN	23	120	1	86 WATTS	15A, 1P		✓					✓		✓		26	26	✓								26						
18	EF-9	EXH. FAN	23	120	1	86 WATTS	15A, 1P		✓					✓		✓		26	26	✓								26						
19	DELETED																																	
20	EF-11	EXH. FAN	23	208	3	1.5 HP	15A, 3P		✓					✓		✓		26	26									25			CONTROLLED BY CO/NOx SENSOR.			
21	EF-12	EXH. FAN	23	120	1	86 WATTS	15A, 1P		✓					✓		✓		26	26						✓			23			BAS CONTROL WIRING BY DIV 25			
22	EF-13	EXH. FAN	23	120	1	86 WATTS	15A, 1P		✓					✓		✓		26	26						✓			23			BAS CONTROL WIRING BY DIV 25			
23	EF-14	EXH. FAN	23	120	1	86 WATTS	15A, 1P		✓					✓		✓		26	26						✓			23			BAS CONTROL WIRING BY DIV 25			
24	EF-15	EXH. FAN	23	120	1	86 WATTS	15A, 1P		✓					✓		✓		26	26						✓			23			BAS CONTROL WIRING BY DIV 25			
25	VRF-CU-1	VRF	23	208	3	15.1 MCA	35A, 3P		✓					✓		✓		26	26									23			BAS CONTROL WIRING BY DIV 25			
26	AWHP-1	AWHP	23	208	1	30 MCA	50A, 2P		✓					✓		✓		23	26									23			DIV 23 TO PROVIDE CONTROL WIRING BETWEEN FLOW SWITCH AND THE AWHP, AND BETWEEN TEMPERATURE SENSOR AND THE AWHP. BAS WIRING BY DIV 25.			
27	ERV-1	ENERGY RECOVERY VENTILATION	23	120	1	23.331 MCA	25A, 1P		✓					✓		✓		26	26		✓						YES	25			BUILT IN SPEED CONTROLLER. WIRED TO BAS BY DIV 25.			
28	SU-1	SU	23	208	1	0.5 MCA	15A, 2P											26	26						✓			23			BAS CONTROL WIRING BY DIV 25			
29	CU-1	CONDENSING UNIT	23	208	1	16.5 MCA	20A, 2P		✓					✓		✓		26	26						✓			23			BAS CONTROL WIRING BY DIV 25			
30	B-1	BOILER	23	208	3	17 KW	60A, 3P		✓					✓		✓		26	26									23			BAS CONTROL WIRING BY DIV 25			
31	B-2	BOILER	23	208	3	17 KW	60A, 3P		✓					✓		✓		26	26									23			BAS CONTROL WIRING BY DIV 25			

NOTES:

- ISOLATION AND CONTROL DEVICES MAY NOT BE SHOWN ON PLANS FOR CLARITY PURPOSES AND SHALL BE PROVIDED AS INDICATED. COORDINATE LOCATIONS ON SITE WITH OWNER AND CONSTRUCTION MANAGER.
- COORDINATE EXACT ELECTRICAL REQUIREMENTS FOR ALL EQUIPMENT WITH SHOP DRAWINGS AND ACTUAL NAMEPLATE DATA, REVISE ELECTRICAL REQUIREMENTS TO SUIT ACCORDINGLY.
- ALL CONTROLS VOLTAGE SHALL BE PROVIDED FROM A PROPER CONTROLS TRANSFORMER MOUNTED INTEGRALLY WITH THE CORRESPONDING DEVICE/STARTER.
- ON/OFF CONTROL SWITCH SHALL BE MOTOR RATED FOR LOAD.
- ALL STATUS CONTACTS FOR ALARM AND DEVICE STATE, ETC. SHALL BE INTEGRAL WITH CONTROL DEVICE ENCLOSURE UNLESS NOTED OTHERWISE.
- ALL MECHANICAL EQUIPMENT FEEDERS SHALL BE RATED TO MATCH THE OVERCURRENT PROTECTION DEVICE SPECIFIED AND/OR THE FLA RATING OF THE MOTOR.
- PROVIDE SUITABLE NORMALLY CLOSED (ENERGIZED) RELAY IN A RATED ENCLOSURE TO OPEN ON FIRE ALARM SIGNAL. MOUNT IN EQUIPMENT HOUSING AS DIRECTED BY DIV. 23 CONTRACTOR.
- PROVIDE PILOT LIGHTS AT OPERATOR CONTROL IN FACE OF ENCLOSURE AS FOLLOWS:  
GREEN - RUNNING  
RED - FAILED  
AMBER - MANUAL
- ABSENCE OF ANY ILLUMINATED LIGHTS INDICATES MOTOR IS OFF AND/OR AVAILABLE FOR USE.
- ALL FANS AND MOTORS SHALL BE PROVIDED C/W LOCAL ISOLATION SWITCH (NOT SHOWN ON DRAWINGS).
- TIME CLOCK CONTROL:  
ELECTRONIC CONTROL OFF AT USER SELECTABLE TIME ON ANY OR ALL DAYS OF THE WEEK. SET DEFAULT FOR OWNER AS PER THEIR DIRECTION. CONTROL SHALL BE CAPABLE OF 48 ON AND OFF SET POINTS WITH MINIMUM SETTINGS OF 1 MINUTE. CONTROL SHALL AUTOMATICALLY ADJUST FOR DAYLIGHT SAVINGS AND LEAP YEARS. BATTERY BACK-UP SHALL RETAIN SCHEDULE DURING POWER OUTAGE. TORK MODEL EDGL100 OR APPROVED EQUAL
- DIVISION 23 - MECHANICAL; DIVISION 25 - BUILDING AUTOMATION SYSTEM, DIVISION 26 - ELECTRICAL.

The Contractor shall verify all dimensions prior to commencement of the work. All print and specifications are the property of the Architect and must be returned upon completion of the work.

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10	100% SUBMISSION	2023-11-24
11	100% SUBMISSION	2024-02-12
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13	ISSUED FOR TENDER	2024-02-26
14	ISSUED FOR ADDENDUM ME-1	2024-03-12

PROJECT :  
**BARRIE FIRE STATION 6**

845 MAPLEVIEW DRIVE EAST, BARRIE, ONTARIO

PROFESSIONAL SEAL :

DWG TITLE :

MECHANICAL EQUIPMENT  
WIRING SCHEDULE



**REGAL CONSULTING ENGINEERS INC.**  
CONSULTING MECHANICAL & ELECTRICAL ENGINEERS  
208 Wycroft Road, Suite 200, Oakville, Ontario L6K 3S3  
PHONE: (905)444-3913  
www.regal-eng.com

DATE :  
**JUN 14, 2023**

SCALE :  
**NTS**

DRAWN BY:  
**AL**

CHECKED BY :  
**MA**


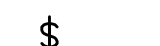
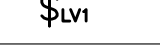

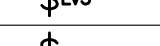
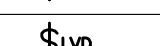




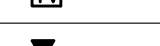
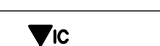




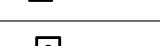
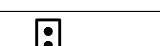
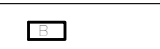
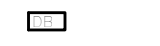






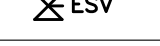



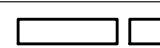

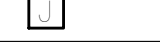
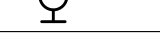
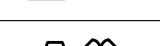
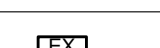
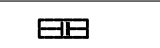


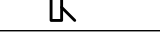
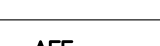
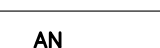


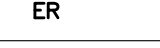
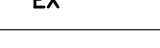
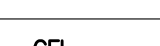


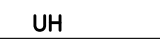
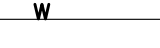
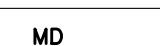




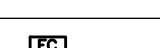
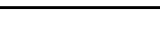


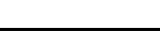


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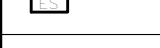

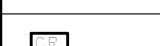

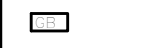
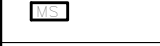

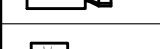
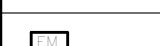




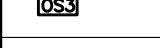
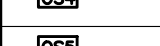
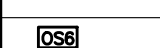
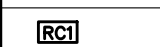
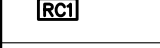
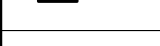


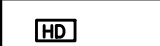

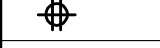
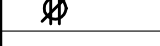
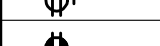

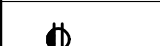
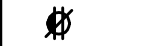
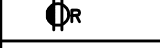
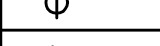
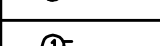
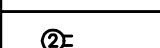

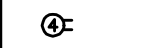
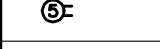
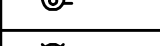




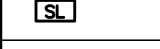
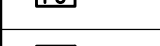
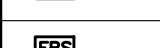
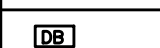
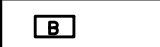














PROJECT No. :  
**2023-401**

DRAWING No. :  
**M7.2**

REVISION



LEGEND	
	FIXTURE TYPE "A1"
	15A, 125V SINGLE POLE SWITCH, \$ (TWO POLE), S <sub>1</sub> (3-WAY), \$ <sub>1</sub> (4-WAY), \$ <sub>1</sub> (KEY OPERATED), \$ <sub>1</sub> (DIMMER), \$ <sub>1</sub> (C/W PILOT LIGHT), \$ <sub>1</sub> (LOW VOLTAGE), \$ (TIMER), \$ <sub>1</sub> (OCCUPANCY SENSOR SWITCH), \$ (GANGED SWITCHES)
	DIGITAL ONE BUTTON LIGHT SWITCH, WATT STOPPER LMSW-101
	DIGITAL TWO BUTTONS LIGHT SWITCH, WATT STOPPER LMSW-102
	DIGITAL THREE BUTTONS LIGHT SWITCH, WATT STOPPER LMSW-103
	DIGITAL FOUR BUTTONS LIGHT SWITCH, WATT STOPPER LMSW-104
	DIGITAL DIMMING WALL SWITCH LIGHT, WATT STOPPER LMDW-101.
	ELECTRIC HEATING EQUIPMENT
	ELECTRICAL PANEL
	NON-FUSED DISCONNECT SWITCH
	WEATHERPROOF DISCONNECT SWITCH
	TELEVISION OUTLET C/W 27MM CONDUIT.
	TELEPHONE OUTLET C/W 27MM CONDUIT.
	INTERCOM UNIT OUTLET C/W 21MM CONDUIT.
	TELEPHONE OUTLET MOUNTED AT 1500MM A.F.F C/W 27MM CONDUIT.
	TELEPHONE/DATA OUTLET C/W 27MM CONDUIT.
	DATA OUTLET C/W 27MM CONDUIT.
	LOCAL SOUND SYSTEM SPEAKER C/W 16MM CONDUIT TO LOCAL SOUND SYSTEM.
	MICROPHONE OUTLET C/W 16MM CONDUIT.
	DOOR OPERATOR
	PUSH BUTTON (OVERHEAD DOOR)
	DOOR BELL BUZZER
	DOOR BELL PUSH BUTTON
	SMOKE DETECTOR – AREA TYPE
	HEAT DETECTOR – FIX TEMPERATURE 57°C
	FIRE ALARM BELL (150mm DIAMETER UNLESS OTHERWISE NOTED)
	FIRE ALARM HORN/STORBE
	FIRE ALARM PULLSTATION
	FIRE ALARM CONTROL PANEL
	FIRE ALARM ANNUNCIATOR PANEL
	ELECTRICALLY SUPERVISED VALVE
	FLOW SWITCH
	ELECTRIC HEATING EQUIPMENT
 	SURFACE OR RECESS MOUNTED LIGHTING FIXTURE. LETTER DENOTES TYPE
 	LIGHTING FIXTURE ON NIGHT LIGHT CIRCUIT
 	SURFACE OR RECESS MOUNTED LIGHTING FIXTURE. LETTER DENOTES TYPE
	DIRECT HARDWIRE CONNECTION
	JUNCTION BOX
	WALL MOUNTED LIGHTING FIXTURE. LETTER DENOTES TYPE
	OCCUPANCY SENSOR
 	EMERGENCY LIGHTING FIXTURE
	EXIT SIGN
	BATTERY
 	EMERGENCY LIGHTING FIXTURE AND BATTERY
 	EMERGENCY LIGHTING FIXTURE, BATTERY AND EXIT SIGN
	SECURITY MOTION SENSOR
	ABOVE COUNTER
	ABOVE FINISHED FLOOR
	FIRE ALARM ANNUNCIATOR
	BASEBOARD HEATER
	CIRCUIT BREAKER
	EXISTING TO BE RELOCATED
	EXISTING TO REMAIN
	FORCED-AIR HEATER
	EQUIPMENT SO NOTED TO BE SUPPLIED WITH GROUND FAULT CIRCUIT INTERRUPT
	JUNCTION BOX
	RELAY WITH AUXILIARY CONTACTS
	UNIT HEATER
	WALL MOUNT – VERIFY HEIGHT
	EQUIPMENT SO NOTED TO BE SUPPLIED WITH THE MANUFACTURER'S WEATHER-PROOF OPTION(S)
	MOTORIZED DAMPER
	CEILING MOUNTED SPEAKER
	MOTOR CONNECTION (SINGLE OR THREE PHASE)
	CEILING FAN SPEED CONTROLLER
	WALL MOUNTED SPEAKER
	VOLUME CONTROL
	FIXED AXIS WIDE ANGLE CAMERA

	OUTLET FOR SECURITY DOOR STRIKE
	OUTLET FOR SECURITY DOOR CONTACT
	FLOOR MOUNTED DATA/TEL OUTLET
	OUTLET FOR SECURITY CARD READER
	OUTLET FOR SECURITY ARM/DISARM KEY PAD
	OUTLET FOR SECURITY GLASS BREAK SENSOR
	OUTLET FOR SECURITY MOTION SENSOR
 	OUTLET FOR SECURITY SIREN/ALARM HORN
 	OUTLET FOR CLOSED CIRCUIT TV SECURITY CAMERA
	OUTLET FOR A/V MICROPHONE.
	EMERGENCY PUSH BUTTON FOR GAS SOLENOID VALVE
 	SMOKE & CARBON MONOXIDE ALARM BY KIDDE OR APPROVED EQUIVALENT. (120V)
 	MICROPHONE OUTLET C/W 16MM CONDUIT
	CEILING MOUNT DUAL TECH OCCUPANCY SENSOR, WATT STOPPER LMDC-100.
	CEILING MOUNT PIR OCCUPANCY SENSOR, WATT STOPPER LMPC-100.
	CEILING MOUNT ULTRA SONIC OCCUPANCY SENSOR, WATT STOPPER LMUC-100.
	WALL CORNER MOUNT DUAL TECH OCCUPANCY SENSOR, WATT STOPPER LMDX-100.
	WALL MOUNT DUAL TECH OCCUPANCY SENSOR, WATT STOPPER LMDX-102.
	WALL MOUNT PIR OCCUPANCY SENSOR, WATT STOPPER PW-100
	DIGITAL ROOM CONTROLLER WITH SINGLE RELAY, WATT STOPPER LMRC-101
	DIGITAL ROOM CONTROLLER WITH TWO RELAYS, WATT STOPPER LMRC-102
	DIGITAL UNIVERSAL DIMMING ROOM CONTROLLER WITH ONE RELAYS, WATT STOPPER LMRC-221
	DIGITAL UNIVERSAL DIMMING ROOM CONTROLLER WITH TWO RELAYS, WATT STOPPER LMRC-222
	GAS SOLENOID VALVE
	HAND DRYER
	15A, 120V DUPLEX RECEPTACLE.
	15A, 120V HALF SWITCHED DUPLEX RECEPTACLE.
	15A, 120V DUPLEX RECEPTACLE MOUNTED ABOVE COUNTER.
	20A, 120V T-SLOT DUPLEX RECEPTACLE.
	15A, 120V ISOLATED GROUND DUPLEX RECEPTACLE WITH SEPARATE NEUTRAL & GROUND WIRE CIRCUIT.
	15A, 120V ISOLATED GROUND DUPLEX RECEPTACLE WITH SEPARATE NEUTRAL & GROUND WIRE PER CIRCUIT MOUNTED ABOVE COUNTER.
	15A, 120V DUPLEX GROUND FAULT INTERRUPTER RECEPTACLE.
	15A, 120V DUPLEX GROUND FAULT INTERRUPTER RECEPTACLE MOUNTED ABOVE COUNTER OR AT HEIGHT.
	15A/20A CEILING MOUNT T-SLOT GF1 CORD REEL RECEPTACLE
	15A, 120V SINGLE RECEPTACLE.
	50A, 250V 3 WIRE RANGE RECEPTACLE.
	30A, 208V, 2P SINGLE RECEPTACLE.
	20A, 120V SINGLE RECEPTACLE.
	20A, 208V, 3ø SINGLE RECEPTACLE.
	15A, 208V, 1ø SINGLE RECEPTACLE.
	15A, 208V, 3ø SINGLE RECEPTACLE.
	40A, 208V, 3ø SINGLE RECEPTACLE.
	TELEVISION OUTLET C/W 21MM CONDUIT.
 	GENERATOR REMOTE CONTROL PANEL
	OUTLET FOR PUSH TO LOCK
	OUTLET FOR REQUEST FOR EXIT
	OUTLET FOR PUSH TO UNLOCK
	STROBE LIGHT FOR EMERGENCY RESPONSE SYSTEM
	PATIENT UNIT FOR EMERGENCY RESPONSE SYSTEM
	OCCUPIED LIGHT FOR EMERGENCY RESPONSE SYSTEM
	EMERGENCY RESPONSE SYSTEM
	DOOR BELL
	BUZZER
 	STARTER COMBINATION WITH DISCONNECT SWITCH

LIGHTING FIXTURE SCHEDULE						
TYPE	DESCRIPTION	MAKE/MODEL OR APPROVED EQUIVALENT	VOLT	LAMP		
				WATT	TYPE	COL.
F1	COLUMBIA LJ724 2X4 DIMMABLE LED, 4792 LUMEN	COLUMBIA MODEL LJ724-40MLB-FSA12-EDU OR APPROVED EQUIVALENT BY PEEPLESS, METALUMEN, GE OR PHILLIPS OR OTHER APPROVED EQUAL.	120-277	38	LED	4000
T1	GASKETED SURFACE MOUNTED FIXTURE, 4' , 4533 LUMEN AND IP65 RATED.	COLUMBIA LXEM4-40ML-RFA-ED347 OR EQUIVALENT BY PEEPLESS, METALUMEN OR PHILLIPS OR OTHER APPROVED EQUAL.	120-277	42	LED	4000
F6	4' UNDERCABINET GM LIGHTING LTAB DIMMABLE HIGH OUTPUT LED LINEAR LIGHTBAR	GM 2X LTAB-H-24 WITH LTOWP-12 CONNECTOR AND LTH-16POWER SUPPLY WITH LTW-24-WP CONNECTOR EQUIVALENT BY COLUMBIA AND PHILLIPS OR OTHER APPROVED EQUAL.	120	10.4	LED	4000
HB	DECORATIVE LED HIGHBAY, 19614 LUMENS	COLUMBIA SAV-MM-40-8-WA22-COL-U-XX OR EQUIVALENT BY PEEPLESS, COLUMBIA OR GE OR OTHER APPROVED EQUAL.	120-277	177	LED	4000
CB	6'LED DOWN LIGHT, WHITE TRIM, 2000 LUMEN	PRESCOLITE LFR-6RD-M-20L-35K8-WD-DM1 / LFR-6RD-T-S OR APPROVED BY PEEPLESS, METALUMEN OR GE OR OTHER APPROVED EQUAL.	120-277	14.6	LED	4000
MA	LED FULL CUT OFF WALL PACK, DIE CAST ALUMINUM HOUSING AND DOOR	EXO LNC2-48L35-SK7-3-UNV EQUIVALENT BY COOPER, CANLYTE OR GE OR OTHER APPROVED EQUAL.	120-277	35	LED	4000
MC	6" LED POT LIGHT, WET LOCATIONS, 1500 LUMEN	PRESCOLITE LFR-6RD-M-15L-40K9-WD-DM1 / LFR-6RD-T-S EQUIVALENT BY PEEPLESS, METALUMEN OR PHILLIPS OR OTHER APPROVED EQUAL.	120	11.4	LED	4000
PA	LIGHTING STANDARD C/W 3.65M HIGH STEEL TAPERED POLE ON 750MM ABOVE GRADE CONCRETE BASE, POLE & LUMINAIRES (BLACK) FINISH AS PER ARCHITECT SELECTION.	BEACON MODEL # URB-MAR-26-80L90-4K7-UNV-3 WITH NEIGHBOR SHIELD OR APPROVED EQUIVALENT BY COOPER, CANLYTE & HUBBELL OR OTHER APPROVED EQUAL.	120-277	110	LED	4000
J	4-VANITY LIT FIXTURE, 3700 LUMEN	VISIONEERING LCAD48-LED84K037LUNV EQUALS: PEEPLESS-ELECTRIC, LITHONIA AND GE OR OTHER APPROVED EQUAL.	120-277	43	LED	4000
JA	WALL SCONCES	674-31-W-L3/B27-UNV-ALP BY COOPER OR APPROVED EQUIVALENT.	120-277	19	LED	3000

GENERAL NOTES

- DO NOT SCALE DRAWINGS FOR INSTALLATION PURPOSES. ALL MEASUREMENTS ARE TO BE OBTAINED FROM ARCHITECTURAL PLANS, ELEVATIONS, AND FROM FIELD MEASUREMENTS.
- DIVISION 16 SHALL REFER TO ARCHITECTURAL & MECHANICAL DRAWINGS FOR ALL SCOPE OF WORK OF DIVISION 16 WHICH ARE RELATED TO OTHER TRADES.
- ELECTRICAL AND MECHANICAL TRADES SHALL WORK IN CONJUNCTION WITH ONE ANOTHER, SO AS TO AVOID INTERFERENCES AND TO MAINTAIN MINIMUM CLEARANCES BETWEEN DUCTWORK, PIPING, CONDUIT AND LIGHTING FIXTURE.
- REVIEW ARCHITECTURAL DRAWINGS FOR FIRE RATED WALLS, AND CEILING AND PROVIDE NECESSARY FIRE STOPPING AS REQUIRED.
- WORK IN CONJUNCTION WITH REFLECTED CEILING PLANS WHEN LOCATING LIGHT FIXTURES.
- WORK IN CONJUNCTION WITH MECHANICAL DIFFUSER LAYOUT WHEN LOCATING SMOKE DETECTORS.
- POWER AND CONTROL WIRING SHALL RISE TO ROOF TOP EQUIPMENT WITHIN CURB OF UNIT, WHEN OTHERWISE APPROVED BY THE CONSULTANT.
- SPARE.
- PROVIDE AND INCLUDE FOR ALL NECESSARY ACCESSORIES AND FITTINGS FOR A FULL AND COMPLETE INSTALLATION OF LIGHTING FIXTURES, INCLUDING CEILING TRIMS AND FRAMES TO SUIT CEILING. REFER TO ARCHITECTURAL CEILING SCHEDULE FOR CEILING TYPES.
- LIGHTING BALLASTS AND DIMMERS SHALL BE COMPATIBLE WITH THE LIGHTING SOURCE AND LIGHTING FIXTURES BEING CONTROLLED AND INSTALLED.
- PROVIDE EACH ITEM MENTIONED OR INDICATED OF QUALITY AND SUBJECT TO QUALIFICATIONS NOTED; PERFORM ACCORDING TO CONDITIONS STATED EACH OPERATIONS STATED. EACH OPERATION PRESCRIBED ; AND PROVIDE THEREFORE ALL LABOR, MATERIAL, EQUIPMENT, INCIDENTALS AND SERVICES REQUIRED TO COMPLETE THE INSTALLATION.
- SCHEDULE AND COORDINATE ALL WORK WITH OTHER TRADES.
- CONTRACTOR SHALL BALANCE CIRCUIT LOADS AS CLOSELY AS POSSIBLE.
- CONTRACTOR SHALL PERFORM VOLTAGE DROP CALCULATIONS FOR ALL BRANCH CIRCUITS OF LIGHTING, POWER AND FEEDERS AND SHALL MAINTAIN VOLTAGE DROP WITHIN PERMISSIBLE LIMITS AS PER OESC REQUIREMENTS AND PROVIDE PROPER WIRE SIZES ACCORDINGLY PRIOR TO COMMENCING ROUGH-IN INSTALLATION. THE VOLTAGE DROP CALCULATIONS SHALL BE BASED ON MAXIMUM CIRCUIT IMPACT.
- ALL CONDUITS BACKBOXES AND ROUGH-IN FOR LOW VOLTAGE SYSTEMS SHALL BE PROVIDED BY ELECTRICAL CONTRACTOR.
- DIVISION 16 TO PROVIDE CONDUIT & WIRING FOR ALL ELECTRICAL & MECHANICAL EQUIPMENT FOR A COMPLETE OPERATIONAL SYSTEM.
- ELECTRICAL CONTRACTOR IS RESPONSIBLE FOR ALL OF THE COORDINATION WORKS REGARDING HYDRO NEW INCOMING SERVICE. ELECTRICAL CONTRACTOR SHALL COMPLY WITH HYDRO REQUIREMENT AND SHALL PROVIDE ALL NECESSARY MATERIAL & LABOR REQUIRED ACCORDINGLY.
- ELECTRICAL CONTRACTOR IS RESPONSIBLE TO PROVIDE ALL THE ROUGH INS REQUIRED FOR DIVISION 15 SCOPE OF WORK (UNLESS NOTED OTHERWISE) INCLUDING CONDUITS, BACK BOXES, JUNCTION BOXES, PULL WIRES, ETC. ELECTRICAL CONTRACTOR SHALL REFER TO DIVISION 15 DRAWINGS AND SPECS FOR MORE INFORMATION AND SHALL INCLUDE ALL COSTS ASSOCIATED RELATED TO THE ROUGH INS IN HIS TENDER PRICE.
- REFER TO DOOR HARDWARE SCHEDULE FOR ROUGH IN REQUIREMENT AND PROVIDE ALL NECESSARY FOR FULL OPERATIONAL SYSTEM TO COMPLY ACCORDINGLY.
- ELECTRICAL CONTRACTOR SHALL PROVIDE SUPPORTING SYSTEM TO SUPPORT ALL LIGHT FIXTURES ONLY FROM THE JOIST OR STEEL BEAMS ( NOT FROM THE ROOF DECK).
- ALL ELECTRICAL EQUIPMENT THAT IS SUSPENDED SHALL BE SUPPORTED BY A SYSTEM THAT IS CERTIFIED BY THE MANUFACTURER TO CARRY THE LOADS OF THE EQUIPMENT. IF NO SYSTEM IS RECOMMENDED BY THE MANUFACTURER, THE CONTRACTOR SHALL PROVIDE A DESIGN STAMPED BY A P.ENG. THESE ITEMS SHALL INCLUDE, BUT NOT LIMITED TO LIGHTING, TRANSFORMER, HEATERS, AND ALL SIMILAR ELECTRICAL EQUIPMENT. INSTALL IN ACCORDANCE WITH MANUFACTURER'S OR P.ENG DESIGN.
- PROVIDE 3/4" EMT CONDUIT FROM EACH VOICE/DATA OUTLET TO THE PLYWOOD BACKBOARD LOCATED IN THE MECH/ELEC ROOM.
- PROVIDE 3/4" EMT CONDUIT FROM PUBLIC ADDRESS SPEAKER TO THE PLYWOOD BACKBOARD LOCATED IN THE MECH/ELEC ROOM.
- PROVIDE STAINLESS STEEL COVER PLATES FOR ALL WIRING DEVICES, LIKE SWITCHES, POWER RECEPTACLES AND COVER PLATES.
- COORDINATION & ARC FLASH STUDY SHOP DRAWINGS SHALL BE PROVIDED FOR THE CONSULTANT'S REVIEW PRIOR TO MANUFACTURING OF ELECTRICAL PANELS INCLUDING MAIN SWITCHBOARD & DISTRIBUTION PANELS.
- THROUGHOUT DIVISION 16 ARE LIST OF "ALTERNATE EQUIPMENT" OR APPROVED EQUIVALENT MANUFACTURERS ACCEPTABLE TO CONSULTANT IF THEIR PRODUCT MEETS CHARACTERISTICS OF SPECIFIED DESCRIBED EQUIPMENT/PRODUCTS. IT IS RESPONSIBILITY OF THIS DIVISION TO ENSURE "ALTERNATE EQUIPMENT" OR APPROVED EQUIVALENT COMPLIES WITH THE SPECIFIED DESCRIBED EQUIPMENT/PRODUCTS. ALL ADDITIONAL WORK REQUIRED FOR AND ASSOCIATED WITH ALTERNATE EQUIPMENT SHALL BE PROVIDED WITHOUT CHANGE IN CONTRACT AMOUNT.
- COORDINATE ON SITE WITH THE GENERATOR MANUFACTURER AND OTHER TRADES BEFORE COMMENCEMENT OF THE GENERATOR INSTALLATION WORK AND THEN PROCEED ACCORDINGLY.
- PROVIDE ADDITIONAL ALARM SIGNALS C/W ALL MATERIAL AND LABOR FOR FULLY OPERATIONAL SYSTEM) AT THE GENERATOR CONTROL PANEL AND THE REMOTE ANNUNCIATOR PANEL TO INCLUDE THE FOLLOWING ALARM SIGNALS:
  - ATS ON BYPASS MODE
  - ATS ON EMERGENCY POWER
  - GENERATOR GAS SHUT OFF VALVE.

ELECTRICAL DRAWING LIST

- E1.0 ELECTRICAL LEAD SHEET
- E2.0 PROPOSED SITE PLAN
- E3.0 PROPOSED POWER & COMMUNICATION FLOOR PLAN
- E3.1 PROPOSED POWER ROOF PLAN
- E4.0 PROPOSED LIGHTING FLOOR PLAN
- E5.0 PROPOSED FIRE ALARM SYSTEM FLOOR PLAN
- E5.1 PROPOSED PORTABLE FIRE EXTINGUISHERS
- E6.0 SINGLE LINE DIAGRAM & PANEL SCHEDULES
- E6.1 SINGLE LINE DIAGRAM & PANEL SCHEDULES WITH PHOTOVOLTAIC PANELS
- E6.2 MECHANICAL EQUIPMENT WIRING SCHEDULE
- E7.0 ELECTRICAL DETAILS –1
- E7.1 ELECTRICAL DETAILS –2
- E9.0 PROPOSED SECURITY SYSTEM FLOOR PLAN
- E10.0 PROPOSED PA SYSTEM FLOOR PLAN

The Contractor shall verify all dimensions prior to commencement of the work. All print and specifications are the property of the Architect and must be returned upon completion of the work.

ISSUE OR REVISION

No.	Description	Date
1	ISSUED FOR REVIEW	2023-06-22
2	ISSUED FOR REVIEW	2023-06-27
3	ISSUED FOR REVIEW	2023-07-06
4	ISSUED FOR 100% DESIGN DEVELOPMENT	2023-08-06
5	ISSUED FOR DD SIGN-OFF	2023-08-23
6	PROGRESS SET	2023-09-22
7	75% SUBMISSION	2023-10-13
8	ISSUED FOR BUILDING PERMIT	2023-11-01
9	95% SUBMISSION	2023-11-10
10	100% SUBMISSION	2023-11-24
11	100% SUBMISSION	2024-02-12
12	ISSUED FOR TENDER	2024-02-23
13	ISSUED FOR TENDER	2024-02-26
14	ISSUED FOR ADDENDUM ME-1	2024-03-12

PROJECT :  
**BARRIE FIRE STATION 6**

845 MAPLEVIEW DRIVE EAST, BARRIE, ONTARIO

PROFESSIONAL SEAL :

DWG TITLE :

ELECTRICAL LEAD SHEET



**REGAL CONSULTING ENGINEERS INC.**  
CONSULTING MECHANICAL & ELECTRICAL ENGINEERS  
208 Wycroft Road, Suite 200, Oakville, Ontario L6K 3S3  
PHONE: (905) 844-3913  
www.regal-eng.com

DATE :  
**JUN 14, 2023**

SCALE :  
**N.T.S**

DRAWN BY :  
**AS**

CHECKED BY :  
**MA**

DWG STATUS :  
**TENDER**

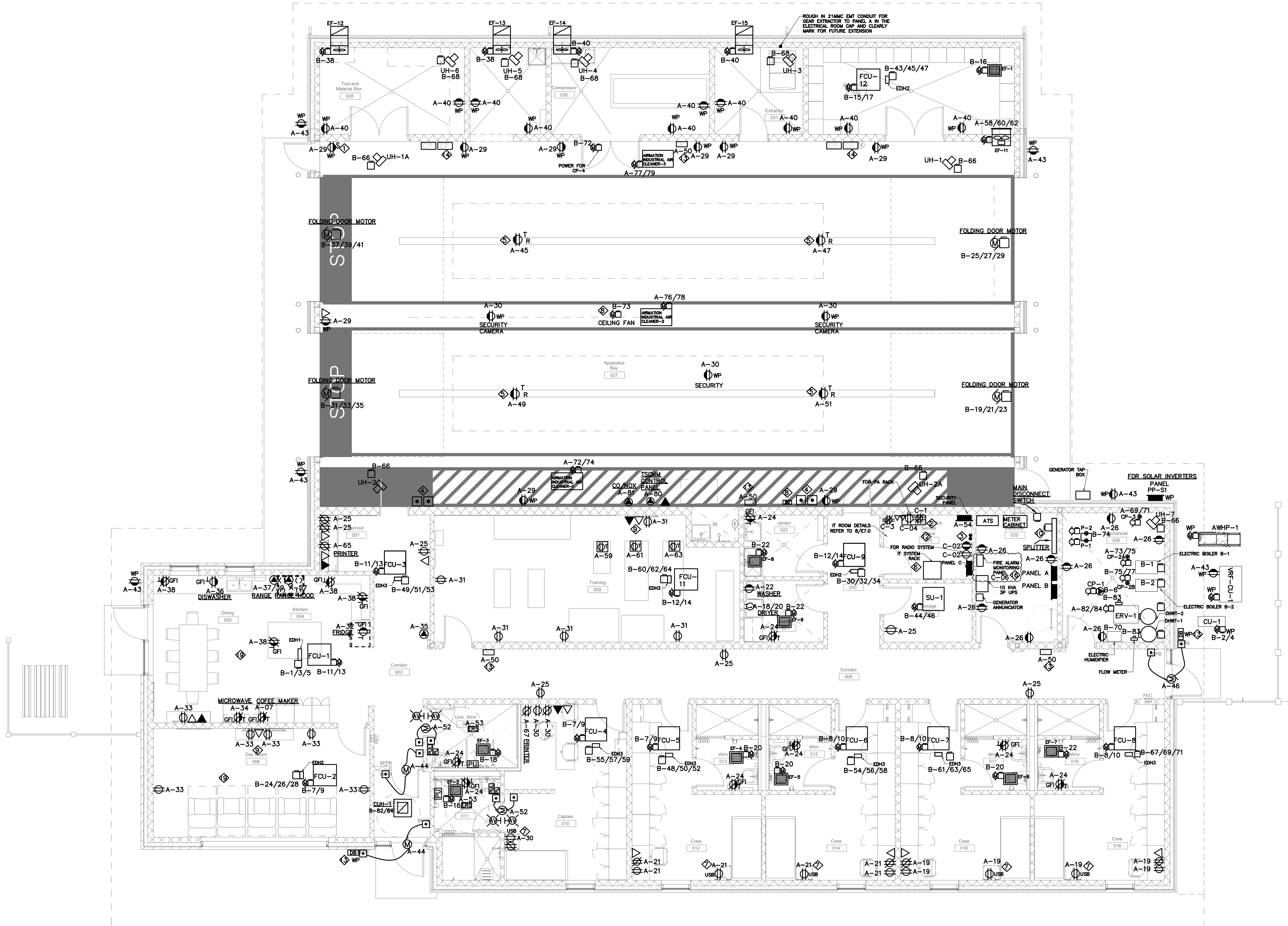
PROJECT No. :  
**2023-401**

DRAWING No. :  
**E1.0 -A-1**

REVISION

NOTES:

- 1 SWITCH TO CONTROL THE POWER TO THE EXTERIOR RECEPTACLES.
- 2 PROVIDE 18"x18"x4" WALL MOUNTED ELECTRICAL BLACK BOX C/W COVER PLATE TO BE INSTALLED ON THE WALL AND BEHIND THE PA SYSTEM RACK. TERMINATE ALL THE ROUGH IN CONDUITS FOR PA SYSTEM SPEAKERS AND MICROPHONES INTO THIS RECESSED BACK BOX.
- 3 PROVIDE TWO CONDUITS 50MM SIZE FROM IT ROOM TO ROOF. THE CONDUITS SHALL BE GROUNDED.
- 4 REMOTE UP/DOWN/OFF PUSH BUTTON FOR MOTORIZED FOLDING DOOR SYSTEMS.
- 5 CORD REEL RECEPTACLES SHALL BE CEILING MOUNTED, 20A, 120V. SUPPLY AND INSTALL 12-40' CABTIRE WHIPS C/W 5-20R WATERLIGHT CONNECTORS, KELLUM GRIPS AND L5-20P CORD ENDS TO CONNECT TO CORD REEL RECEPTACLES. WIRING THROUGH DEAD FRONT GFCI SHOW ON DRAWING.  
HUBBELL #HBL45123 SERIES  
ALTERNATE : APPLINGTON OR APPROVED EQUIVALENT
- 6 RACK SIZE IN IT ROOM IS 24U RACK CABINET, SIDE ACCESS, NOT HINGED ACCESS.
- 7 RECEPTACLES WITH USB IN THE CREW ROOM TO BE MOUNTED AT 700MM FROM F.F.
- 8 COORDINATE WITH OTHER TRADE REGARDING CEILING FANS AND PROVIDE 3/4" CONDUIT AND WIRING FROM EACH SPEED CONTROLLER SWITCH TO EACH RESPECTIVE CEILING FAN FOR FULLY OPERATIONAL SYSTEM.
- 9 ELECTRICAL CONTRACTOR TO PROVIDE AND INSTALL POWER AND DATA IN A TV CABLE ORGANISER BOX BEHIND TV. ( TYPICAL FOR ALL TV'S)
- 10 2440MMX1830MMX18MM FIRE RATED PLYWOOD BACKBOARD FOR SPLITTER, PANEL, ATS, ETC. PROVIDE ROUGH IN CONDUITS FOR SPLITTER TO BE TERMINATED AT THIS PLYWOOD BACK BOARD. ALL FIRE RATED PLYWOOD TO BE 100% FSC CERTIFIED WOOD.
11. RESERVED.
- 12 ALL WALLS IN I.T. ROOM TO HAVE FIRE RATED PLYWOOD BACKBOARD FOR LOW VOLTAGE SYSTEMS. PROVIDE ALL ROUGH IN CONDUITS FOR LOW VOLTAGE OUTLETS (I.E. VOICE, DATA, ETC) TO BE TERMINATED AT THIS PLYWOOD BACK BOARD. ALL FIRE RATED PLYWOOD TO BE 100% FSC CERTIFIED.
- 13 PROVIDE DOOR BUZZER SYSTEM FOR FULLY OPERATIONAL SYSTEM AS PER MANUFACTURER RECOMMENDATION INCLUDING BUT NOT LIMITED TO THE FOLLOWING:  
  
PROVIDE ALL CONDUIT, OUTLETS, CABLES, COVER PLATES, DOOR BUZZER, PUSH-BUTTON AND ASSOCIATE COMPONENTS AS REQUIRED AND/OR AS SHOWN ON THE DRAWINGS FOR OPERATIONAL SYSTEM.  
  
DOOR BUZZER SHALL BE EDWARD#762, 24VOLT AC, COMPACT STRAP MOUNTED SUITABLE FOR FLUSH MOUNTING IN STANDARD GANG BOX.  
  
PUSH-BUTTON SHALL BE EDWARD#654, 24VOLT, COMPACT, STRAP MOUNTED SUITABLE FOR FLUSH MOUNTING IN STANDARD GANG BOX.  
  
TRANSFORMER SHALL BE EDWARDS#590 SERIES, 24VOLT, 20VA OUTPUT RATING COMPLETE WITH NO.593 PLATE TO PERMIT A COMPLETELY ENCLOSED MOUNTING OF 590 SERIES TRANSFORMER IN A STANDARD TWO GANG OUTLET BOX.  
  
ALL WIRING SHALL BE RUN IN CONDUIT, CONDUIT SHALL BE 16MM(1/2") UNLESS OTHERWISE NOTED.
- 14 CONTROL PANELS FOR MOTORIZED FOLDING DOOR SYSTEMS. PROVIDE CONDUITS, POWER, & CONTROL WIRING, DISCONNECT SWITCHES, OUTLET AND POWER CONNECTIONS FOR MOTORS CONTROL PANES AND REMOTE UP/DOWN/OFF PUSH BUTTONS FOR MOTORIZED FOLDING DOOR SYSTEMS. COORDINATE WITH OTHER TRADES AND SYSTEMS SUPPLIES AND PROVIDE ALL NECESSARY MATERIALS AND LABOR REQUIRED FOR FULLY OPERATIONAL SYSTEM. ALL RECEPTIVE HARDWARE FOR FOLDING DOOR SYSTEMS WILL BE PROVIDED BY THE GENERAL CONTRACTOR.COORDINATE WITH THE OWNER FOR FOLDING DOORS SEQUENCE OF OPERATION.
- 15 CONTRACTOR TO PROVIDE AND INSTALL LEVITON PILOT LIGHT SWITCH FOR EXHAUST FAN.
- 16 CONTRACTOR TO ALLOW FOR WORK RELATED TO THE FIRE ALARM MONITORING (REMOTE). PROVIDE POWER (DEDICATED 120V CIRCUIT WITH LOCKABLE BREAKER) FOR THE FIRE ALARM MONITORING PANEL. ALLOW FOR RUNNING 18/6 CABLE IN 3/4" EMT FROM THE FIRE ALARM PANEL TO THE FIRE ALARM MONITORING PANEL. ALLOW FOR TESTING & VERIFICATION.
- 17 PROVIDE 3/4" CONDUIT FOR 2 JACK DATA/VOICE OUTLETS AND 1" FOR MORE THAN 2 JACK DATA/VOICE OUTLETS .
- 18 PROVIDE THE FOLLOWING EMPTY CONDUITS:  
  
A)2" CONDUIT FROM THE PLYWOOD BACK BOARD IN IT ROOM TO ROOF FOR FAUX TOWER. COORDINATE ON SITE FOR EXACT STUB UP LOCATION PRIOR TO ROUGH IN AND PROCEED ACCORDINGLY.  
  
B)2" CONDUIT FROM THE PLYWOOD BACK BOARD IN IT ROOM TO ROOF FOR IT SYSTEM. COORDINATE ON SITE FOR EXACT STUB UP LOCATION PRIOR TO ROUGH IN AND PROCEED ACCORDINGLY.



The Contractor shall verify all dimensions prior to commencement of the work.  
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14	ISSUED FOR ADDENDUM ME-1	2024-03-12

PROJECT: **BARRIE FIRE STATION 6**

845 MAPLEVIEW DRIVE EAST, BARRIE, ONTARIO

PROFESSIONAL SEAL :

DWG TITLE :

**PROPOSED ELECTRICAL  
POWER & COMMUNICATION  
FLOOR PLAN**



**REGAL CONSULTING ENGINEERS INC.**  
CONSULTING MECHANICAL & ELECTRICAL ENGINEERS  
208 Wyecroft Road, Suite 200, Oakville, Ontario L6K 3S3  
PHONE: (905) 844-3913  
www.regal-eng.com

DATE : **JUN 14, 2023**

SCALE : **1:75**

DRAWN BY: **MS**

CHECKED BY : **MA**

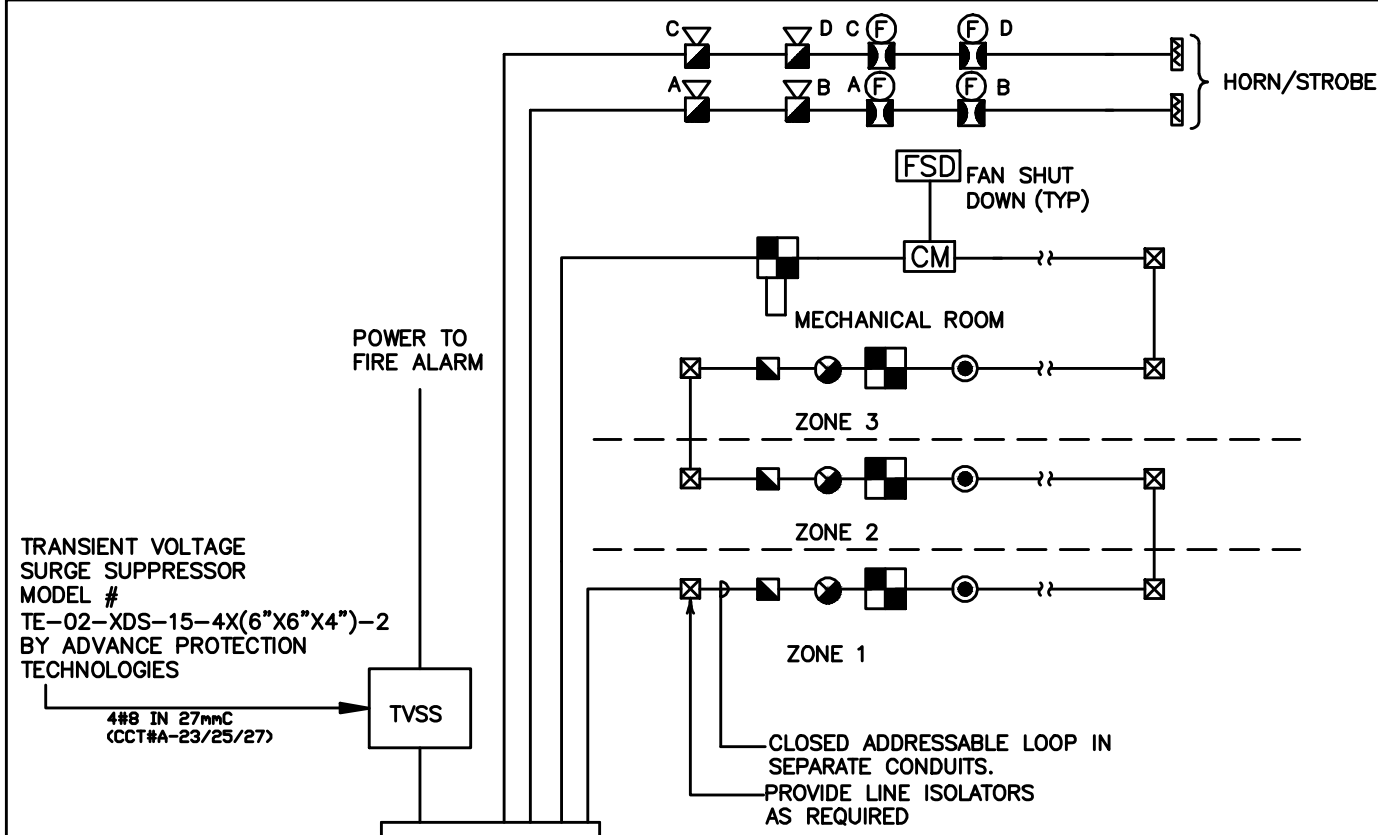
DWG STATUS : **TENDER**

PROJECT No. : **2023-401**

DRAWING No. : **E3.0 -A-1**

REVISION





- NOTES:**
- CONFIRM LOCATIONS, QUANTITIES AND LABELS OF THE AIR HANDLING UNITS ON SITE. PROVIDE RELAYS AND CONTROL WIRING AS REQUIRED TO SHUT DOWN AIR HANDLING UNITS UPON ACTIVATION OF ANY FIRE ALARM ZONES.
  - THIS DETAIL IS DIAGRAMMATICAL ONLY. REFER TO FLOOR PLANS FOR FIRE ALARM SYSTEM EQUIPMENT AND DEVICE LOCATIONS.
  - ALL FIRE ALARM SYSTEM WIRING SHALL BE AS PER MANUFACTURER'S RECOMMENDATIONS AND MUST MEET ALL APPLICABLE CODE REQUIREMENTS. ALL WIRING SHALL BE RUN IN CONDUIT UNLESS NOTED OTHERWISE.
  - CONTRACTOR TO SUBMIT COMPUTER PRINTOUT OF THE ANNUNCIATOR MESSAGES FOR ALL ZONES FOR APPROVAL AND INCORPORATE ALL COMMENTS IN THE FINAL PROGRAMMING AND SETUP.
  - CONTRACTOR TO TEST NEW AUDIBILITY LEVELS IN THE AREAS INDICATED IN THE SPECIFICATIONS AND SUBMIT A REPORT TO THE LOCAL FIRE DEPT. AND ATTACH A COPY WITH EACH MAINTENANCE MANUAL.
  - UPON COMPLETION, THIS CONTRACTOR TO SUBMIT AN ELECTRONIC DATA SHEET (IN MS EXCEL FORMAT) CONSISTING OF ADDRESSES OF ALL DEVICES.
  - CONTRACTOR TO ALLOW FOR WORK RELATED TO FIRE ALARM MONITORING SYSTEM (REMOTE).
  - THE PROPOSED NEW FIRE ALARM SYSTEM IS A SINGLE STAGE SYSTEM.
  - CENTRAL STATION MONITORING SHALL BE IN ACCORDANCE WITH LEVEL 2 SERVICE OF ULC-S561. THIS INCLUDES SEPARATE SIGNALS FOR ALARM, SUPERVISORY, TROUBLE.

**FIRE ALARM SYSTEM - TYPICAL SCHEMATIC DIAGRAM**  
SCALE: NTS

#### FULLY ADDRESSABLE FIRE ALARM SYSTEM SEQUENCES OF OPERATION:

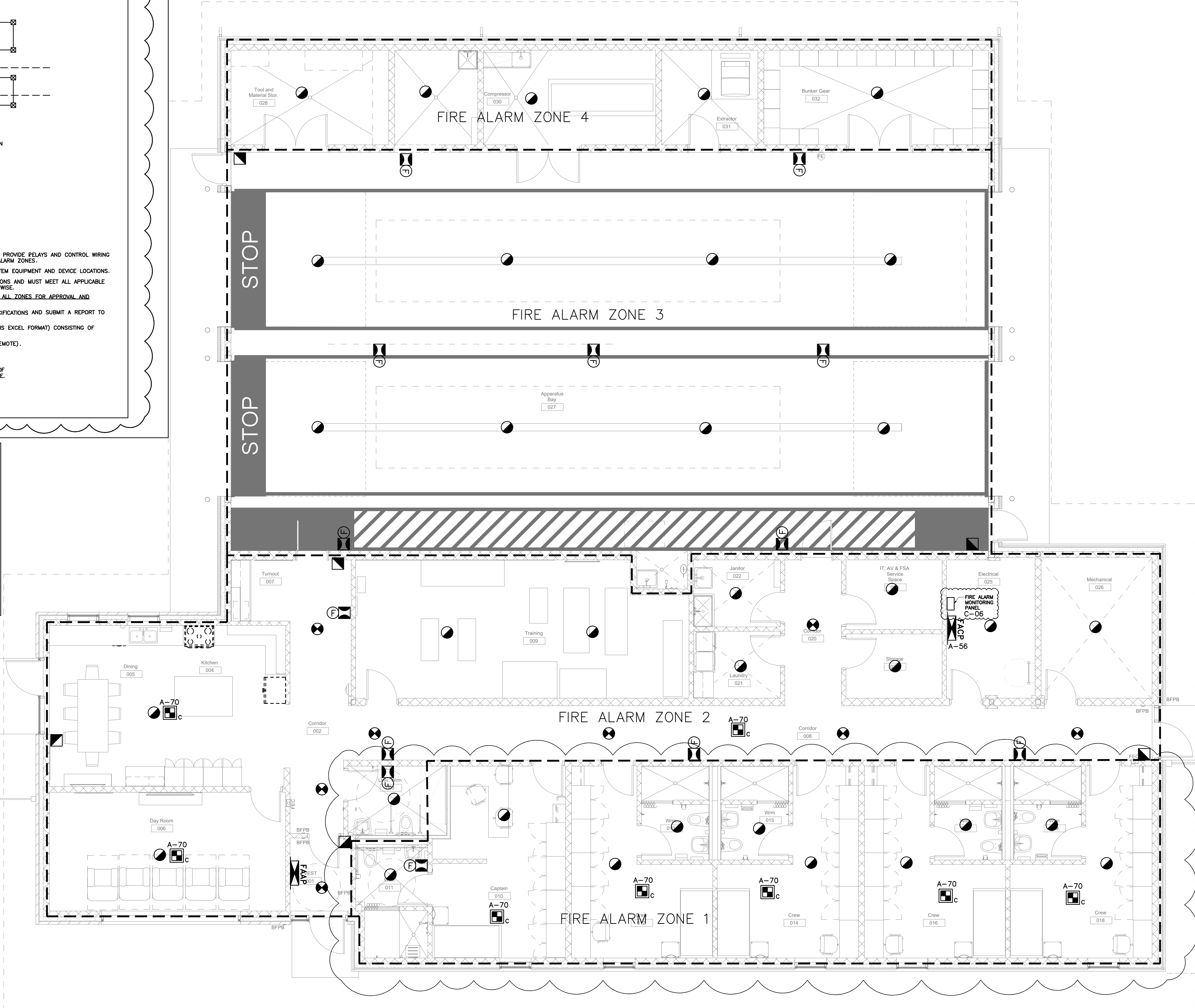
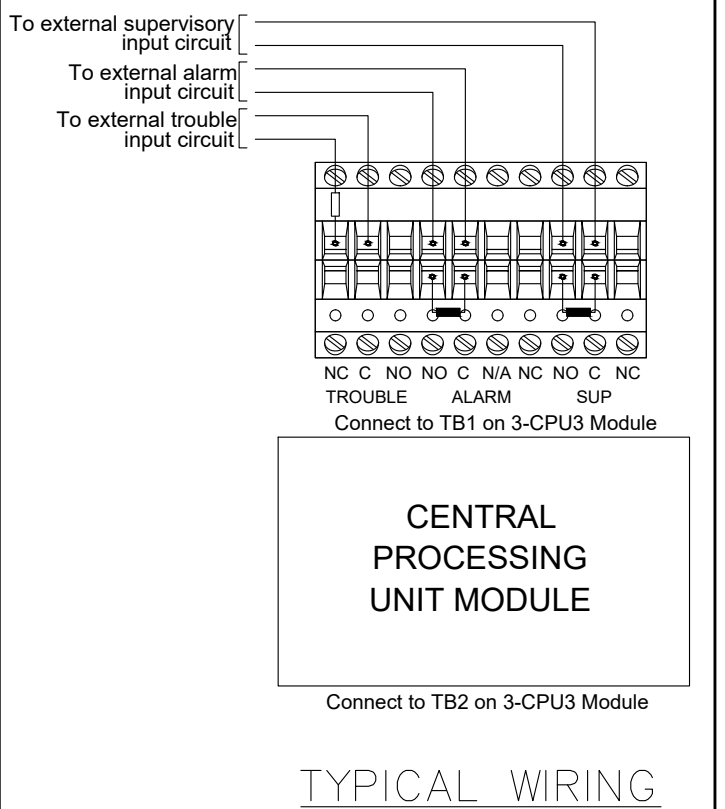
ADDRESSABLE FIRE ALARM DEVICES AND CONTROL PANEL ARE DISTINGUISHED BY THEIR ABILITY TO IDENTIFY EACH ACTIVE FIRE ALARM FIELD DEVICE. THE ADDRESSABLE FIRE ALARM SYSTEM MEET THE REQUIREMENTS FOR THE ELECTRICAL SUPERVISION OF FIELD DEVICES AND IT PROVIDES THE MEANS OF IDENTIFYING THE POINT IN A BUILDING WHERE AN ALARM HAS BEEN INITIALLY ACTIVATED.

ADDRESSABLE FIRE ALARM SYSTEM DESIGNED FOR THE FIRE STATION #6 (CITY OF BARRIE) IS A SINGLE STAGE FIRE ALARM SYSTEM. A SINGLE STAGE FIRE ALARM SYSTEM SHALL UPON THE OPERATION OF ANY MANUAL PULL STATION OR FIRE SMOKE DETECTOR, CAUSE ANY ALARM SIGNAL TO SOUND ALL AUDIBLE SIGNAL DEVICES IN THE SYSTEM.

ALL THE FIRE ALARM DEVICES OF THE FULLY ADDRESSABLE FIRE ALARM SYSTEM ARE CONNECTED TO THE FIRE ALARM PANEL THROUGH THE INITIATING CIRCUITS OR SLC, WHICH STANDS FOR SIGNALING LINE CIRCUITS. ON THE OTHER SIDE OF THE FIRE ALARM PANEL ARE THE OUTPUT CIRCUITS FOR A BUILDING ALARM AND EVACUATION.

HORN/STROBE DEVICES ARE CONNECTED ON THE OUTPUT CIRCUITS WHICH IS LABELLED NAC. THATS STANDS FOR NATIONAL APPLIANCE CIRCUIT.

WHEN THERE IS AN INPUT FROM SMOKE / HEAT OR ANY FIRE ALARM INITIATING DEVICE. IT SENDS A SIGNAL TO THE FIRE ALARM PANEL. THE PANEL WILL GO INTO A FIRE ALARM CONDITION AND WILL SOUND ALL AUDIBLE SIGNAL DEVICES IN THE SYSTEM FOR THE EVACUATION OF THE BUILDING.



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PROJECT: **BARRIE FIRE STATION 6**

845 MAPLEVIEW DRIVE EAST, BARRIE, ONTARIO

PROFESSIONAL SEAL:

DWG TITLE:

**PROPOSED FIRE ALARM PLAN**



**REGAL CONSULTING ENGINEERS INC.**  
CONSULTING MECHANICAL & ELECTRICAL ENGINEERS  
208 Wycroft Road, Suite 200, Oakville, Ontario L6K 3S3  
PHONE: (905) 844-1913  
www.regal-eng.com

DATE: **JUN 14, 2023**

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DWG STATUS: **TENDER**

PROJECT No.: **2023-401**

DRAWING No.: **E5.0-A-1**

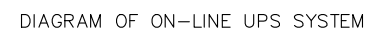
REVISION

TVSS	30
	30
	30
RECEPTACLES	20

15	SECURITY PANEL
20	FIRE ALARM PANEL (**)
20	RECEPTACLES

20	FIRE ALARM MONITORING PANEL (**)
20	RECEPTACLES
20	RECEPTACLES

4. PROVIDE LOW VOLTAGE RELAY PANEL FOR EXTERIOR LIGHTING C/W ST TRANSFORMER. RELAY PANELS SHALL BE LOCATED ADJACENT TO RELEVANT VERIFICATION LOCATIONS OF PHOTOCELLS ON SITE.
5. PROVIDE ALL NECESSARY CONDUIT, WIRING, BACKBOXES ETC. FOR LIGHTING SYSTEM FULLY OPERATIONAL SYSTEM.



ISSUE OR REVISION

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PROJECT:

Q18

PROFESSIONAL SEAL :

## SINGLE LINE DIAGRAM & PANEL SCHEDULES

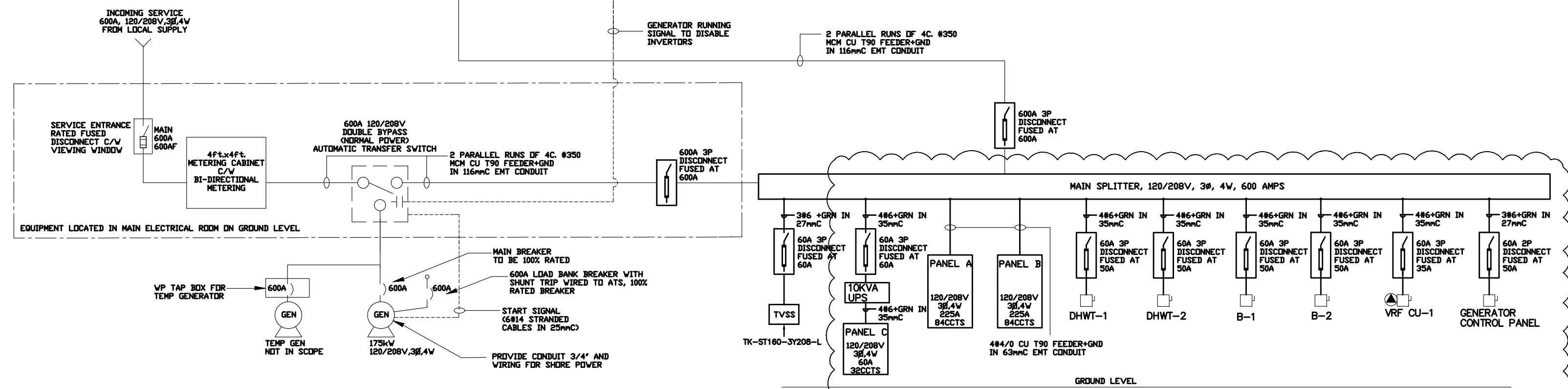


SCALE : N.T.S

CHECKED BY : MA

PROJECT No. : 2023-401

REVISION



## REVISION



MECHANICAL EQUIPMENT WIRING SCHEDULE																																			
DESCRIPTION				POWER					STARTER						ACCESSORIES			ISOLATING DEVICE		CONTROL														REMARKS	
NUMBER	ITEM NUMBER	ITEM	SUPPLIED BY	VOLTAGE	PHASE	H.P./KW/AMPS	MOCF (A)	FEEDER SIZE	PANEL & CCT. NOS.	MANUAL	MAGNETIC	COMBINATION	CONTACTOR	CONTROL VOLTAGE	VFD	HAND/OFF/AUTO	ON/OFF SELECTOR	PILOT LIGHT	WEATHERPROOF DISCONNECT	DISCONNECT	WIRED BY	MOTOR RATED SWITCH	OCCUPANCY SENSOR	VFD	TIMER	TIME CLOCK	R.A. THERMOSTAT	THERMOSTAT	SCF CONTROLLER	VARIABLE SPEED	WIRED BY	INTERLOCKED WITH	INTERLOCKED BY	26 - SUPPLIED/INSTALLED BY DIV. 26. 23 - SUPPLIED/INSTALLED BY DIV. 23. 25 - SUPPLIED/INSTALLED BY DIV. 25. O - SUPPLIED BY OWNER/OTHERS GC - SUPPLIED/INSTALLED BY GENERAL CONTRACTOR * - REFER TO REMARKS	
1	DHWT-1	DOMESTIC HOT WATER TANK	23	208	3	18 KW	50A, 3P	4#6+GRD-.35mmC	2		✓					✓		✓		26	26							✓			25			INTEGRAL THERMOSTAT	
2	DHWT-2	DOMESTIC HOT WATER TANK	23	208	3	18 KW	50A, 3P	4#6+GRD-.35mmC	2		✓					✓		✓		26	26							✓			25			INTEGRAL THERMOSTAT	
3	CP-1	RE-CIRC. PUMP	23	120	1	1/25 HP	15A, 1P	2#12+GRD-.16mmC	2		✓					✓		✓		26	26				✓	✓					25			INTEGRAL TIMER AND TIME CLOCK	
4	CP-2A	RE-CIRC. PUMP	23	208	1	0.333 HP	15A, 2P	2#12+GRD-.16mmC	2		✓					✓		✓		26	26										25			PUMP CONTROLLED BY BAS. CONTROL WIRING BY DIV 25.	
5	CP-2B	RE-CIRC. PUMP	23	208	1	0.333 HP	15A, 2P	2#12+GRD-.16mmC	2		✓					✓		✓		26	26										25			PUMP CONTROLLED BY BAS. CONTROL WIRING BY DIV 25.	
6	CP-3	RE-CIRC. PUMP	23	208	1	0.124 HP	15A, 2P	2#12+GRD-.16mmC	2		✓					✓		✓		26	26										25			PUMP CONTROLLED BY BAS. CONTROL WIRING BY DIV 25.	
7	CP-4	RE-CIRC. PUMP	23	120	1	0.167 HP	15A, 1P	2#12+GRD-.16mmC	2		✓					✓		✓		26	26										25			PUMP CONTROLLED BY OEM CONTROLLER. CONTROL WIRING BY DIV 25.	
8	P-1	HYDRONIC HEATING PUMP	23	208	1	0.75 HP	15A, 2P	2#12+GRD-.16mmC	2		✓					✓		✓		26	26			Yes						Yes	25			FITTED WITH ECM. BAS WIRING BY DIV 25.	
9	P-2	HYDRONIC HEATING PUMP	23	208	1	0.75 HP	15A, 2P	2#12+GRD-.16mmC	2		✓					✓		✓		26	26			Yes						Yes	25			FITTED WITH ECM. BAS WIRING BY DIV 25.	
10	EF-1	EXH. FAN	23	120	1	1/6 HP	15A, 1P	2#12+GRD-.16mmC	2		✓					✓		✓		26	26	✓									26				
11	EF-2	EXH. FAN	23	120	1	86 WATTS	15A, 1P	2#12+GRD-.16mmC	2		✓					✓		✓		26	26		✓								26				
12	EF-3	EXH. FAN	23	120	1	86 WATTS	15A, 1P	2#12+GRD-.16mmC	2		✓					✓		✓		26	26		✓								26				
13	EF-4	EXH. FAN	23	120	1	86 WATTS	15A, 1P	2#12+GRD-.16mmC	2		✓					✓		✓		26	26		✓								26				
14	EF-5	EXH. FAN	23	120	1	86 WATTS	15A, 1P	2#12+GRD-.16mmC	2		✓					✓		✓		26	26		✓								26			CONTROLLED VIA BOILER	
15	EF-6	EXH. FAN	23	120	1	86 WATTS	15A, 1P	2#12+GRD-.16mmC	2		✓					✓		✓		26	26		✓								26				
16	EF-7	EXH. FAN	23	120	1	86 WATTS	15A, 1P	2#12+GRD-.16mmC	2		✓					✓		✓		26	26		✓								26				
17	EF-8	EXH. FAN	23	120	1	86 WATTS	15A, 1P	2#12+GRD-.16mmC	2		✓					✓		✓		26	26	✓									26				
18	EF-9	EXH. FAN	23	120	1	86 WATTS	15A, 1P	2#12+GRD-.16mmC	2		✓					✓		✓		26	26	✓									26				
19	DELETED																																		
20	EF-11	EXH. FAN	23	208	3	1.5 HP	15A, 3P	3#12+GRD-.16mmC	2		✓					✓		✓		26	26										25			CONTROLLED BY CO/NOx SENSOR.	
21	EF-12	EXH. FAN	23	120	1	86 WATTS	15A, 1P	2#12+GRD-.16mmC	2		✓					✓		✓		26	26							✓			23			BAS CONTROL WIRING BY DIV 25	
22	EF-13	EXH. FAN	23	120	1	86 WATTS	15A, 1P	2#12+GRD-.16mmC	2		✓					✓		✓		26	26							✓			23			BAS CONTROL WIRING BY DIV 25	
23	EF-14	EXH. FAN	23	120	1	86 WATTS	15A, 1P	2#12+GRD-.16mmC	2		✓					✓		✓		26	26							✓			23			BAS CONTROL WIRING BY DIV 25	
24	EF-15	EXH. FAN	23	120	1	86 WATTS	15A, 1P	2#12+GRD-.16mmC	2		✓					✓		✓		26	26							✓			23			BAS CONTROL WIRING BY DIV 25	
25	VRF-CU-1	VRF	23	208	3	34.1 MCA	35A, 3P	4#6+GRD-.35mmC	2		✓					✓		✓		26	26										23			BAS CONTROL WIRING BY DIV 25	
26	AWHP-1	AWHP	23	208	1	30 MCA	50A, 2P	2#6+GRD-.27mmC	2		✓					✓		✓		23	26										23			DIV 23 TO PROVIDE CONTROL WIRING BETWEEN FLOW SWITCH AND THE AWHP, AND BETWEEN TEMPERATURE SENSOR AND THE AWHP. BAS WIRING BY DIV 25.	
27	ERV-1	ENERGY RECOVERY VENTILATION	23	120	1	23.331 MCA	25A, 1P	2#10+GRD-.21mmC	2		✓					✓		✓		26	26		✓							YES	25			BUILT IN SPEED CONTROLLER. WIRED TO BAS BY DIV 25.	
28	SU-1	SU	23	208	1	0.5 MCA	15A, 2P	3#12+GRD-.16MMC	2											26	26							✓			23			BAS CONTROL WIRING BY DIV 25	
29	CU-1	CONDENSING UNIT	23	208	1	16.5 MCA	20A, 2P	3#12+GRD-.16MMC	2		✓					✓		✓		26	26							✓			23			BAS CONTROL WIRING BY DIV 25	
30	B-1	BOILER	23	208	3	17 KW	50A, 3P	4#6+GRD-.35mmC	2		✓					✓		✓		26	26										23			BAS CONTROL WIRING BY DIV 25	
31	B-2	BOILER	23	208	3	17 KW	50A, 3P	4#6+GRD-.35mmC	2		✓					✓		✓		26	26										23			BAS CONTROL WIRING BY DIV 25	
NOTES: 1. ISOLATION AND CONTROL DEVICES MAY NOT BE SHOWN ON PLANS FOR CLARITY PURPOSES AND SHALL BE PROVIDED AS INDICATED. COORDINATE LOCATIONS ON SITE WITH OWNER AND CONSTRUCTION MANAGER. 2. COORDINATE EXACT ELECTRICAL REQUIREMENTS FOR ALL EQUIPMENT WITH SHOP DRAWINGS AND ACTUAL NAMEPLATE DATA, REVISE ELECTRICAL REQUIREMENTS TO SUIT ACCORDINGLY. 3. ALL CONTROLS VOLTAGE SHALL BE PROVIDED FROM A PROPER CONTROLS TRANSFORMER MOUNTED INTEGRALLY WITH THE CORRESPONDING DEVICE/STARTER. 4. ON/OFF CONTROL SWITCH SHALL BE MOTOR RATED FOR LOAD. 5. ALL STATUS CONTACTS FOR ALARM AND DEVICE STATE, ETC. SHALL BE INTEGRAL WITH CONTROL DEVICE ENCLOSURE UNLESS NOTED OTHERWISE. 6. ALL MECHANICAL EQUIPMENT FEEDERS SHALL BE RATED TO MATCH THE OVERCURRENT PROTECTION DEVICE SPECIFIED AND/OR THE FLA RATING OF THE MOTOR. 7. PROVIDE SUITABLE NORMALLY CLOSED (ENERGIZED) RELAY IN A RATED ENCLOSURE TO OPEN ON FIRE ALARM SIGNAL. MOUNT IN EQUIPMENT HOUSING AS DIRECTED BY DIV. 23 CONTRACTOR. 8. PROVIDE PILOT LIGHTS AT OPERATOR CONTROL IN FACE OF ENCLOSURE AS FOLLOWS: GREEN - RUNNING RED - FAILED AMBER - MANUAL 9. ABSENCE OF ANY ILLUMINATED LIGHTS INDICATES MOTOR IS OFF AND/OR AVAILABLE FOR USE. 10. ALL FANS AND MOTORS SHALL BE PROVIDED C/W LOCAL ISOLATION SWITCH (NOT SHOWN ON DRAWINGS). 11. TIME CLOCK CONTROL: ELECTRONIC CONTROL OFF AT USER SELECTABLE TIME ON ANY OR ALL DAYS OF THE WEEK. SET DEFAULT FOR OWNER AS PER THEIR DIRECTION. CONTROL SHALL BE CAPABLE OF 48 ON AND OFF SET POINTS WITH MINIMUM SETTINGS OF 1 MINUTE. CONTROL SHALL AUTOMATICALLY ADJUST FOR DAYLIGHT SAVINGS AND LEAP YEARS. BATTERY BACK-UP SHALL RETAIN SCHEDULE DURING POWER OUTAGE. TORK MODEL #DGI100 OR APPROVED EQUAL. 12. REFER TO PANEL SCHEDULES AND FLOOR PLAN FOR CIRCUITING. 13. DIVISION 23-MECHANICAL, DIVISION 25 -BUILDING AUTOMATION SYSTEM, DIVISION 26- ELECTRICAL.																																			

The Contractor shall verify all dimensions prior to commencement of the work. All print and specifications are the property of the Architect and must be returned upon completion of the work.		
ISSUE OR REVISION		
No.	Description	Date
1	ISSUED FOR REVIEW	2023-06-22
2	ISSUED FOR REVIEW	2023-06-27
3	ISSUED FOR REVIEW	2023-07-06
4	ISSUED FOR 100% DESIGN DEVELOPMENT	2023-08-06
5	ISSUED FOR DD SIGN-OFF	2023-08-23
6	PROGRESS SET	2023-09-22
7	75% SUBMISSION	2023-10-13
8	ISSUED FOR BUILDING PERMIT	2023-11-01
9	95% SUBMISSION	2023-11-10
10	100% SUBMISSION	2023-11-24
11	100% SUBMISSION	2024-02-12
12	ISSUED FOR TENDER	2024-02-23
13	ISSUED FOR TENDER	2024-02-26
14	ISSUED FOR ADDENDUM ME-1	2024-03-12
PROJECT : <div>BARRIE FIRE STATION 6</div> <div>845 MAPLEVIEW DRIVE EAST, BARRIE, ONTARIO</div>		
PROFESSIONAL SEAL :		
DWG TITLE : MECHANICAL WIRING SCHEDULE		
<div> REGAL CONSULTING ENGINEERS INC. CONSULTING MECHANICAL &amp; ELECTRICAL ENGINEERS 208 Wycroft Road, Suite 200, Oakville, Ontario L6K 3S3 PHONE: (905) 844-1913 www.regal-eng.com</div>		
DATE :	JUN 14, 2023	
SCALE :	NTS	
DRAWN BY:	MS	
CHECKED BY :	MA	
DWG STATUS :	TENDER	
PROJECT No. :	2023-401	
DRAWING No. :	E6.2-A-1	REVISION

## **1 General**

### **1.1 GENERAL**

- .1 Read and conform to:
  - .1 The Contract CCDC 2-2008, Stipulated Price Contract as amended.
  - .2 Division 21 01 01 General Requirements.

### **1.2 SECTION INCLUDES**

- .1 Sequence of operation:
  - .1 VRF System.
  - .2 Energy Recovery Ventilator, ERV-1.
  - .3 Air-to-Water Heat Pump, AWHP-1.
  - .4 Electric Boiler, B-1.
  - .5 In-floor hydronic radiant heating system.
  - .6 Exhaust Fans EF-2 to EF-9.
  - .7 EF-1, Bunker Gear Room Exhaust Fan.
  - .8 Unit Heaters UH-1 to UH-7.
  - .9 Vehicle Tail Pipe Exhaust System for Apparatus Bay.
  - .10 Circulating Pump CP-1.
  - .11 Circulating Pump CP-2.
  - .12 Circulating Pump CP-3.
  - .13 Circulating Pumps P-1/P-2.
  - .14 Circulating Pump CP-4.
- .2 Points List

## **.1 VRF System**

### **.1 General**

- .1 The VRF system serves the space through Fan Coil Units that supply conditioned air. The fan coil units are piped to a branch selector box that is connected to the outdoor units through refrigerant pipes.
- .2 The outdoor condensing unit, CU-1 has variable speed compressor that can vary the capacity from 15% to 100%.
- .3 The fan coil units have variable speed direct drive DC motor that will allow fans to vary between 5 speeds based on space load.

### **.2 Modes of Operation**

- .1 The occupied and unoccupied modes of operation are determined by a time clock. The fan coil units are set to run continuously in the occupied mode. The schedule of space temperature set points shall include temperature set backs for the unoccupied modes.
- .2 Standby mode: In the occupied mode, if no occupancy is sensed by the occupancy sensor embedded in the wall thermostat for 15 minutes, the FCU shall be shut off and the space temperature set point shall be reset to that of the unoccupied mode. Upon sensing occupancy, the temperature setpoint shall be reset to that of occupied mode and the FCU shall be started.
- .3 In the unoccupied mode, the fan coil units will operate/run only when the space temperature drops below the set point in the heating mode. There is no cooling in the unoccupied mode and the fan coil units will be OFF.

### **.3 Start Up/Shutdown**

- .1 The VRF system will remain enabled by BAS all the time throughout the year.
- .2 The supply fan of each of the fan coil unit will be started per schedule by the respective wall mounted FCU controller.
- .3 The supply fan of each of the fan coil unit will be shut down at the beginning of unoccupied hours per schedule by the wall mounted controller.

### **.4 Occupied Mode**

- .1 The supply fan in each of the fan coil unit runs continuously supplying the required airflow to each of the spaces. Each fan coil unit, in the automatic fan speed mode, varies the fan speed to deliver the required airflow to maintain the space temperature at the set point. The unit adjusts the external static pressure settings of the fan automatically.
- .2 The Central controller of the VRF system shall set the heating and cooling mode based on one of the 2 automatic change over system available that is selected upon commissioning.
- .3 Each fan coil unit monitors and maintains the unit superheat (cooling mode) or sub-cooling (heating mode) using a computerized PID control.
- .4 In the heating mode, if the unit failed to maintain the space temperature as sensed by the wall mounted controller, the unit shall energize the duct mounted electric heater to maintain the space temperature at the set point.
- .5 BAS will enable electric duct heaters when the OAT drops below 0°C and disables the electric duct heaters when the OAT rises above 3°C.

### **.5 Unoccupied Mode**

- .1 The supply fan in each of the fan coil unit is off.
- .2 Each fan coil unit starts its supply fan when there is a heating load demand as sensed by the wall mounted controller. The supply fan stops when the space temperature reaches the set point. There is no cooling during the unoccupied mode.
- .3 In the heating mode, if the unit failed to maintain the space temperature at the set point as sensed by the wall mounted controller, the unit shall energize the duct mounted electric heater to provide the additional heating required.
- .4 BAS will enable electric duct heaters when the OAT drops below 0°C and disables the electric duct heaters when the OAT rises above 3°C.

### **.6 Critical Alarms**

- .1 Fan coil units are enabled and status is not received (2 minute delay).
- .2 Low temperature limit.
- .3 High supply air temperature shutdown.
- .4 High return air temperature shutdown.

### **.7 General Alarms**

- .1 The supply air temperature drops below 7 Deg C.
- .2 The supply air temperature rises above 43 Deg C.
- .3 The duct heater is ON.



## **.8 Maintenance Alarms**

- .1 Fan is commanded off and status is on (10-minute delay).

## **.9 Trends**

- .1 Supply air temperature and setpoint.
- .2 Outside air temperature.
- .3 Return air temperature.
- .4 Mixed air temperature.
- .5 Supply air static pressure and setpoint.
- .6 Fan status.

## **.2 Energy Recovery Ventilator, ERV-1**

### **.1 Modes of Operation**

- .1 The occupied and unoccupied modes of operation are determined by a time clock. ERV-1 runs continuously during occupied hours.
- .2 In the unoccupied mode, ERV-1 remains OFF.

### **.2 Start Up/Shutdown**

- .1 ERV-1 will be enabled by BAS as per the occupancy schedule. The motorised dampers at the outdoor air inlet and the exhaust air outlet are opened. The supply and exhaust fans are started.
- .2 The BAS disables the ERV-1 at the beginning of the unoccupied hours. The motorised dampers at the outdoor air inlet and the exhaust air outlet are closed.

### **.3 Occupied Mode**

- .1 The supply fan and the exhaust fan run at variable speed based on the input from the in-built CO2 sensor. The minimum speed of the supply and exhaust fans will correspond to 50% of the design airflow. BAS to signal the ERV to increase speed if any one of the room sensors detect CO2 levels above the set point. The unit controller modulates the energy recovery wheel speed for optimum energy recovery efficiency.
- .2 The electric pre-heater is energized by the unit controller for frost control. When the outdoor air temperature is below -15°C(5F) and the differential pressure across the energy wheel is above 1.5", the frost control is enabled by the unit control panel. Once the differential pressure falls below the set point or the outside air temperature rises above the set point, the ERV will resume normal operation.

### **.4 Unoccupied Mode**

- .1 ERV-1 remains OFF. The motorized dampers at the outdoor air intake and exhaust air outlet remain closed.

### **.5 Critical Alarms**

- .1 ERV is enabled and status is not received (2 minute delay).
- .2 Low temperature limit.

- .3 Dirty filter.
- .4 Motorised dampers status.

## **.6 General Alarms**

- .1 The supply air temperature drops below 5 Deg C (adjustable).
- .2 The supply air temperature rises above 43 Deg C(adjustable).

## **.7 Maintenance Alarms**

- .1 ERV-1 is disabled by the BAS but the status is ON (10 minute delay).

## **.8 Trends**

- .1 Supply air temperature.
- .2 Outside air temperature.
- .3 Exhaust air temperature.
- .4 CO<sub>2</sub> in rooms

## **.3 Air-to-Water Heat Pump, AWHP-1**

### **.1 Modes of Operation**

- .1 The Air-to-Water Heat Pump, AWHP-1, remains enabled during the entire heating season from September 1<sup>st</sup> (adjustable) to June 30<sup>th</sup> (adjustable).
- .2 During the summer months of July and August, AWHP-1 remains OFF.

### **.2 Start Up/Shutdown**

- .1 AWHP-1 will be enabled by BAS on September 1<sup>st</sup> (adjustable) and disabled on June 30<sup>th</sup> (adjustable). If the leaving water temperature as sensed by the temperature sensor in the mechanical room drops below 37.8°C(100°F), the condenser fans are started by the unit controller. After a time lag of 2 minutes (adjustable), compressors are started if the water flow through the heat exchanger is confirmed by the in-built flow switch. BAS shuts down the AWHP-1 during the emergency mode when the hydronic loop temperature is reset to 180°F.

### **.3 Enabled Mode**

- .1 In the enabled mode, the AWHP-1 runs its compressors to maintain the leaving water temperature as sensed by the temperature sensor mounted on the supply pipe in the mechanical room.
- .2 AWHP-1 modulates the speed of the compressors and the condenser fans to meet the heating load. Once the leaving water temperature rises above the set point (110°F / 43.3°C), the compressors are stopped and then after time lag of 2 minutes(adjustable), the condenser fans are stopped.
- .3 When the outside air temperature rises above 21°C(69.8°F) or drops below -6.7°C(20°F), BAS disables AWHP-1.

### **.4 Disabled Mode**

- .1 AWHP-1 remains OFF.

### **.5 Critical Alarms**

- .1 AWHP-1 is enabled and status is not received (2 minute delay).

- .2 Low temperature limit.
- .3 Low leaving water temperature.

## **.6 General Alarms**

- .1 The leaving water temperature drops below 37.8 Deg C (adjustable).
- .2 The leaving water temperature rises above 43.3 Deg C(adjustable).

## **.7 Maintenance Alarms**

- .1 AWHP-1 is disabled by the BAS but the status is ON (10 minute delay).

## **.8 Trends**

- .5 Leaving water temperature.
- .6 Compressor run hours.
- .7 Condenser fan run hours.

## **.4 Electric Boilers, B-1 / B-2**

### **.1 Modes of Operation**

- .1 The Electric Boilers, B-1 & B-2, remain enabled during the entire heating season from September 1<sup>st</sup> to June 30<sup>th</sup>.
- .2 During the summer months of July and August, **B-1 & B-2** remains OFF.

### **.2 Start Up/Shutdown**

- .1 **B-1 & B-2** will be enabled by BAS on September 1<sup>st</sup> (adjustable) and disabled on June 30<sup>th</sup> (adjustable). Boiler is switched ON by its own controller once the water flow through the heat exchanger is confirmed by the flow switch. Boiler is switched OFF by the controller when the leaving water temperature rises above 110°F/43.3°C.

### **.3 Enabled Mode**

- .1 In the enabled mode, if the leaving water temperature as sensed by the temperature sensor in the mechanical room remains below 37.8°C(100°F) for more than 15 minutes(adjustable), the circulating pump CP-2A is started by the BAS, followed by the lead electric boiler (B-1) started by its own controller.
- .2 The lead boiler (B-1) switches OFF when the leaving water temperature as sensed by the temperature sensor on the supply pipe in the mechanical room equals (43.3°C)110°F.
- .3 If the heating water temperature remains below the set point for more than 15 minutes after the lead boiler is ON, the BAS switches ON the circulating pump(CP-2B) of the lag boiler(B-2). Once the water flow through the heat exchanger is confirmed as sensed by the in-built flow switch, the lag boiler (B-2) is switched ON by its own controller. The lag boiler (B-2) switches OFF when the leaving water temperature as sensed by the temperature sensor on the supply pipe in the mechanical room equals (43.3°C)110°F.
- .3 When the outside air temperature rises above 10°C(adjustable), BAS disables both the lead and lag electric boilers, B-1 & B-2.
- .4 The BAS alternates the lead and lag boiler every week.

### **.4 Emergency Mode**

- .1 In the emergency mode when the doors of the apparatus bay are opened, and the indoor air temperature of the apparatus bay drops and remains below 0°C for more than 5 minutes, the BAS raises



the heating water loop temperature set point to 82.2°C (180°F), starts pumps CP-2A and CP-2B. Boilers B-1 and B-2 are switched ON by the OEM controllers. BAS switches OFF the pump, CP-3, and the Air-to-Water Heat Pump, AWHP-1.

- .2 Boilers B-1 & B-2 run simultaneously to maintain the heating water loop at the set point. When the heating water loop temperature exceeds the set point by 0.5°C, the BAS switches OFF the pump (CP-2A) of the lead boiler (B-1) and the lead boiler (B-1) is switched OFF by its own controller. The BAS switches OFF the pump (CP-2B) of lag boiler (B-2) when the heating water temperature exceeds the set point by 1°C. The lag boiler (B-2) is switched OFF by its own controller when there is no water flow through the heat exchanger as sensed by the in-built flow switch.
- .3 When the doors of the apparatus bay are closed, and the air temperature inside the apparatus bay reaches the set point and the boilers are switched OFF, the BAS lowers the heating water loop temperature set point to 43.3°C (110°F) and switches ON the Air-to-Water Heat Pump, AWHP-1.

.4 **Schedule of Emergency Mode:**

Apparatus Bay Temperature	-	below 0.0 °C(32°F) (adjustable)
Response time by BAS	-	5 minutes (adjustable)
Hydronic loop temperature set point	-	82.2°C (180°F)
Boilers on duty	-	Both B-1 and B-2
Status of Air-Source Heat Pump	-	OFF
Status of pump, CP-3	-	OFF
Lead boiler cut-off temperature	-	0.5 °C > loop set point temperature(adjustable)
Lag boiler cut-off temperature	-	1 °C > loop set point temperature(adjustable)
End of emergency mode	-	Doors of the bay are closed, space temperature set point satisfied.

.5 **Disabled Mode**

- .1 Boilers B-1 and B-2 remain OFF.

.6 **Critical Alarms**

- .1 The lead boiler (B-1) is enabled and status is not received (2 minute delay).
- .2 Low temperature limit.
- .3 Low leaving water temperature.

.7 **General Alarms**

- .1 The leaving water temperature remains below 37.8 Deg C (adjustable) for more than 30 minutes.
- .2 The leaving water temperature remains above 43.3 Deg C(adjustable) for more than 30 minutes.

.8 **Maintenance Alarms**

- .1 The boilers are disabled by the BAS but the status is ON (10 minute delay).

.9 **Trends**

- .1 Leaving water temperature.
- .2 Boiler run hours.
- .3 Return water temperature.

.5 **IN-FLOOR HYDRONIC RADIANT HEATING SYSTEM**

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**.1 Modes of Operation**

- .1 The in-floor hydronic radiant heating system remains enabled during the entire heating season from September 1<sup>st</sup> to June 30<sup>th</sup>.
- .2 During the summer months of July and August, the system remains OFF.

**.2 Start Up/Shutdown**

- .1 The circulating pump, CP-4, in the manifold cabinet will be enabled by BAS on September 1<sup>st</sup> (adjustable) and disabled on June 30<sup>th</sup> (adjustable). The circulating pump is switched ON/OFF by its own controller based on the temperature in the Apparatus Bay.

**.3 Enabled Mode**

- .1 In the enabled mode, the circulating pump, CP-4, runs circulating heating water through the embedded pipes in the floor slab when there is a demand for heating. The three-way valve modulates to maintain the required supply loop temperature.
- .2 The circulating pump, CP-4, switches OFF when the space temperature as sensed by the thermostat in the Apparatus Bay equals the set point (adjustable). The three-way valve closes the port connected to the high temperature water.
- .3 When the outside air temperature rises above 21°C(adjustable), BAS disables the circulating pump, CP-4, and the three-way valve closes the port connected to the high temperature water.

**.4 Disabled Mode**

- .1 The circulating pump, CP-4, remains OFF and the three-way valve port connected to the high temperature water remains closed.

**.5 Critical Alarms**

- .1 The circulating pump, CP-4, is enabled and status is not received (2 minute delay).
- .2 High temperature limit.
- .3 Low leaving water temperature.

**.6 General Alarms**

- .1 The leaving water temperature remains below 37.8 Deg C (adjustable) for more than 30 minutes.
- .2 The leaving water temperature remains above 43.3 Deg C(adjustable) for more than 30 minutes.

**.7 Maintenance Alarms**

- .1 The circulating pump, CP-4, is disabled by the BAS but the status is ON (10 minute delay).

**.8 Trends**

- .1 Leaving water temperature.
- .2 Pump run hours.
- .3 Return water temperature.
- .4 Space temperature in the Apparatus Bay.

**.6 EXHAUST FANS, EF-2 TO EF-9**

**.1 Modes of Operation**

- .1 The exhaust fans EF-2 to EF-9 are switched ON/OFF automatically by the occupancy sensor in the respective washroom.

**.7 EF-1, BUNKER GEAR ROOM EXHAUST FAN**

**.1 Modes of Operation**

- .1 The exhaust fan EF-1 is switched ON/OFF manually by the user through wall mounted H-O-A switch. In the auto mode, BAS shall command the fan ON/OFF.

**.8 EF-11, APPARATUS BAY VENTILATION AIR EXHAUST FAN**

**.1 Modes of Operation**

- .1 The exhaust fan EF-11 is switched ON/OFF by the CO/NOx sensor mounted in the Apparatus Bay based on the amount of CO/NOx present in the air.

**.2 Critical Alarms**

- .1 The CO/NOx level rises above the set point but the fan status is OFF.
- .2 The fan status is ON but the air intake motorised damper position is CLOSED.

**.3 General Alarms**

- .1 The CO/NOx level is below the set point but the fan status is ON.

**.4 Trends**

- .1 Fan run hours.
- .2 CO/NOx level.

**.9 EF-12, EF-13, EF-14 and EF-15**

**.1 Modes of Operation**

- .1 The exhaust fan is switched ON/OFF by BAS based on input from the wall mounted temperature sensor in the respective space when the space temperature exceeds 26.6°C (80°F)(adjustable) during the summer months of July and August.

**.2 Critical Alarms**

- .1 The space temperature level rises above the set point but the fan status is OFF.

**.3 General Alarms**

- .1 The space temperature level is below the set point but the fan status is ON.

**.4 Trends**

- .1 Fan run hours.
- .2 space temperature.

**.10 UNIT HEATERS UH-1 TO UH-7**



## **.1 Modes of Operation**

- .1 Unit heaters UH-1 to UH-7 are enabled by BAS in the entire heating season from September 1<sup>st</sup> to June 30<sup>th</sup>. In the summer months of July and August, the unit heaters remain disabled by the BAS.

## **.2 Start Up/Shutdown**

- .1 The unit heaters are switched ON/OFF by the BAS based on the input from the respective space temperature sensors in the spaces.

## **.3 Enabled Mode**

- .1 The unit heater fan runs delivering the airflow to the room. The two-way valve on the heating water supply pipe remains open. When the space temperature equals the set point (70°F/21°C), the BAS shuts off the fan and the two-way valve.
- .2 In the Apparatus Bay when the space temperature drops to 65°F/18°C, the BAS opens the two-way valve on the heating supply pipe and starts the unit heater fan (UH-1 to 4). When the space temperature equals the set point (72°F/22.2°C), the BAS shuts off the unit heaters and 2-way valves.
- .3 When the outside air temperature rises above 18°C, the unit heaters are disabled by the BAS.

## **.4 Disabled Mode**

- .1 The unit heaters remain OFF and the two-way valve on the heating supply pipe remains closed.

## **.5 Critical Alarms**

- .1 The unit heaters are enabled and status is not received (2 minute delay).
- .2 Unit heater is ON but the fan not running.
- .3 Unit heater fan is running but the two-way valve is closed.

## **.6 General Alarms**

- .1 The space temperature remains below set point for more than 30 minutes.

## **.7 Maintenance Alarms**

- .1 The unit heaters are disabled by the BAS but the status is ON (10 minute delay).

## **.8 Trends**

- .1 Leaving water temperature.
- .2 Fan run hours.
- .3 Space temperature.

## **.11 AIR FILTRATION SYSTEM FOR APPARATUS BAY**

### **.1 General**

- .1 The air filtration system comprises of an air circulating unit with a blower and multiple filters. The units are suspended from the under side of the roof structure.

### **.2 Modes of Operation**

- .1 The air filtration units remain enabled all the time by the BAS.

### **.3 Start Up/Shutdown**

- .1 The units are started by the control panel mounted on the wall by one of the following inputs:
  - a. Signal from the optical eye view sensors mounted on the opposite sides of the overhead doors in the Apparatus Bay.
  - b. Signal from the particulate sensor mounted on the wall near the control panel.
  - c. Signal from the CO/NOx sensor when the CO/NOx level exceeds the set point.
- .2 The units are switched off at the end of the cycle time by the control panel. Cycle time is set at a rotary selector provided in the control panel.

### **.4 Enabled Mode**

- .1 When the overhead doors open, the flag fitted on the door breaks the light beam between the 2 eye sensors on the opposite walls. The sensors send the signals to the control panel that starts the filtration blower drawing air through the filters and discharging at the outlet.
- .2 When the overhead doors are closed and the trucks are turned ON, the units are started by the particulate sensor or the CO/NOx sensor.

### **.5 Critical Alarms**

- .1 The status of the units is OFF(disabled).
- .2 The status of control panel is OFF.
- .3 Filter alarm from the units.

### **.6 General Alarms**

- .1 The exhaust fan, EF-10, runs more than 3 minutes after the fire truck is out of range.

### **.7 Trends**

- .1 Fan status.
- .2 Fan run hours.

### **.12 CIRCULATING PUMP, CP-1**

#### **.1 Modes of Operation**

- .1 The circulating pump, CP-1, is enabled during the occupancy hours by the integral timer. CP-1 is disabled by the timer during unoccupied hours.

#### **.2 Start Up/Shutdown**

- .1 The circulating pump, CP-1, is switched ON/OFF by the integral thermostat based on the return hot water temperature.

#### **.3 Enabled Mode**

- .1 The circulating pump, CP-1, runs continuously circulating the domestic hot water until the return water temperature exceeds 105°F/40.6°C when it is stopped by the integral aquastat. When the water temperature drops below 85°F/29.4°C, the pump CP-1 is started by the aquastat.

#### **.4 Disabled Mode**

- .1 The circulating pump, CP-1, remains OFF.

**.5 Critical Alarms**

- .1 No critical alarm.

**.6 Trends**

- .1 Pump status.

**.13 CIRCULATING PUMPS, CP-2A and CP-2B**

**.1 Modes of Operation**

- .1 The circulating pumps, CP-2A and CP-2B, are enabled by the BAS for the entire heating season from September 1<sup>st</sup> to June 30<sup>th</sup>. The pumps are disabled by the BAS during the summer months of July and August.

**.2 Start Up/Shutdown**

- .1 The circulating pumps, CP-2A and CP-2B, are switched ON/OFF by the BAS as described in the sequence of operations for the boilers.

**.3 Enabled Mode**

- .1 The circulating pump, CP-2A, is switched ON by the BAS before starting the boiler B-1. The BAS switches OFF the pump, CP-2A, when the leaving water temperature as sensed by the temperature sensor on the supply pipe in the mechanical room equals (43.3°C)110°F.
- .2 The circulating pump, CP-2B, is switched ON by the BAS before starting the boiler B-2. The BAS switches OFF the pump, CP-2B, when the leaving water temperature as sensed by the temperature sensor on the supply pipe in the mechanical room equals (43.3°C)110°F.
- .3 When the outside air temperature rises above 10°C (adjustable), the BAS disables the circulating pumps, CP-2A and CP-2B.
- .4 Refer to sequence of operations of the boilers for emergency mode operation of the pumps.

**.4 Disabled Mode**

- .1 The circulating pumps, CP-2A and CP-2B, remain OFF.

**.5 Critical Alarms**

- .1 The circulating pumps are enabled and status is not received (2-minute delay).
- .2 The circulating pump is ON but there is no water flow.

**.6 Trends**

- .1 Pumps status.
- .2 Pumps run hours.

**.14 CIRCULATING PUMP, CP-3**

**.1 Modes of Operation**

- .1 The circulating pump, CP-3, is enabled by the BAS for the entire heating season from September 1<sup>st</sup> to June 30<sup>th</sup>. CP-3 is disabled by the BAS during the summer months of July and August.

**.2 Start Up/Shutdown**

- .1 The circulating pump, CP-3, is switched ON/OFF by the BAS based on the heating supply temperature as sensed by the temperature sensor on the heating supply pipe.

**.3 Enabled Mode**

- .1 The circulating pump, CP-3, is switched ON by the BAS when the heating supply temperature as sensed by the temperature sensor in the heating supply pipe drops below 37.8°C(100°F) (adjustable). The BAS switches OFF the pump, CP-3, after 5 minutes(adjustable) when the leaving water temperature as sensed by the temperature sensor on the supply pipe in the mechanical room rises above (43.3°C)110°F.
- .2 When the outside air temperature rises above 21 °C(adjustable), the BAS disables the circulating pump, CP-3.

**.4 Disabled Mode**

- .1 The circulating pump, CP-3, remains OFF.

**.5 Critical Alarms**

- .1 The circulating pump, CP-3, is enabled and status is not received (2-minute delay).
- .2 The circulating pump, CP-3, is ON but there is no water flow.

**.6 Trends**

- .1 Pump status.
- .2 Pump run hours.

**.15 CIRCULATING PUMPS, P-1/P-2**

**.1 Modes of Operation**

- .1 The circulating pumps, P-1/P-2, are enabled by the BAS for the entire heating season from September 1<sup>st</sup> to June 30<sup>th</sup>. P-1/P-2 are disabled by the BAS during the summer months of July and August.

**.2 Start Up/Shutdown**

- .1 The circulating pump, either P-1 or P-2, is run continuously during the heating season when the outside air temperature remains below 21°C. When the outside air temperature rises above 21 °C, the BAS shuts down the pump.

**.3 Enabled Mode**

- .1 The circulating pump, either P-1 or P-2, is switched ON by the BAS when the outside air temperature drops below 21°C(70°F). The speed of the pump is varied based on the differential pressure in the heating supply pipes.
- .2 If there is no heating demand from any of the zones for 5 minutes, the pump shall be stopped. Upon heating demand from any one of the zones as sensed by the temperature sensors in the room, BAS shall start the pump.
- .3 The BAS alternates the duty pump between P-1 and P-2 every Monday(adjustable).

**.4 Disabled Mode**

- .1 The circulating pumps, P-1 and P-2, remain OFF.

**.5 Critical Alarms**

- .1 The circulating pumps, P-1 and P-2, are enabled and status is not received (2-minute delay).
- .2 The circulating pumps, either P-1 or P-2, is ON but there is no water flow.

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**.6 Trends**

- .1 Pump status.
- .2 Pump run hours.

**.16 CIRCULATING PUMP, CP-4**

**.1 Modes of Operation**

- .1 The circulating pump, CP-4, is enabled by the BAS for the entire heating season from September 1<sup>st</sup> to June 30<sup>th</sup>. CP-4 is disabled by the BAS during the summer months of July and August.

**.2 Start Up/Shutdown**

- .1 The circulating pump, CP-4, is switched ON/OFF by the pump controller mounted inside the manifold cabinet for in-floor hydronic radiant floor heating system.

**.3 Enabled Mode**

- .1 The circulating pump, CP-4, is switched ON by the pump controller in the manifold cabinet when the floor slab temperature as sensed by the temperature sensor embedded in the floor slab of the Apparatus Bay drops below 22.2°C(72°F) (adjustable). The pump is switched OFF when the temperature of the floor slab rises above 23.9°C(75°F).
- .2 When the outside air temperature rises above 21 °C(adjustable), the BAS disables the circulating pump, CP-4.

**.4 Disabled Mode**

- .1 The circulating pump, CP-4, remains OFF.

**.5 Critical Alarms**

- .1 The circulating pump, CP-4, is enabled and status is not received (2-minute delay).
- .2 The circulating pump, CP-4, is ON but there is no water flow.

**.6 Trends**

- .1 Pump status.
- .2 Pump run hours.



Points List

		Analog Points												Digital points				Misc.				Notes					
	Point name EQ Type	Input												Output		Input		Output		Alarm	Weekly Sch.		BACNET Object Exchan	Graphic			
		Temperature	CO2/CO/NO2	Sub-metering	Diff. Press.	Pressure	Low Limit	Flow	Timer	Position	Speed	Humidity	Lux	Electric	Damper	H / C Valve	Status	Position	Switch						Start/Stop	On/Off	
OUTDOOR	OAT																					X			Sensor fail alarm		
Temperature		X																				X			2 Sensors with temp avg		
Photo Cell												X										X					
Humidity											X											X					
Building Pressure Sensor						X																X					
VRF SYSTEM																											
Outdoor Condensing Unit				X												X						X			X		
Fan Coil Units				X												X						X			X		
Electric duct heater				X												X			X			X			X		
Supply Air		X																				X					
Return Air		X									X											X					
Mixed Air		X											X									X					
Space Temp - Display/Adjust/Override		X																				X					
Freeze Stat						X																X					
Humidification																X			X			X					
Outdoor Air Flow Monitor	OAF						X															X					

	Point name EQ Type	Analog Points													Digital points					Misc.				Notes			
		Input												Output		Input		Output			Alarm	Weekly Sch.	BACNET Object Exchan		Graphic		
		Temperature	CO2/CO/NO2	Sub-metering	Diff. Press.	Pressure	Low Limit	Flow	Timer	Position	Speed	Humidity	Lux	Electric	Damper	H / C Valve	Status	Position	Switch	Start/Stop						On/Off	
HYDRONIC HEATING Systems																											
Boiler	B-1			X													X			X			X			X	
Boiler Circulator	CP-2																X			X	X		X			X	
Heating water Supply Temperature	HST	X																				X				X	
Heating water return temperature	HRT	X																				X					
Air-to-Water Heat Pump	AWHP-1			X													X			X		X			X		
Circulator Pump	CP-3																X			X	X		X			X	
Circulator Pump	CP-4																X			X		X			X		
Discharge water temp. from AWHP-1		X																				X			X		
Two-Way valve																	X			X		X			X		All heating valves will be fully modulating 0-10V
Space Temp - Display/Adjust/Override		X																				X					
Circulating pumps, P-1/P-2						X					X						X			X		X	X		X		
Heating water supply pressure						X																X			X		
Heating water return pressure						X																X			X		
ENERGY RECOVERY VENTILATOR - 1																											
Fans																	X			X		X			X		
Motorised Dampers																	X	X				X			X		
Filters																	X					X			X		
Supply air temperature		X																									
Return air temperature		X																									
Exhaust air temperature		X	X																								
Pre-heater amps														X													
EXHAUST FANS																											
Fan	EF1 to 9																X					X			X		Washroom exhaust fans to be controlled by time of the day schedule
Fan	EF-10																X					X			X		
Fan	EF-11																X					X			X		
Motorised damper – Air Intake	EF-11																	X	X			X			X		
CO/NOx Level – Apparatus Bay	CO/NOx Sensor		X																			X			X		
Fan	EF-12 to 15																X					X			X		
Space temperature	Thermostat	X																									

Washroom exhaust fans to be controlled by time of the day schedule.

	Point name EQ Type	Analog Points													Digital points						Misc.				Notes																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
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End of Section

**1 GENERAL****1.01 REFERENCES**

- .1 The General Conditions of the Contract, the Supplementary Conditions, and all Sections of Division 01 apply to and are a part of this Section of the Specification.

**1.02 APPLICATION**

- .1 This Section specifies requirements that are common to electrical work Sections of the Specification and it is a supplement to each Section and is to be read accordingly.

**1.03 NOTE RE: BOLD LETTERING**

- .1 "**Bold**" type lettering is used throughout this Specification in an attempt to enhance the readability of the text. The use of "**bold**" lettering does not indicate a greater level of importance.

**1.04 SUBMITTALS**

- .1 As specified in this Section, submit the following to the Consultant:
  - .1 **project close-out documentation:** O & M Manuals, record as-built drawings, and all associated data.
  - .2 **progress payment breakdown:** a detailed breakdown of the electrical work cost
  - .3 **Extended Warranties:** copies of all extended warranties specified and shall be in the name of the Owner.
  - .4 **O & M Training Schedules & Manual:** a proposed schedule of demonstration and training dates and times, and a preliminary copy of the training manual developed for operational and maintenance training.

**1.05 DEFINITIONS**

- .1 The following are definitions of words found in electrical work Sections of the Specification and on associated drawings:
  - .1 "concealed" – means work hidden from normal sight in furred spaces, shafts, tunnels, ceiling spaces, walls and partitions
  - .2 "exposed" – means work normally visible, including work in electrical and equipment rooms and similar spaces
  - .3 "provide" (and tenses of provide) – means supply and install complete
  - .4 "install" (and tenses of install) – means install and connect complete
  - .5 "supply" – means supply only

- 6 "finished area" - means any area or part of an area which receives a finish such as paint, or is factory finished
- .7 "governing authority" and/or "regulatory authority" and/or "Municipal authority" – means all government departments, agencies, standards, rules and regulations that apply to and govern the electrical work and to which the work must adhere
- .8 "Consultant" – means the Architect or Consulting Engineer who has prepared the Contract Documents on behalf of the Owner
- .2 Wherever the words "indicated", "shown", "noted", "listed", or similar words or phrases are used in the specification they are understood, unless otherwise defined, to mean that the product referred to is "indicated", "shown", "listed", or "noted" on the drawings.
- .3 Wherever the words "approved", "satisfactory", "as directed", "submit", "permitted", "inspected" or similar words or phrases are used in the specification or on the drawings they are understood, unless otherwise defined, to mean that work or product referred to is "approved by", "inspected by", etc., the Consultant.
- .4 In the electrical specification, singular may be read as plural, and vice-versa.

#### **1.06 QUALITY ASSURANCE**

- .1 All electrical work is to be done by journeyman tradesmen who perform only the work that their certificates permit, or by apprentice tradesmen under direct on-site supervision of an experienced journeyman tradesman. The use of apprentice tradesmen is to be limited and the journeyman/apprentice ratio is subject to the Consultant's approval.
- .2 An experienced and qualified superintendent is to be on-site at all times when electrical work is being performed.

#### **1.07 CODES, REGULATIONS, AND STANDARDS**

- .1 All Codes, Regulations, and Standards referred to in this Section and in Sections to which this Section applies are the latest edition of the Codes, Regulations, and Standards in effect at the time of bidding on this Project.
- .2 All electrical items are to be certified and bear the 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.
- .3 Requirements of the Contract Documents are to take precedence when they are more stringent than codes, ordinances, standards, and statutes.

#### **1.08 IMPERIAL AND METRIC MEASUREMENTS**

- .1 Conform to requirements of CAN/CSA-Z234.1, Canadian Metric Practice Guide.
- .2 Both Metric and Imperial units of measurement are indicated in the electrical Specification. Metric measurements are "soft" and have been rounded off.



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**1.09 EXAMINATION OF SITE AND DOCUMENTS**

- .1 When estimating the cost of the work and prior to submitting a bid for the work carefully examine all of the bid documents and visit the site to determine and review all existing site conditions that will or may affect the work and include for all such conditions in the bid price.
- .2 Report to the Consultant, prior to bid submittal, any existing site condition that will or may affect performance of the work as per the drawings and specifications. Failure to do so will not be grounds for additional costs.

**1.10 DRAWINGS AND SPECIFICATION**

- .1 Read the electrical work drawings in conjunction with all other structural, architectural, sprinkler, mechanical, etc., drawings.
- .2 The electrical drawings are performance drawings, diagrammatic, and show approximate locations of equipment and connecting services. Any information regarding accurate measurement of the building are to be taken at the site. Do not scale the drawings, and do not use the drawings for prefabrication work.
- .3 The drawings are intended to convey the scope of work and do not show architectural and structural details. Provide, at your cost, all offsets, fittings, transformations, and similar products required as a result of obstructions and other architectural and structural details but not shown on the drawings.
- .4 The locations of equipment and materials shown may be altered, when reviewed by the Consultant, to meet requirements of the equipment and/or materials, other equipment or systems being installed, and of the building, all at your cost.
- .5 Sections of the electrical specification 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 the Sections are to be read as a whole.
- .6 The electrical specification does not generally indicate the specific number of items or extent of material required. The specification is intended to provide product data and installation requirements. It is necessary to refer to drawing schedules, layouts, schematic diagrams, riser diagrams, and details to determine correct quantities.
- .7 The electrical drawings and specification are intended to be cooperative. Perform all work that is shown, specified, or reasonably implied on the drawings but not mentioned in the specification, or vice-versa, as though fully covered by both.
- .8 When the scale and date of the drawings are the same, or when the discrepancy exists within the specification, the most costly arrangement will take precedence.
- .9 In the case of discrepancies or conflicts between the drawings and specification, the documents will govern in the following order:
  - .1 the specification
  - .2 drawings of larger scale

- .3 drawings of smaller scale
- .4 drawings of later date when the scale of the drawings is the same.
- .10 In the case of discrepancies between the drawings and specifications, the documents will govern in the order specified in the General Conditions, however, when the scale and date of the drawings are the same, or where the discrepancy exists within the specification, the costliest arrangement will take precedence.

#### **1.11 PLANNING AND LAYOUT OF THE WORK, AND ASSOCIATED DRAWINGS**

- .1 Properly plan, coordinate, and establish the locations and routing of services with all subcontractors affected prior to installation such that the services will clear each other as well as any obstructions, including structural components of the building. Unless otherwise specified, the order of right-of-way for services is to be as follows:
  - .1 piping requiring uniform pitch
  - .2 piping 100 mm (4") dia. and larger
  - .3 large ducts (main runs)
  - .4 electrical cable tray and bus duct
  - .5 conduit 100 mm (4") dia. and larger
  - .6 piping less than 100 mm (4") diameter
  - .7 smaller branch ductwork
  - .8 conduit less than 100 mm (4") diameter
- .2 Unless otherwise shown or specified, conceal all work in finished areas, and conceal work in partially finished or unfinished areas to the extent made possible by the area construction. Install conduit, raceway, and similar 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.
- .3 Revise or alter the arrangement of work that has been installed without proper coordination, study and review, even if it was completed in accordance with the Contract Documents, in order to conceal the work behind finishes, or to allow the installation of other work, at no additional cost. In addition, pay for the cost of alterations in other work required by the alterations to your work.
- .4 All junction boxes, 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.

#### **1.12 COORDINATION OF THE WORK**

- .1 Review all the Contract Documents and coordinate the work with the work of all subcontractors. Coordination requirements are to include, but not be limited to, the following:

- .1 written notifications of all concrete work such as housekeeping pads, bases, etc., required for electrical work, and including required dimensions, operating weight of equipment, location, etc.
- .2 depth and routing of excavation required for electrical work, and requirements for bedding and backfill

### **1.13 GENERAL RE: INSTALLATION OF EQUIPMENT**

- .1 Unless otherwise specified all equipment is to be installed in accordance with the 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.
- .2 Ensure that proper access and service clearances are maintained around equipment, and, where applicable, access space for future equipment removal or replacement is not impeded. Remove and replace any equipment which does not meet this requirement.

### **1.14 PERMITS, FEES, AND CERTIFICATES**

- .1 Apply for, obtain and pay for all permits required to complete the electrical work.
- .2 Submit to the Consultant, all approval/inspection certificates issued by governing authorities to confirm that the work as installed is in accordance with the rules and regulations of the governing authorities. Pay any costs associated with issue of the certificates.
- .3 Include a copy of all approval/inspection certificates in each operating and maintenance manual.

### **1.15 WORKPLACE SAFETY**

- .1 Comply with requirements of the Workplace Hazardous Materials Information System (WHMIS) regarding the use, handling, storage and disposal of hazardous materials. Submit WHMIS MSDS (Material Safety Data Sheets) for all products where required, and maintain one copy at the site in a visible and accessible location available to all personnel.
- .2 Comply with all requirements of Occupational Health and Safety Regulations and all other regulations pertaining to health and safety, including worker's compensation/ insurance board and fall protection regulations.

### **1.16 SHOP DRAWINGS AND PRODUCT DATA SHEETS**

- .1 Prior to supplying any products to the site, submit for review, shop drawings and/or product data sheets indicating in detail the design, construction, and performance of products as requested in Sections of this Specification. The number of copies of shop drawings and/or product data sheets will be as later directed.
- .2 Shop drawings are those prepared specifically for the Project. Product data sheets are copies of manufacturer's standard catalogue, etc., literature.
- .3 Unless otherwise specified or required, submit shop drawings/product data sheets via email in

AutoCAD or PDF format only.

- .4 Wherever possible, shop drawings and/or product data sheets are to be digital electronic PDF format; 215 mm x 280 mm (8½" x 11"), 215 mm x 356 mm (8½" x 14"), or 356 mm x 432 mm (11" x 17") single side white bond paper with sufficient clear space for review stamps, comments, and identification as specified below.
- .5 Shop drawings and product data sheets must confirm that the product proposed meets all requirements of the Contract Documents.
- .6 Each shop drawing or product data sheet is to be properly identified with the project name and the product drawing or specification reference, i.e. "Lighting Fixture F1", and all shop drawing or product data sheet dimensions are to be either SI or Imperial to match dimensions on the drawings.
- .7 Carefully review each shop drawing and product data sheet prior to submittal to ensure that the proposed product is correct and meets with all requirements of the Project. Endorse each copy of each shop drawing or product data sheet "Correct for Review By Consultant", or "Certified to Be In Accordance With All Requirements" and include your company name, the submittal date, and the signature of an officer of your company to indicate your review and approval as above.
- .8 The Consultant will review shop drawings and product data sheets and will indicate the review status by stamping the shop drawings and product data sheets as follows:
  - .1 **"Reviewed" or "Reviewed As Noted"** to indicate that his review is final and no re- submittal is required
  - .2 **"Returned For Correction"** to indicate that the submission is rejected and is to be revised in accordance with comments marked on the shop drawings and product data sheets by the Consultant and re-submitted
- .9 The Consultant will retain one digital electronic PDF copy of each shop drawing or product data sheet submission. Copy of shop drawings in digital and hard copy format shall be kept on site for the duration of the construction.
- .10 The following is to be read in conjunction with the wording on the Consultant's review stamp applied to each and every electrical work shop drawing or product data sheet submitted:
 

"This review is for the sole purpose of ascertaining conformance with the general design concept. This review does not approve the detail design inherent in the product data/shop drawings, responsibility for which remains with the Contractor, and such review does not relieve the Contractor of the responsibility for errors or omissions in the product data/shop drawings or of his 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 coordination of the work of all sub-trades."

#### 1.17 N I L ( NOT IN LIST)

#### 1.18 SCAFFOLDING, RIGGING, AND HOISTING

- .1 Unless otherwise specified or directed, supply, erect and operate all scaffolding, rigging, hoisting

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equipment and associated hardware required for your work. Immediately remove from the site all scaffolding, rigging, and hoisting equipment when no longer required.

## 1.19 PROJECT CLOSEOUT SUBMITTALS

- .1 Prior to application for Substantial Performance, submit all required items and documentation specified, including the following:
  - .1 Operating and Maintenance Manuals
  - .2 as-built record drawings and associated data.
  - .3 extended warranties for equipment as specified.
  - .4 all operating test certificates, i.e. Fire Alarm System Test Certificate.
  - .5 identified keys for electrical equipment and/or panels for which keys are required, and all other items required to be submitted.
  - .6 other data or products specified.
- .2 **Operating and Maintenance Manuals:** Submit (2) two hard copies and (1) one digital electronic PDF of operating and maintenance manuals consolidated in hardcover three "D" ring binders, each binder sized to include approximately 25% spare space for future data, and identified permanently with the Project name, "ELECTRICAL OPERATING AND MAINTENANCE MANUAL" wording, and the date. Manuals are to include the following:
  - .1 an Introduction sheet listing the Consultant's, Contractor's, and Subcontractor names, street addresses, telephone and fax numbers, and e-mail addresses.
  - .2 a Table of Contents sheet, and corresponding index tab sheets
  - .3 a copy of each "Reviewed" or "Reviewed As Noted" shop drawing or product data sheet, with manufacturer's/supplier's name, telephone and fax numbers, email address, and the email address for local source of parts and service
  - .4 test reports, and certificates issued by governing authorities.
  - .5 **Operating Data:** Operating data is to include:
    - .1 a description of each system and its controls
    - .2 operation instruction for each system and each component
    - .3 description of actions to be taken in event of emergencies and/or equipment failure
  - .6 **Maintenance Data:** Maintenance data is to include:
    - .1 servicing maintenance, operation and trouble-shooting instructions for each item of equipment and each system
    - .2 schedules of tasks, frequency, tools required, and estimated task time.



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- .3 complete parts list with numbers
  - .7 **Performance Data:** Performance data is to include:
    - .1 equipment and system start-up data sheets
    - .2 equipment performance verification test results, and final commissioning report
  - .8 **Review Submittal:** Assemble one copy of the O & M Manual and submit to the Consultant for review prior to Owner training and instructions and assembling the remaining copies. Incorporate all comments into the final submission.
  - .9 **Digital O & M Manuals:** Submit four digital versions of the hard copy manual using the latest version of Adobe Acrobat Portable Document Format and enhanced with bookmarks, internet links, and internal document links. The digital copies are to be copied to CDR with custom labels which indicate the project name, date, the Consultant's name, and "Operating & Maintenance Manual for Electrical Systems".
  - .3 **Record "As-Built" Drawings and Data:** As work progresses at the site, clearly mark in red in a neat and legible manner on a set of white prints of the Contract Drawings, all significant changes and deviations from the routing of services and locations of equipment shown on the Contract Drawings and resulting from the issue of Addenda, Site Instructions, Change Orders, and job conditions. Use notes marked in red as required. Maintain the white print red line as-built set at the site for the exclusive use of recording as-built conditions, keep the set up-to-date at all times, and ensure that the set is always available for periodic review. The as-built set is also to include the following:
    - .1 the dimensioned location of all inaccessible concealed work
    - .2 the locations of control devices with identification for each
    - .3 the location of all junction boxes, terminal cabinets, etc.
    - .4 for underground conduit, ducts, etc., record dimensions, invert elevations, all offsets, fittings, and accessories if applicable, and locate dimensions from benchmarks that will be preserved after construction is complete.
    - .5 the location of all concealed services terminated for future extension.
  - .6 **Digital Record "As-Built" Drawings:** When work on site is complete, transfer all the as-built red line information from the site as-built drawings to a recordable and identified CAD disc with CAD work of equal quality to the Contract Drawings. Obtain a CAD disc as described below.
  - .7 **Obtaining CAD Discs:** The electrical drawings have been prepared on a CAD system using the latest Release of AutoCad software. For the purpose of producing final as-built drawings, discs of the Contract Drawings will be supplied free of charge by the Consultant.
  - .8 **Review and Submittal:** Prior to inspection for Substantial Performance of the work, submit for review, the red line site as-built white prints, a CAD disc of the as-built drawings, and a bound set of white prints (of equal quality to the Contract Drawings) made from the disc. The Consultant
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will review the drawings and, if necessary, return the disc and the marked-up white prints for corrections or further revisions, in which case complete the corrective and/or revision work and

resubmit the disc and white prints until they are determined to be acceptable, all prior to issue of a Certificate of Substantial Performance.

**1.20 (NOT IN LIST)**

**1.21 (NOT IN LIST)**

**1.22 EXTENDED WARRANTIES**

- .1 Unless otherwise specified, all extended warranties specified in electrical work Sections of the Specification are to be full parts and labour warranties, at the site, and in accordance with requirements of the Contract warranty, but direct from the equipment manufacturer/supplier to the Owner. Submit signed and dated copies of extended warranties which clearly state requirements specified above.

**1.23 EQUIPMENT AND MATERIAL MANUFACTURER REQUIREMENTS**

- .1 Equipment and materials scheduled or specified on the drawings or in the Specification have been selected to establish a performance and quality standard.
- .2 In most cases acceptable equipment and material manufacturers are listed for any product specified by manufacturer's name and model number. **Unless otherwise stated the bid price may be based on products supplied by any of the manufacturers or an approved equivalent named as acceptable for the particular product. If acceptable manufacturers are not listed for a particular product, base the bid price on the products supplied by the specified manufacturers or an approved equivalent.**
- .3 If products supplied by a manufacturer named as acceptable **or approved equivalent** are used in lieu of the products specified by manufacturer's name and model number, ensure that the product is equivalent in performance and operating characteristics (including energy efficiency if applicable) to the specified product. Pay for any additional costs and changes to associated or adjacent work resulting from the use of products supplied by a manufacturer other than the specified manufacturer. In addition, in equipment spaces where products named as acceptable are used in lieu of the specified products and the dimensions of such products differ from the specified products prepare and submit for review, if requested, accurately dimensioned layouts of the rooms affected to prove that all the equipment in the room will fit properly.

**1.24 LIST OF ACCEPTABLE MANUFACTURERS AND SUPPLIERS**

- .1 At the contract kick-off meeting after award of a Contract, submit to the Consultant for review, a list to indicate the name of the manufacturers/suppliers you propose to use for each item of equipment, material, or service listed, except for items such as conduit, branch circuit conductors, and similar products. Manufacturers and/or suppliers on the list must be named in the Specification or on the drawings.
- .2 If the List of Acceptable Manufacturers and Suppliers is not submitted at the contract **kick-off meeting**

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after award of a Contract, the products specified and scheduled by manufacturer's name and model number and on which the Project is based are to be supplied. No substitutions whatsoever will be accepted unless previously approved in writing by the Consultant.  
General Contractor can provide list of approved equivalent equipment which meets the specifications.

**1.25 (NOT IN LIST)**

**1.26 (NOT IN LIST)**

**1.27 EQUIPMENT AND SYSTEM MANUFACTURER'S CERTIFICATION**

- .1 When equipment/system installation is complete, but prior to start-up procedures, arrange and pay for the equipment/system manufacturer's authorized representative to visit the site to examine the installation, and when any required corrective measures have been made, to certify in writing to the Consultant that the equipment/system installation is complete and in accordance with the equipment/system manufacturer's instructions.

**1.28 EQUIPMENT AND SYSTEM START-UP**

- .1 When installation of equipment/systems is complete but prior to commissioning, perform start-up for equipment/systems as specified in electrical work Sections in accordance with the 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.
  - .2 under direct on-site supervision and involvement of the equipment/system manufacturer's representative, start-up the equipment/systems, make any required adjustments, document the procedures, leave the equipment/systems in proper operating condition, and submit a complete set of start-up documentation sheets signed by the manufacturer/supplier and the Contractor.

**1.29 EQUIPMENT AND SYSTEM COMMISSIONING**

- .1 After successful start-up and prior to Substantial Performance, commission the electrical work using approved commissioning sheets. Submit final commissioning data sheets. Include for equipment manufacturer's representation at the site to assist in the commissioning process.

**1.30 EQUIPMENT AND SYSTEM O & M DEMONSTRATION & TRAINING**

- .1 Refer to equipment and system operational and maintenance training requirements specified in Division 01.
- .2 Train the Owner's designated personnel in all aspects of operation and maintenance of equipment and systems as specified in electrical work Sections of the Specification. All demonstrations and training is to be performed by qualified technicians employed by the equipment/system manufacturer/supplier.
- .3 For each item of equipment and for each system for which training is specified, prepare training modules as specified below. Operating and Maintenance Manuals are to be used during the training sessions, and training modules are to include:

- .1 **Operational Requirements and Criteria:** requirements and criteria are to include but not be limited to equipment function, stopping and starting, safeties, operating standards, operating characteristics, and limitations.
- .2 **Troubleshooting:** troubleshooting is to include but not be limited to diagnostic instructions, test and inspection procedures.
- .3 **Documentation:** documentation is to include but not be limited to equipment/system warranties, and manufacturer's/supplier's parts and service facilities, telephone numbers, email addresses, and the like
- .4 **Maintenance:** maintenance requirements are to include but not be limited to 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:** repair requirements are to include but not be limited to diagnostic instructions, disassembly, component removal and repair instructions, instructions for identifying parts and components, and review of any spare parts inventory.
- .4 Assemble the training modules into a training manual and submit a copy to the Consultant for review prior to scheduling training. Ensure that each participant in each training session has all required training material.
- .5 Schedule demonstrations and training at mutually agreed to times with a minimum of 7 working days notice.
- .6 **Demonstration and Training Confirmation:** Obtain a list of personnel to receive demonstration and training from the Consultant, and have each participant sign the list to confirm that he/she understood the demonstration and training session.

**End of Section**

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**1 GENERAL**

**1.01 APPLICATION**

- .1 This Section specifies seismic control and restraint requirements that are common to electrical work Sections of the Specification and it is a supplement to each Section and is to be read accordingly.

**1.02 SEISMIC CONSULTANT**

- .1 Retain and pay for the services of an experienced Seismic Consultant who is a registered professional engineer licensed in the area of the work and a member in good standing of a Professional Engineers Association in the area of the work.
- .2 The Seismic Consultant is to:
- .1 determine the proper seismic hazard level, design, recommend, and review all proposed electrical work seismic restraint shop, placement and securing drawings, and sign and stamp all drawings prior to submittal for review as specified below
  - .2 supervise installation of all electrical work seismic restraint and, when work is complete, certify in writing that the seismic restraint work has been installed in accordance with signed, stamped and reviewed drawings
  - .3 prepare and submit to the Municipality and authorities having jurisdiction, on a form approved by the Municipality and authorities having jurisdiction, at the beginning of seismic restraint work and when the work is complete, original signed and sealed Letters of Assurance for the design, installation and field review of all seismic restraint work

**1.03 SUBMITTALS**

- .1 **Shop Drawings/Product Data Sheets:** Obtain all required equipment information and submit manufacturer's shop drawings/product data sheets for all restraining devices and steel bases. Include placement data, and details of attachment to both the equipment and the structure meeting requirements of the forces involved. All product data sheets and drawings are to be signed and stamped by the Seismic Consultant referred to above.
- .2 **Seismic Consultant's/Seismic Control Product Manufacturer's Certification Letters:** Submit copies of the Seismic Consultant's Letters of Assurance as specified above. Submit copies of the Seismic Consultant and seismic control manufacturer's certification letters as specified in Part 3 of this Section.
- .3 **Samples:** If requested, submit samples of seismic restraint materials for review.

## **1.04 QUALITY ASSURANCE**

- .1 Seismic restraints are to be designed by a Seismic Consultant as specified above, and are to be installed by qualified tradesmen under the supervision of and to the approval of the Seismic Consultant.
- .2 Unless otherwise specified seismic control and restraints are to be designed in accordance with
  - .1 National Building Code of Canada
  - .2 CAN/CSA-S832, Seismic Risk Reduction of Operational and Functional Components (OFC's) of Buildings
  - .3 local Code requirements
- .3 All restraint products must be tested in an independent testing laboratory, or certified by the Vibration Isolation and Seismic Control Manufacturer's Association and Seismic Consultant, to confirm that the restraint products meet all requirements of this Section, i.e. dynamic ultimate limit load state as required by the Code, "Fail Safe" design, etc. If particular tests are carried out to represent a restraint type, the test is to be valid for the full load range of the restraint. Submit such tests or certification when requested.
- .4 Seismic control and restraint product manufacturers are to provide all required assistance during the installation, and, when the installation is complete, submit written reports from the manufactures listing any deficiencies to the installation.

## **2 PRODUCTS**

### **2.01 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 the Code for the seismic zone in which the 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, design and provide anchors and bolts to withstand, without failure or yielding, a dynamic ultimate limit state load as defined in the Code, of the greater of 0.3 g or as required by the Code, applied horizontally through the centre of gravity.
- .3 Where impact forces may be significant, use ductile materials.
- .4 Seismic restraining devices which are factory supplied with equipment are to meet all requirements of this Section.

### **2.02 ACCEPTABLE MANUFACTURERS**

- .1 Acceptable seismic restraint product manufacturers are:
  - .1 Mason Industries Inc.

.2 Kinetics Noise Control

.3 Vibro-Acoustics Ltd.

.4 The VCM Group

.5 **Approved Equivalent.**

## **2.03 SLACK CABLE RESTRAINTS**

- .1 Galvanized steel aircraft cable slack cable restraints meeting all current requirements of the Building Code, sized to suit the application and complete with all required cable ties, anchor hardware (selected for a load equal to twice the weight of the equipment), and similar connection accessories.

## **2.04 ANCHOR BOLTS**

- .1 Equal to Mason Industries type SAB seismic anchor bolts.

## **3 EXECUTION**

### **3.01 INSTALLATION OF SEISMIC RESTRAINT MATERIALS**

- .1 Provide seismic restraint for all electrical equipment, conduit, raceways, lighting fixtures, etc., as per the requirements of the current edition of the Building Code and this Section of the Specification.
- .2 Provide structural steel bases for all equipment unless the equipment manufacturer certifies direct attachment capabilities.
- .3 Space restraints under equipment so that the 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 the supports and submit design calculations with shop drawings.
- .4 Floor mounted isolated equipment is to be installed on concrete housekeeping pads (design and thickness as selected by the Seismic Consultant) with at least 200 mm (8") clearance between drilled inserts and the edges of the pads. Ensure that all housekeeping pads are keyed to the structure to resist seismic displacement.
- .5 Requirements pertaining to seismic control work are as follows:
  - .1 execute seismic control and restraint work in accordance with drawing details and reviewed product data and shop drawings
  - .2 seismic control systems are to work in all directions
  - .3 fasteners and attachment points are to resist the 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 the structure

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- .6 seismic control measures are not to interfere with the integrity of firestopping
  - .7 all equipment is to be bolted to the structure, and all bolts are to be fitted with isolation washers
  - .8 the number, size, type, and installation of anchor bolts are to be as recommended by the anchor bolt manufacturer and the Seismic Design Consultant
  - .9 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 the air gap with Mason type 0.5 FastSteel reinforced epoxy putty
  - .10 all hung equipment and hangers are to be fitted with a means of preventing upward movement, and non-isolated equipment and hanger rods are to be fitted with oversized steel washers and nuts above and below the hanger or equipment attachment point, locked tight to prevent uplift of the equipment or hanger
  - .11 where suspended equipment hanger rod length exceeds 50 rod diameters between the structure and the equipment attachment point, reinforce the rods with angle iron to prevent bending due to uplift forces
  - .12 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
  - .13 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 the water-tight integrity of the roof
  - .14 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 the clamps due to seismic force

### **3.02 SITE INSPECTION AND LETTERS OF CERTIFICATION**

- .1 When all seismic control products have been installed, arrange for the seismic control product manufacturer and Seismic Consultant to examine the installation of all seismic control products and to certify in writing (separate letters) that the products have been properly installed in accordance with governing Codes and Regulations, and recommendations and instructions. The Seismic Consultant is to apply his signed and dated professional stamp to the letter.

**End of Section**



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## **1 GENERAL**

### **1.01 SUBMITTALS**

- .1 **Product Data:** Submit product data sheets for lighting fixtures. Include certified fixture photometric data which includes total input watts, candlepower summary, candela distribution zonal lumen summary, CIE type coefficient of utilization, and lamp type and lumen rating in accordance with CSA IESNA testing procedures.
- .2 **Lighting Fixture Colour(s):** For all lighting fixtures where the colour is to be selected after award of the Contract, submit colour charts and obtain fixture colour information in writing prior to ordering.
- .3 **Spare Lamps:** Submit spare lamps as specified in Part 3 of this Section.

### **1.02 QUALITY ASSURANCE**

- .1 All lighting fixtures are to be ULC listed and/or CSA certified and labelled.

## **2 PRODUCTS**

### **LED LIGHTING FIXTURES**

#### **2.01 FIXTURE CONSTRUCTION**

- .1 Fixtures must be constructed of 20 gauge (minimum) cold rolled steel. All metal edges require smooth finish.
- .2 Light leaks must be prevented by providing gasketting, stops, and barriers.
- .3 Fixtures must be finished in high reflective baked white enamel. This surface must have a reflectance of not less than 85%.

#### **2.02 FIXTURE LENS**

Unless otherwise noted fixture lenses shall be as follows:

- .1 Lens thickness: 3.2mm (1/8")
- .2 Material: injection moulded clear prismatic virgin acrylic.
- .3 Frame: hinged, latched, steel.

#### **2.03 LED FIXTURES**

- .1 Fixture LED'S must be tested in conformance with IESNA LM80 standard.
- .2 LED's must be selected using a binning algorithm to ensure colour and lumen output of a given fixture are consistent, as well as meet or surpass ANSI C78.377 specification for the rated lifetime of the fixture. Colour accuracy between products must be within a 2 step MacAdam ellipse.

- .3 Luminaires must be tested in conformance with IESNA LM79 by an independent approved laboratory.
- .4 Luminaires must be tested prior to shipping.
- .5 Luminaires must be ULC certified and approved for use in Canada.
- .6 Fixtures must maintain a minimum of 90% of their initial light output for 60,000 hours. Submit test result upon request.
- .7 Lumen values indicated for fixtures in the project documents are to be considered as “absolute” or “delivered” values.
- .8 Other than for specialty fixtures, and unless otherwise indicated, the maximum driver current is to be 750 mA.

### **3 EXECUTION**

#### **3.01 INSTALLATION OF LIGHTING FIXTURES**

- .1 **General Installation Requirements:** Provide lighting fixtures and lamps where shown. Include for all required site assembly and provide all required installation and support hardware. Additional requirements are as follows:
  - .1 confirm exact lighting fixture locations prior to roughing-in
  - .2 in finished areas, refer to architectural reflected ceiling plans and/or wall elevations.
  - .3 in equipment rooms, shafts, and similar unfinished areas, install fixtures after the equipment is roughed-in, and shelving and similar items are installed, and do not suspend fixtures from piping, ductwork, conduit equipment, or similar items.
  - .4 prior to roughing-in for lighting fixture installations, examine drawings and site conditions to determine that suitable space is available for the fixture installation as shown. If sufficient space is not available, notify the Consultant immediately and, if required, relocate the fixtures within reasonable distances without additional cost
  - .5 locate recessed downlights, troffers, and surface mounted fixtures in or on suspended tile ceilings in or on full tiles, and where ceiling tile openings are cut for fixtures, cut to exact sizes so that there are no gaps, and fixture trim completely covers the perimeter of the opening.
  - .6 provide plaster frames for fixtures in suspended plaster or drywall ceilings.
  - .7 use clean gloves when handling reflector cones, louvers, LED strips, glass sconces, and all exposed surfaces of fixtures.

### **3.02 SUSPENDED LIGHTING FIXTURES**

- .1 Support all lighting fixtures in suspended ceilings from the slab or building construction above, independent of the suspended ceiling construction. Support 1.2 m (4') fluorescent fixtures with a minimum of 2 aircraft type cable supports or 2 #3 Tenso Chains. Support HID or incandescent fixtures with 1 #3 Tenso Chain or 1 aircraft type cable. All support is to be in accordance with requirements of governing Codes and Regulations.
- .2 Support continuous rows of fixtures at minimum 1.2 m (48") centres.

### **3.03 LIGHTING FIXTURES ALIGNMENT**

- .1 Align lighting fixtures mounted in continuous rows to form straight uninterrupted lines. Alignment variation is not to exceed 6 mm ( $\frac{1}{4}$ ") in any 5 m (15') run.
- .2 Align lighting fixtures mounted individually parallel and/or perpendicular to building lines.
- .3 Aim accent and spot lighting as indicated and/or as directed by the Consultant, and secure the fixture positions after the Consultant's approval.

### **3.04 LIGHTING FIXTURES CIRCUIT WIRING**

- .1 Connect lighting fixtures to circuits indicated with wiring as shown/specified.
- .2 Minimize the number of splices required.

### **3.05 CLEANING**

- .1 When all lighting fixture installation work is complete, clean all fixtures and lamps, and any ceiling, wall, etc., surfaces soiled as a result of the fixture installation work.
- .2 If wall and ceiling surfaces are damaged as a result of the fixture installation, replace the wall or ceiling surface to the Consultant's approval.

**END OF SECTION**

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## **FIRE DETECTION AND ALARM SYSTEM**

### **3180 POINT INTELLIGENT FIRE ALARM DETECTION SYSTEM**

#### **PART 1 GENERAL**

##### **1.1 RELATED SECTIONS**

- A. Building Automation and Control.
- B. Fire Suppression.

##### **1.2 DESCRIPTION:**

- A. This section of the specification includes the furnishing, installation, and connection of an intelligent reporting, microprocessor controlled, addressable, fire detection and emergency voice alarm communication system. It shall include, but not be limited to, alarm initiating devices, alarm notification appliances, control panels, auxiliary control devices, annunciators, power supplies, and wiring as shown on the drawings and specified herein.
- B. The fire alarm system shall comply with requirements of CAN/ULC Standards. The system shall be electrically supervised and monitor the integrity of all conductors.
- C. The system shall be an active/interrogative type system where each addressable device is repetitively scanned, causing a signal to be transmitted to the main fire alarm control panel (FACP) indicating that the device and its associated circuit wiring is functional. Loss of this signal at the main FACP shall result in a trouble indication as specified hereinafter for the particular input.
- D. Each designated zone shall transmit separate and different alarm, supervisory and trouble signals to the Fire Command Center (FCC) and designated personnel in other buildings at the site via a multiplex communication network.
- E. The fire alarm system shall be manufactured by an ISO 9001 certified company and meet the requirements of BS EN9001: ANSI/ASQC Q9001-1994.
- F. The system and its components shall be Underwriters Laboratories of Canada listed under the appropriate ULC testing standard as listed herein for fire alarm applications and the installation shall be in compliance with the CAN/ULC-S524-06 Standard.
- G. The installing company shall employ qualified Fire Alarm Technicians on site to guide the final checkout and to ensure the systems integrity.
- H. Fire Alarm System shall be tested as an integrated system as per CAN/ULC-S1001.

**1.3 SCOPE:**

- A. A new intelligent reporting, microprocessor controlled fire detection system shall be installed in accordance with the specifications and drawings.
- B. The system shall be designed such that each Data Communication Link (DCL) is limited to only 80% of its total capacity at initial installation.
- C. Basic Performance:
  - 1. Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded on Class A Data Communication Link (DCLA).
  - 2. Initiation Device Circuits (IDC) shall support Class A or Class B wiring as part of an addressable device connected by the DCLA Circuit
  - 3. Notification Appliance Circuits (NAC) shall support Class A or Class B wiring as part of an addressable device connected by the DCL Circuit.
  - 4. On Class A configurations a single ground fault or open circuit on the system Signalling Line Circuit shall not cause system malfunction, loss of operating power or the ability to report an alarm.
  - 5. Alarm signals arriving at the FACP shall not be lost following a primary power failure (or outage) until the alarm signal is processed and recorded.
- D. Basic System Functional Operation

When a fire alarm condition is detected and reported by one of the system initiating devices, the following functions shall immediately occur:

- 1. The System Alarm LED shall flash.
- 2. A local piezo electric signal in the control panel shall sound.
- 3. The 640 character LCD display shall indicate all information associated with the fire alarm condition, including the type of alarm point and its location within the protected premises.
- 4. Printing and history storage equipment shall log the information associated each new fire alarm control panel condition, along with time and date of occurrence.
- 5. All system output programs assigned via control-by-event interlock programming to be activated by the particular point in alarm shall be executed, and the associated system outputs (notification appliances and/or relays) shall be activated.

#### **1.4 SUBMITTALS**

**A. General:**

1. At least two copies of all submittals shall be submitted to the Architect/Engineer for review.
2. All references to manufacturer's model numbers and other pertinent information herein is intended to establish minimum standards of performance, function and quality. Equivalent compatible ULC listed equipment from other manufacturers may be substituted for the specified equipment as long as the minimum standards are met.
3. All substitute equipment proposed as equal to the equipment specified herein, shall meet or exceed the following standards. For equipment other than that specified, the contractor shall supply proof that such substitute equipment equals or exceeds the features, functions, performance, and quality of the specified equipment.

**B. 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, device arrangement, complete wiring point-to-point diagrams, and conduit layouts.
3. Show annunciator layout, configurations, and terminations.

**C. Manuals:**

1. Submit simultaneously with the shop drawings, complete operating and maintenance manuals listing the manufacturer's name(s), including technical data sheets.
2. Wiring diagrams shall indicate internal wiring for each device and the interconnections between the items of equipment.
3. Provide a clear and concise description of operation that gives, in detail, the information required to properly operate the equipment and system.
4. Approvals will be based on complete submissions of manuals together with shop drawings.

**D. Software Modifications**

1. Provide the services of a factory trained and authorized technician to perform all system software modifications, upgrades or changes. Response time of the technician to the site shall not exceed 4 hours.
2. Provide all hardware, software, programming tools and documentation necessary to modify the fire alarm system on site. Modification includes addition and deletion of devices, circuits, zones and changes to system operation and custom label changes for devices or zones. The system structure and

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software shall place no limit on the type or extent of software modifications onsite. Modification of software shall not require power down of the system or loss of system fire protection while modifications are being made.

E. Certifications:

Together with the shop drawing submittal, submit a certification from the major equipment manufacturer indicating that the proposed supervisor of the installation and the proposed performer of contract maintenance is an authorized representative of the major equipment manufacturer. Include names and addresses in the certification.

**1.5 GUARANTY:**

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 12 months from the date of acceptance. The full cost of maintenance, labour and materials required to correct any defect during this one year period shall be included in the submittal bid.

**1.6 POST CONTRACT MAINTENANCE:**

- A. Complete maintenance and repair service for the fire alarm system shall be available from a factory trained authorized representative of the manufacturer of the major equipment for a period of five (5) years after expiration of the guaranty.
- B. As part of the bid/proposal, include a quote for a maintenance contract to provide all maintenance, tests, and repairs described below. Include also a quote for unscheduled maintenance/repairs, including hourly rates for technicians trained on this equipment, and response travel costs for each year of the maintenance period. Submittals that do not identify all post contract maintenance costs will not be accepted. Rates and costs shall be valid for the period of five (5) years after expiration of the guaranty.
- C. Maintenance and testing shall be on an annual basis or as required by the AHJ. A preventive maintenance schedule shall be provided by the contractor describing the protocol for preventive maintenance. The schedule shall include:
  - 1. Systematic examination, adjustment and cleaning of all detectors, manual fire alarm stations, control panels, power supplies, relays, waterflow switches and all accessories of the fire alarm system.
  - 2. Each circuit in the fire alarm system shall be tested annually.
  - 3. Each smoke detector shall be tested in accordance with the requirements of CAN/ULC S-536.

**1.7 POST CONTRACT EXPANSIONS:**

- A. The contractor shall have the ability to provide parts and labour to expand the system specified, if so requested, for a period of five (5) years from the date of acceptance.

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- B. As part of the submittal, include a quotation for all parts and material, and all installation and test labour as needed to increase the number of intelligent or addressable devices by ten percent (10%). This quotation shall include intelligent smoke detectors, intelligent heat detectors, addressable manual stations, addressable monitor modules and addressable modules equal in number to one tenth of the number required to meet this specification (list actual quantity of each type).
- C. The quotation shall include installation, test labour, and labour to reprogram the system for this 10% expansion. If additional FACP hardware is required, include the material and labour necessary to install this hardware.
- D. Do not include cost of conduit or wire or the cost to install conduit or wire.
- E. Submittals that do not include this estimate of post contract expansion cost will not be accepted.

**1.8 APPLICABLE PUBLICATIONS:**

The publications listed below form a part of this specification. The publications are referenced in text by the basic designation only.

A. Government of Canada:

Canadian Building Code as adopted by the Provincial Building Code

The Canadian Electrical Code, Part 1

B. Underwriters Laboratories of Canada (ULC):

CAN/ULC-S524, Installation of Fire Alarm Systems.

CAN/ULC-S525, Audible Signal Appliances for Fire Alarm.

CAN/ULC-S526, Visual Signal Appliances, Fire Alarm.

CAN/ULC-S527, Control Units.

CAN/ULC-S528, Manual Pull Stations.

CAN/ULC-S529, Smoke Detectors.

CAN/ULC-S530, Heat Actuated Fire Detectors.

CAN/ULC-S531, Smoke Alarms.

CAN/ULC-S536, Inspection and Testing of Fire Alarm Systems.

CAN/ULC-S537, Verification of Fire Alarm Systems.



- C. National Fire Protection Association (NFPA):
  - No. 72 National Fire Alarm Code
  - No. 101 Life Safety Code
  - No. 2001 Clean Agent Fire Extinguishing Systems
- D. Local and Provincial Building Codes.
- E. All requirements of the Authority Having Jurisdiction (AHJ).

#### **1.9 APPROVALS:**

- A. The system shall have proper listing and/or approval from the following nationally recognized agencies:
  - ULC Underwriters Laboratories Canada.
- B. The Fire Alarm Control Panel and all transponders shall meet the modular listing requirements of Underwriters Laboratories of Canada. Each subassembly, including all printed circuits, shall include the appropriate ULC modular label. This includes all printed circuit board assemblies, power supplies, and enclosure parts. Systems that do not include modular labels may require return to the factory for system upgrades and are not acceptable.

### **PART 2.0 PRODUCTS**

#### **2.1 EQUIPMENT AND MATERIAL, GENERAL:**

- A. All equipment and components shall be new, and the manufacturer's current model. 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 signalling (fire alarm) system. 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.
- B. All equipment and components shall be installed in strict compliance with each manufacturer's recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc. before beginning system installation. Refer to the riser/connection diagram for all specific system installation/termination/wiring data.
- C. All equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place (e.g., detectors shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load.
- D. All equipment shall be supplied by Notifiers Authorizes Engineered Systems or approved equivalent.

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## **2.2 CONDUIT AND WIRE:**

### **A. Conduit:**

1. Conduit shall be in accordance with Canadian Electrical Code as adopted by the local Province
2. Where possible, all wiring shall be installed in conduit or raceway. Conduit fill shall not exceed 40 percent of interior cross sectional area where three or more cables are contained within a single conduit.
3. Cable must be separated from any open conductors of Power, or Class 1 circuits, and shall not be placed in any conduit, junction box or raceway containing these conductors.
4. Wiring for 24 volt control, alarm notification, emergency communication and similar power limited auxiliary functions may be run in the same conduit as initiating and signalling line circuits. All circuits shall be provided with transient suppression devices and the system shall be designed to permit simultaneous operation of all circuits without interference or loss of signals.
5. Conduit shall not enter the fire alarm control panel or any other remotely mounted control panel equipment or back boxes, except where conduit entry is specified by the FACP manufacturer.

### **B. Wire**

1. All fire alarm system wiring must be new.
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 recommended by the fire alarm system manufacturer, but not less than 18 AWG (1.02 mm) for initiating device circuits and signalling line circuits, and 14 AWG (1.63 mm) for notification appliance circuits.
3. All wire and cable shall be listed and/or approved by a recognized testing agency for use with a protective signalling system.
4. Wiring used for the multiplex communication circuit (DCL) shall be twisted and unshielded and support a minimum wiring distance of 12,500 feet. The design of the system shall permit use of IDC and NAC wiring in the same conduit with the DCL communication circuit.
5. The system shall permit the use of IDC and NAC wiring in the same conduit with the multiplex communication loop.
6. All field wiring shall be completely supervised. In the event of a primary power failure, disconnected standby battery, removal of any internal modules, or any open circuits in the field wiring; A trouble signal will be activated until the system and its associated field wiring are restored to normal condition.

### **C. Terminal Boxes, Junction Boxes and Cabinets:**

All boxes and cabinets shall be CSA listed for their intended purpose.

- D. Initiating circuits shall be arranged to serve like categories (manual, smoke, waterflow). Mixed category circuitry shall not be permitted except on Data Communication Link connected to intelligent reporting devices.
- E. The fire alarm control panel shall be connected to a separate dedicated branch circuit, maximum 20 amperes. This circuit shall be labelled at the main power distribution panel as FIRE ALARM. Fire alarm control panel primary power wiring shall be 12 AWG. The control panel cabinet shall be grounded securely to either a cold water pipe or grounding rod.

### **2.3 MAIN FIRE ALARM CONTROL PANEL OR NETWORK NODE:**

- A. The main FACP Central Console shall be a NOTIFIER Model NFS2-3030 by CONTROL FIRE SYSTEMS or approved equivalent and shall contain a microprocessor based Central Processing Unit (CPU). The CPU shall communicate with and control the following types of equipment used to make up the system: intelligent addressable smoke and thermal (heat) detectors, addressable modules, control circuits, and notification appliance circuits, local and remote operator terminals, printers, annunciators, and other system-controlled devices.
- B. In conjunction with intelligent Loop Control Modules and Loop Expander Modules, the main FACP shall perform the following functions:
  - 1. Supervise and monitor all intelligent addressable detectors and monitor modules connected to the system for normal, trouble and alarm conditions.
  - 2. Supervise all initiating signalling and notification circuits throughout the facility by way of connection to addressable monitor and control modules.
  - 3. Detect the activation of any initiating device and the location of the alarm condition. Operate all notification appliances and auxiliary devices as programmed. In the event of CPU failure, all DCL loop modules shall fallback to degrade mode. Such degrade mode shall treat the corresponding DCL loop control modules and associated detection devices as conventional two wire operation. Any activation of a detector in this mode shall automatically activate associated Notification Appliance Circuits.
  - 4. Visually and audibly annunciate any trouble, supervisory, security or alarm condition on operator's terminals, panel display, and annunciators.
  - 5. When a fire alarm condition is detected and reported by one of the system initiating devices or appliances, the following functions shall immediately occur:
    - a. The system alarm LED shall flash.
    - b. A local piezoelectric audible device in the control panel shall sound a distinctive signal.
    - c. The 640 character backlit LCD display shall indicate all information associated with the fire alarm condition, including the type of alarm point and its location within the protected premises.
    - d. Printing and history storage equipment shall log and print the event information along with a time and date stamp.

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- e. All system outputs assigned via pre-programmed equations for a particular point in alarm shall be executed, and the associated system outputs (alarm notification appliances and/or relays) shall be activated.
  - f. When a trouble condition is detected and reported by one of the system initiating devices or appliances, the following functions shall immediately occur:
    - g. The system trouble LED shall flash.
    - h. A local piezoelectric audible device in the control panel shall sound a distinctive signal.
    - i. The 640 character backlit LCD display shall indicate all information associated with the trouble condition, including the type of trouble point and its location within the protected premises.
    - j. Printing and history storage equipment shall log and print the event information along with a time and date stamp.
    - k. All system outputs assigned via pre-programmed equations for a particular point in trouble shall be executed, and the associated system outputs (trouble notification appliances and/or relays) shall be activated.
6. When a supervisory condition is detected and reported by one of the system initiating devices or appliances, the following functions shall immediately occur:
- a. The system trouble LED shall flash.
  - b. A local piezoelectric audible device in the control panel shall sound a distinctive signal.
  - c. The 640 character backlit LCD display shall indicate all information associated with the supervisory condition, including the type of trouble point and its location within the protected premises.
  - d. Printing and history storage equipment shall log and print the event information along with a time and date stamp.
  - e. All system outputs assigned via pre-programmed equations for a particular point in trouble shall be executed, and the associated system outputs (notification appliances and/or relays) shall be activated.
7. When a security alarm condition is detected and reported by one of the system initiating devices or appliances, the following functions shall immediately occur:
- a. The system security LED shall flash.
  - b. A local piezoelectric audible device in the control panel shall sound a distinctive signal.
  - c. The 640 character backlit LCD display shall indicate all information associated with the fire alarm condition, including the type of alarm point and its location within the protected premises.

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- d. Printing and history storage equipment shall log and print the event information along with a time and date stamp.
  - e. All system outputs assigned via pre-programmed equations for a particular point in alarm shall be executed, and the associated system outputs (alarm notification appliances and/or relays) shall be activated.
8. When a pre-alarm condition is detected and reported by one of the system initiating devices or appliances, the following functions shall immediately occur:
- a. The system pre-alarm LED shall flash.
  - b. A local piezoelectric audible device in the control panel shall sound a distinctive signal.
  - c. The 640character backlit LCD display shall indicate all information associated with the fire alarm condition, including the type of alarm point and its location within the protected premises.
  - d. Printing and history storage equipment shall log and print the event information along with a time and date stamp.
  - e. All system outputs assigned via pre-programmed equations for a particular point in alarm shall be executed, and the associated system outputs (alarm notification appliances and/or relays) shall be activated.

C. Operator Control

- 1. Acknowledge Switch:
  - a. Activation of the control panel acknowledge switch in response to new alarms and/or troubles shall silence the local panel piezo electric signal and change the alarm and trouble LEDs from flashing mode to steady ON mode. If multiple alarm or trouble conditions exist, depression of this switch shall advance the LCD display to the next alarm or trouble condition. In addition, the FACP shall support Block Acknowledge to allow multiple trouble conditions to be acknowledged with a single depression of this switch.
  - b. Depression of the Acknowledge switch shall also silence all remote annunciator piezo sounders.
- 2. Signal Silence Switch:
  - a. Depression of the Signal Silence switch shall cause all programmed alarm notification appliances and relays to return to the normal condition. The selection of notification circuits and relays that are silence able by this switch shall be fully field programmable within the confines of all applicable standards. The FACP software shall include silence inhibit and auto silence timers.
- 3. Drill Switch:

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- a. Depression of the Drill switch shall activate all programmed notification appliance circuits. The drill function shall latch until the panel is silenced or reset.
  4. System Reset Switch:
    - a. Depression of the System Reset switch shall cause all electronically latched initiating devices to return to their normal condition. Initiating devices shall report if active. Active notification appliance circuits shall not silence upon Reset. Systems that deactivate and subsequently reactivate notification appliance circuits shall not be considered equal. All programmed Control-By-Event equations shall be re-evaluated after the reset sequence is complete if the initiating condition has cleared. Non-latching trouble conditions shall not clear and re report upon reset.
  5. Lamp Test:
    - a. The Lamp Test switch shall activate all local system LEDs, light each segment of the liquid crystal display and display the panel software revision for service personal.
  6. Scroll Display Keys:
    - a. There shall be Scroll Display keys for FIRE ALARM, SECURITY, SUPERVISORY, TROUBLE, and OTHER EVENTS. Depression of the Scroll Display key shall display the next event in the selected queue allowing the operator to view events by type.
  7. Print Screen:
    - a. Depression of the PRINT SCREEN switch shall send the information currently displayed on the 640character display to the printer.

**D. System Capacity and General Operation**

1. The control panel shall be capable of expansion via up to 10 DCL modules. Each module shall support a maximum of 318 analogue/addressable devices for a maximum system capacity of 3,180 points. The system shall be capable of 3072 annunciation points per system regardless of the number of addressable devices.
2. The Fire Alarm Control Panel shall include a full featured operator interface control and annunciation panel that shall include a backlit 640 character liquid crystal display, individual, colour coded system status LEDs, and a QWERTY style alphanumeric keypad for the field programming and control of the fire alarm system. Said LCD shall also support graphic bit maps capable of displaying the company name and logo of either the owner or installing company.
3. All programming or editing of the existing program in the system shall be achieved without special equipment and without interrupting the alarm monitoring functions of the fire alarm control panel.
4. The FACP or each node shall be able to provide the following software and hardware features:

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- a. Pre-signal and Positive Alarm Sequence: The system shall provide means to cause alarm signals to only sound in specific areas with a delay of the alarm from 60 to up to 180 seconds after start of alarm processing. In addition, a Positive Alarm Sequence selection shall be available that allows a 15 second time period for acknowledging an alarm signal from a fire detection/initiating device. If the alarm is not acknowledged within 15 seconds, all local and remote outputs shall automatically activate immediately.
  - b. Smoke Detector Pre-alarm Indication at Control Panel: To obtain early warning of incipient or potential fire conditions, the system shall support a programmable option to determine system response to real time detector sensing values above the programmed setting. Two levels of Pre-alarm indication shall be available at the control panel: alert and action.
  - c. Alert: It shall be possible to set individual smoke detectors for pre-programmed pre-alarm thresholds. If the individual threshold is reached, the pre-alarm condition shall be activated.
  - d. Action: If programmed for Action and the detector reaches a level exceeding the pre-programmed level, the control panel shall indicate an action condition. Sounder bases installed with either heat or smoke detectors shall automatically activate on action Pre Alarm level, with general evacuation on Alarm level.
  - e. The system shall support a detector response time to meet world annunciation requirements of less than 3 seconds.
  - f. Device Blink Control: Means shall be provided to turn off detector/module LED strobes for special areas.
  - g. Smoke Detector Sensitivity Test: The system shall provide an automatic smoke detector test function that meets the requirements of CAN/ULC-S527.
  - h. Programmable Trouble Reminder: The system shall provide means to automatically initiate a reminder that troubles exist in the system. The reminder will appear on the system display and (if enabled) will sound a piezo alarm.
  - i. Online or Offline programming: The system shall provide means to allow panel programming either through an offline software utility program away from the panel or while connected and online. The system shall also support upload and download of programmed database and panel executive system program to a Personal Computer/laptop.
  - j. History Events: The panel shall maintain a history file of the last 4000 events, each with a time and date stamp. History events shall include all alarms, troubles, operator actions, and programming entries. The control panels shall also maintain a 1000 event Alarm History buffer, which consists of the 1000 most recent alarm events from the 4000 event history file.
  - k. Smoke Control Modes: The system shall provide means to perform FSCS mode Smoke Control to meet CAN/ULC-S527 and the National Building Code of Canada and HVAC mode to meet the National Building Code of Canada.

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- l. The system shall provide means for all DCL devices on any DCL loop to be auto programmed into the system by specific address. The system shall recognize specific device type ID's and associate that ID with the corresponding address of the device.
  - m. Drill: The system shall support means to activate all silenceable fire output circuits in the event of a practice evacuation or "drill". If enabled for local control, the front panel switch shall be held for a minimum of 2 seconds prior to activating the drill function.
  - n. Passwords and Users: The system shall support two password levels, master and user. Up to 9 user passwords shall be available, each of which may be assigned access to the programming change menus, the alter status menus, or both. Only the master password shall allow access to password change screens.
  - o. Two Wire Detection: The system shall support standard two wire detection devices specifically all models of System Sensor devices, Fenwal PDS7125/ 7126 and CPD7021, Hochiki model SLK24F/ 24FH, Edwards 6250B/6270B and 6264B and Simplex models 20989201/ 9202 and 9576 or Approved Equivalent.
  - p. Block Acknowledge: The system shall support a block Acknowledge for Trouble Conditions
  - q. Sensitivity Adjust: The system shall provide Automatic Detector Sensitivity Adjust based on Occupancy schedules including a Holiday list of up to 15 days.
  - r. Environmental Drift Control: The system shall provide means for setting Environmental Drift Compensation by device. When a detector accumulates dust in the chamber and reaches an unacceptable level but yet still below the allowed limit, the control panel shall indicate a maintenance alert warning. When the detector accumulates dust in the chamber above the allowed limit, the control panel shall indicate a maintenance urgent warning.
  - s. Custom Action Messages: The system shall provide means to enter up to 100 custom action messages of up to 160 characters each. It shall be possible to assign any of the 100 messages to any point.
  - t. Print Functions: The system shall provide means to obtain a variety of reports listing all event, alarm, trouble, supervisory, or security history. Additional reports shall be available for point activation for the last Walk Test performed, detector maintenance report containing the detector maintenance status of each installed addressable detector, all network parameters, all panel settings including broad cast time, event ordering, and block acknowledge, panel timer values for Auto Silence, Silence Inhibit, AC Fail Delay time and if enabled, Proprietary Reminder, and Remote Reminder timers, supervision settings for power supply and printers, all programmed logic equations, all custom action messages, all non fire and output activations (if pre-programmed for logging) all active points filtered by alarms only, troubles only, supervisory alarms, pre-alarms, disabled points and activated points, all installed points filtered by DCL points, logic zones, annunciators, releasing zones, special zones, and trouble zones.
  - u. Local Mode: If communication is lost to the central processor the system shall provide added survivability through the intelligent loop control modules. Inputs from devices connected to the



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DCL and loop control modules shall activate outputs on the same loop when the inputs and outputs have been set with point programming to participate in local mode or when the type codes are of the same type: that is, an input with a fire alarm type code shall activate an output with a fire alarm type code.

- v. Resound based on type for security or supervisory: The system shall indicate a Security alarm when a monitor module point programmed with a security Type Code activates. If silenced alarms exist, a Security alarm will Re-sound the panel sounder. The system shall indicate a Supervisory alarm when a monitor module point programmed with a supervisory Type Code activates. If there are silenced alarms, a Supervisory alarm will Re-sound the panel sounder.
- w. Read status preview enabled and disabled points: Prior to re enabling points, the system shall inform the user that a disabled device is in the alarm state. This shall provide notice that the device must be reset before the device is enabled thereby avoiding activation of the notification circuits.
- x. Custom Graphics: When fitted with an LCD display, the panel shall permit uploading of a custom bitmapped graphic to the display screen.
- y. Multi Detector and Cooperating Detectors: The system shall provide means to link one detector to up to two detectors at other addresses on the same loop in cooperative multi detector sensing. There shall be no requirement for sequential addresses on the detectors and the alarm event shall be a result or product of all cooperating detectors chamber readings.
- z. Tracking/Latching Duct (ion and photo): The system shall support both tracking and latching duct detectors either ion or photo types.
- aa. ACTIVE EVENT: The system shall provide a Type ID called FIRE CONTROL for purposes of air handling shutdown, which shall be intended to override normal operating automatic functions. Activation of a FIRE CONTROL point shall cause the control panel to (1) initiate the monitor module Control by Event, (2) send a message to the panel display, history buffer, installed printer and annunciators, (3) shall not light an indicator at the control panel, (4) Shall display ACTIVE on the LCD as well a display a FIRE CONTROL Type Code and other information specific to the device.
- bb. NONFIRE Alarm Module Reporting: A point with a type ID of NONFIRE shall be available for use for energy management or other non fire situations. NONFIRE point operation shall not affect control panel operation nor shall it display a message at the panel LCD. Activation of a NONFIRE point shall activate control by event logic but shall not cause any indication on the control panel.
- cc. Security Monitor Points: The system shall provide means to monitor any point as a type security.
- dd. One Man Walk Test: The system shall provide both a basic and advanced walk test for testing the entire fire alarm system. The basic walk test shall allow a single operator to run audible tests on the panel. All logic equation automation shall be suspended during the test and while

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annunciators can be enabled for the test, all shall default to the disabled state. During an advanced walk test, field supplied output point programming will react to input stimuli such as CBE and logic equations. When points are activated in advanced test mode, each initiating event shall latch the input. The advanced test shall be audible and shall be used for pull station verification, magnet activated tests on input devices, input and output device and wiring operation/verification.

- ee. Control-By-Event Functions: CBE software functions shall provide means to program a variety of output responses based on various initiating events. The control panel shall operate CBE through lists of zones. A zone shall become listed when it is added to a point's zone map through point programming. Each input point such as detector, monitor module or panel circuit module shall support listing of up to 10 zones into its programmed zone map.
- ff. Permitted zone types shall be general zone, releasing zone and special zone. Each output point (control module, panel circuit module) can support a list of up to 10 zones including general zone, logic zone, releasing zone and trouble zone. It shall be possible for output points to be assigned to list general alarm. Non Alarm or Supervisory points shall not activate the general alarm zone.
- gg. 1000 General Zones: The system shall support up to 1000 general purpose software zones for linking inputs to outputs. When an input device activates, any general zone programmed into that device's zone map will be active and any output device that has an active general zone in its map will be active. It shall also be possible to use general zone as arguments in logic equations.
- hh. 1000 Logic Equations: The system shall support up to 1000 logic equations for AND, OR, NOT, ONLY1, ANYX, XZONE or RANGE operators that allow conditional I/O linking. When any logic equation becomes true, all output points mapped to the logic zone shall activate.
- ii. 10 trouble equations per device: The system shall provide support for up to 10 trouble equations for each device, which shall permit programming parameters to be altered, based on specific fault conditions. If the trouble equation becomes true, all output points mapped to the trouble zone shall activate.
- jj. Control-By-Time: A time based logic function shall be available to delay an action for a specific period of time based upon a logic input with tracking feature. A latched version shall also be available. Another version of this shall permit activation on specific days of the week or year with ability to set and restore based on a 24 hour time schedule on any day of the week or year.
- kk. Multiple agent releasing zones: The system shall support up to 10 releasing zones to protect against 10 independent hazards. Releasing zones shall provide up to three cross zone and four abort options to satisfy any local jurisdiction requirements.
- ll. Alarm Verification, by device, with timer and tally: The system shall provide a user defined global software timer function that can be set for a specific detector or indicating panel module input. The timer function shall delay an alarm signal for a user specified time period and the

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control panel shall ignore the alarm verification timer if another alarm is detected during the verification period. It shall also be possible to set a maximum verification count between 0 and 20 with the "0" setting producing no alarm verification. When the counter exceeds the threshold value entered, a trouble shall be generated to the panel.

#### E. Central Processing Unit

1. The Central Processing Unit shall communicate with, monitor, and control all other modules within the control panel. Removal, disconnection or failure of any control panel module shall be detected and reported to the system display by the Central Processing Unit.
2. The Central Processing Unit shall contain and execute all control by event (including Boolean functions including but not limited to AND, OR, NOT, ANY, and CROSSZONE) programs for specific action to be taken if an alarm condition is detected by the system. Such control by event programs shall be held in non-volatile programmable memory, and shall not be lost with system primary and secondary power failure.
3. The Central Processing Unit shall also provide a real time clock for time annotation, to the second, of all system events. The time of day and date shall not be lost if system primary and secondary power supplies fail.
4. The CPU shall be capable of being programmed on site without requiring the use of any external programming equipment. Systems that require the use of external programmers or change of EPROMs are not acceptable.
5. Consistent with UL864 standards, the CPU and associated equipment are to be protected so that voltage surges or line transients will not affect them.
6. Each peripheral device connected to the CPU shall be continuously scanned for proper operation. Data transmissions between the CPU and peripheral devices shall be reliable and error free. The transmission scheme used shall employ dual transmission or other equivalent error checking techniques.
7. The CPU shall provide an EIA232 interface between the fire alarm control panel and the UL Listed Electronic Data Processing (EDP) peripherals.
8. The CPU shall provide two EIA485 ports for the serial connection to annunciation and control subsystem components.
9. The EIA232 serial output circuit shall be optically isolated to assure protection from earth ground.
10. The CPU shall provide one high speed serial connection for support of network communication modules.
11. The CPU shall provide double pole relays for FIRE ALARM, SYSTEM TROUBLE, SUPERVISORY, and SECURITY. The SUPERVISORY and SECURITY relays shall provide selection for additional FIRE ALARM contacts.

F. Display

1. The system display shall provide all the controls and indicators used by the system operator and may also be used to program all system operational parameters.
2. The display assembly shall contain, and display as required, custom alphanumeric labels for all intelligent detectors, addressable modules, and software zones.
3. The system display shall provide a 640character backlit alphanumeric Liquid Crystal Display (LCD). It shall also provide ten Light Emitting Diodes (LEDs) that indicate the status of the following system parameters: AC POWER, FIRE ALARM, PREALARM, SECURITY, SUPERVISORY, SYSTEM TROUBLE, OTHER EVENT, SIGNALS SILENCED, POINT DISABLED, and CPU FAILURE.
4. The system display shall provide a QWERTY style keypad with control capability to command all system functions, entry of any alphabetic or numeric information, and field programming. Two different password levels with up to ten (one Master and nine User) passwords shall be accessible through the display interface assembly to prevent unauthorized system control or programming.
5. The system display shall include the following operator control switches: ACKNOWLEDGE, SIGNAL SILENCE, RESET, DRILL, and LAMP TEST. Additionally, the display interface shall allow scrolling of events by event type including, FIRE ALARM, SECURITY, SUPERVISORY, TROUBLE, and OTHER EVENTS. A PRINT SCREEN button shall be provided for printing the event currently displayed on the 640character LCD.

G. Loop (Signalling Line Circuit) Control Module:

1. The Loop Control Module shall monitor and control a minimum of 318 intelligent addressable devices. This includes 159 intelligent detectors (Ionization, Photoelectric, or Thermal) and 159 monitor or control modules.
2. The Loop Control Module shall contain its own microprocessor and shall be capable of operating in a local/degrade mode (any addressable device input shall be capable of activating any or all addressable device outputs) in the unlikely event of a failure in the main CPU.
3. The Loop Control Module shall provide power and communicate with all intelligent addressable detectors and modules on a single pair of wires. This DCL Loop shall be capable of operating as a Class B circuit.
4. The DCL interface board shall be able to drive a Class A or B twisted unshielded circuit up to 12,500 feet in length. The DCL Interface shall also be capable of driving a Class A or B, no twist, no shield circuit for limited distances determined by the manufacturer. In addition, DCL wiring shall meet the listing requirements for it to exit the building or structure. "T" tapping shall be allowed in either case.
5. The DCL interface board shall receive analogue or digital information from all intelligent detectors and shall process this information to determine whether normal, alarm, or trouble conditions exist for that

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particular device. Each DCL Loop shall be isolated and equipped to annunciate an Earth Fault condition. The DCL interface board software shall include software to automatically maintain the detector's desired sensitivity level by adjusting for the effects of environmental factors, including the accumulation of dust in each detector. The analogue information may also be used for automatic detector testing and the automatic determination of detector maintenance requirements.

H. Enclosures:

1. The control panel shall be housed in a ULC listed cabinet suitable for surface or semi flush mounting. The cabinet and front shall be corrosion protected, given a rust resistant prime coat, and manufacturer's standard finish.
2. The back box and door shall be constructed of 0.060 steel with provisions for electrical conduit connections into the sides and top.
3. The door shall provide a key lock and include a transparent opening for viewing all indicators. For convenience, the door shall have the ability to be hinged on either the right or left hand side.
4. The control unit shall be modular in structure for ease of installation, maintenance, and future expansion.

I. Power Supply:

1. The Addressable Main Power Supply shall operate on 120/240 VAC, 50/60 Hz, and shall provide all necessary power for the FACP.
2. The Addressable Main Power Supply shall provide the required power to the CPU using a switching 24 VDC regulator and shall incorporate a battery charger for 24 hours of standby power using dual rate charging techniques for fast battery recharge.
3. The Addressable Main Power Supply shall provide a battery charger for 24 hours of standby using dual rate charging techniques for fast battery recharge. The supply shall be capable of charging batteries ranging in capacity from 25 - 200 amp hours within a 48 hour period.
4. The Addressable Main Power Supply shall provide a very low frequency sweep earth detect circuit, capable of detecting earth faults.
5. The Addressable Main Power Supply shall be power limited.

K. System Circuit Supervision

1. The FACP shall supervise all circuits to intelligent devices, transponders, annunciators and peripheral equipment and annunciate loss of communication with these devices. The CPU shall continuously scan above devices for proper system operation and upon loss of response from a device shall sound an audible trouble, indicate which device or devices are not responding and print the information in the history buffer and on the printer.

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2. Transponders that lose communication with the CPU shall sound an audible trouble and light an LED indicating loss of communications.
  3. Sprinkler system valves, standpipe control valves, PIV, and main gate valves shall be supervised for off normal position.

**L. Field Wiring Terminal Blocks**

1. All wiring terminal blocks shall be the plug in/removable type and shall be capable of terminating up to 12 AWG wire. Terminal blocks that are permanently fixed to the PC board are not acceptable.

**M. Remote Transmissions:**

1. Provide local energy or polarity reversal or trip circuits as required.
2. The system shall be capable of operating a polarity reversal or local energy or fire alarm transmitter for automatically transmitting fire information to the fire department.
3. Provide capability and equipment for transmission of zone alarm and trouble signals to remote operator's terminals, system printers and annunciators.
4. Transmitters shall be compatible with the systems and equipment they are connected to such as timing, operation and other required features.

**N. System Expansion:**

Design the main FACP and required components so that the system can be expanded in the future (to include the addition of twenty percent more circuits or zones) without disruption or replacement of the existing control panel. This shall include hardware capacity, software capacity and cabinet space.

**O. Field Programming**

1. The system shall be programmable, configurable and expandable in the field without the need for special tools, laptop computers, or other electronic interface equipment. There shall be no firmware changes required to field modify the system time, point information, equations, or annunciator programming/information.
2. It shall be possible to program through the standard FACP keyboard all system functions.
3. All field defined programs shall be stored in non-volatile memory.
4. Two levels of password protection shall be provided in addition to a key lock cabinet. One level shall be used for status level changes such as point/zone disable or manual on/off commands (Building Manager). A second (higher level) shall be used for actual change of the life safety program (installer). These passwords shall be five (5) digits at a minimum. Upon entry of an invalid password for the third time within a one minute time period an encrypted number shall be displayed. This number can be used as a reference for determining a forgotten password.

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5. The system programming shall be "backed" up via an upload/download program, and stored on compatible removable media. A system backup disk shall be completed and given in duplicate to the building owner and/or operator upon completion of the final inspection. The program that performs this function shall be "non-proprietary", in that, it shall be possible to forward it to the building owner/operator upon his or her request.
  6. The installer's field programming and hardware shall be functionally tested on a computer against known parameters/norms which are established by the FACP manufacturer. A software program shall test Input to Output correlations, device Type ID associations, point associations, time equations, etc. This test shall be performed on an IBM compatible PC with a verification software package. A report shall be generated of the test results and two copies turned in to the engineer(s) on record.

P. Specific System Operations

1. Smoke Detector Sensitivity Adjust: Means shall be provided for adjusting the sensitivity of any or all analogue intelligent smoke detectors in the system from the system keypad or from the keyboard of the video terminal. Sensitivity range shall be within the allowed ULC window.
2. Alarm Verification: Each of the Intelligent Addressable Smoke Detectors in the system may be independently selected and enabled to be an alarm verified detector. The alarm verification function shall be programmable from 5 to 50 seconds and each detector shall be able to be selected for verification during the field programming of the system or anytime after system turn on. Alarm verification shall not require any additional hardware to be added to the control panel. The FACP shall keep a count of the number of times that each detector has entered the verification cycle. These counters may be displayed and reset by the proper operator commands.

Q. System Point Operations:

1. Any addressable device in the system shall have the capability to be enabled or disabled through the system keypad or video terminal.
2. System output points shall be capable of being turned on or off from the system keypad or the video terminal.
3. Point Read: The system shall be able to display the following point status diagnostic functions without the need for peripheral equipment. Each point shall be annunciated for the parameters listed:
  - a. Device Status.
  - b. Device Type.
  - c. Custom Device Label.
  - d. Software Zone Label.
  - e. Device Zone Assignments.
  - f. Analog Detector Sensitivity.
  - g. All Program Parameters.
4. System Status Reports: Upon command from an operator of the system, a status report will be generated and printed, listing all system statuses:

5. System History Recording and Reporting: The fire alarm control panel shall contain a history buffer that will be capable of storing up to 4000 system events. Each of these events will be stored, with time and date stamp, until an operator requests that the contents be either displayed or printed. The contents of the history buffer may be manually reviewed; one event at a time, and the actual number of activations may also be displayed and or printed. History events shall include all alarms, troubles, operator actions, and programming entries.
6. The history buffer shall use non-volatile memory. Systems which use volatile memory for history storage are not acceptable.
7. Automatic Detector Maintenance Alert: The fire alarm control panel shall automatically interrogate each intelligent system detector and shall analyze the detector responses over a period of time.
8. If any intelligent detector in the system responds with a reading that is below or above normal limits, then the system will enter the trouble mode, and the particular Intelligent Detector will be annunciated on the system display, and printed on the optional system printer. This feature shall in no way inhibit the receipt of alarm conditions in the system, nor shall it require any special hardware, special tools or computer expertise to perform.
9. The system shall include the ability (programmable) to indicate a "pre-alarm" condition. This will be used to alert maintenance personal when a detector is at 80% of its alarm threshold in a 60 second period.

## **2.4 SYSTEM COMPONENTS:**

### **A. Programmable Electronic Sounders:**

1. Shall be a System Sensor SpectrAlert Advance which is listed to CAN/ULC-S525, Audible Signal Appliances, Fire Alarm.
2. Shall operate on 24 VDC nominal.
3. Shall be field programmable with three audibility options and an option to switch between a temporal three-pattern and a non-temporal (continuous) pattern without the use of special tools.
4. Shall produce a sound level of at least 90 dBA measured at 10 feet from the device.
5. Shall be flush or surface mounted as shown on plans.

### **B. Strobe lights shall meet the requirements of CAN/ULC-524, Installation of Fire Alarm, and be fully synchronized, and shall meet the following criteria:**

1. Shall be a System Sensor SpectrAlert Advance which consists of a xenon flash tube and associated lens/reflector system, is listed to CAN/ULC-S526 and shall be approved for fire protective service.
2. Strobe intensity shall meet the requirements of CAN/ULC-S526, Visual Signal Appliances, Fire Alarm.
3. The flash rate shall meet the requirements of CAN/ULC-S526, Visual Signal Appliances, Fire Alarm.
4. Shall have field-selectable candela settings including 15, 15/75, 30, 75, 95, 110, 115, 135, 150, 177, 185.

### **C. Manual Fire Alarm Stations**



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1. Manual fire alarm stations shall be non-coded, non-breakglass type, equipped with key lock so that they may be tested without operating the handle.
  2. Stations must be designed such that after an actual activation, they cannot be restored to normal except by key reset.
  3. An operated station shall automatically condition itself so as to be visually detected, as operated, at a minimum distance of 100 feet (30.5 m) front or side.
  4. Manual stations shall be constructed of high impact Lexan, with operating instructions provided on the cover. The word FIRE shall appear on the manual station in letters one half inch (12.7 mm) in size or larger.

D. Conventional Photoelectric Area Smoke Detectors

1. Photoelectric smoke detectors shall be a 24 VDC, two-wire, ceiling mounted, light scattering type using an LED light source.
2. Each detector shall contain a remote LED output and a built in test switch.
3. Detector shall be provided on a twist lock base.
4. It shall be possible to perform a calibrated sensitivity and performance test on the detector without the need for the generation of smoke. The test method shall test all detector circuits.
5. A visual indication of an alarm shall be provided by dual latching Light Emitting Diodes (LEDs), on the detector, which may be seen from ground level over 360 degrees. These LEDs shall flash at least every 10 seconds, indicating that power is applied to the detector.
6. The detector shall not go into alarm when exposed to air velocities of up to 3000 feet (914.4 m) per minute.
7. The detector screen and cover assembly shall be easily removable for field cleaning of the detector chamber.
8. All field wire connections shall be made to the base through the use of a clamping plate and screw.

E. Conventional Ionization Type Area Smoke Detectors

1. Ionization type smoke detectors shall be a two wire, 24 VDC type using a dual uni-polar chamber.
2. Each detector shall contain a remote LED output and a built in test switch.
3. Detector shall be provided on a twist lock base.
4. It shall be possible to perform a calibration sensitivity and performance test on the detector without the need for the generation of smoke.
5. A visual indication of an alarm shall be provided by dual latching Light Emitting Diodes (LEDs) over 360 degrees, on the detector, which may be seen from ground level. This LED shall flash every 10 seconds, indicating that power is applied to the detector.

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6. The detector shall not alarm when exposed to air velocities of up to 1,200 feet (365.76 m) per minute. The detector screen and cover assembly shall be easily removable for field cleaning of the detector chamber.
  7. All field wire connections shall be made to the base through the use of a clamping plate and screw.

F. NIL (Not in List).

G. NIL (Not in List).

H. Automatic Conventional Heat Detectors

1. Automatic heat detectors shall have a combination rate of rise and fixed temperature rated at 135 degrees Fahrenheit (57.2 Celsius) for areas where ambient temperatures do not exceed 100 degrees (37.7 Celsius), and 200 degrees (93.33 Celsius) for areas where the temperature does not exceed 150 degrees (65.5 Celsius).
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 15 degrees F (9.4 degrees C) 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 900 square feet (87 meters square).

**2.5. SYSTEM COMPONENTS ADDRESSABLE DEVICES**

A. Addressable Devices General

1. Addressable devices shall provide an address setting means using rotary decimal switches.
2. Addressable devices shall use simple to install and maintain decade (numbered 0 to 9) type address switches. Devices which use a binary address or special tools for setting the device address, such as a dip switch are not an allowable substitute.
3. Detectors shall be Analogue and Addressable, and shall connect to the fire alarm control panel's Signalling Line Circuits.
4. Addressable smoke and thermal detectors shall provide dual (2) status LEDs. Both LEDs shall flash under normal conditions, indicating that the detector is operational and in regular communication with the control panel, and both LEDs shall be placed into steady illumination by the control panel, indicating that an alarm condition has been detected. If required, the flashing mode operation of the detector LEDs can be programmed off via the fire control panel program.
5. The fire alarm control panel shall permit detector sensitivity adjustment through field programming of the system. Sensitivity can be automatically adjusted by the panel on a time of day basis.

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6. Using software in the FACP, detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance. The detectors shall be listed by ULC as meeting the calibrated sensitivity test requirements of CAN/ULC-S529 Smoke Detector.
  7. The detectors shall be ceiling mount and shall include a separate twist lock base which includes a tamper proof feature.
  8. The following bases and auxiliary functions shall be available:
    - a. Sounder base rated at 85 dBA minimum.
    - b. Form C Relay base rated 30VDC, 2.0A
    - c. Isolator base
  9. The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself (by activating a magnetic switch) or initiated remotely on command from the control panel.
  10. Detectors shall also store an internal identifying type code that the control panel shall use to identify the type of device (example: ION, PHOTO, THERMAL).

**B. Addressable Manual Fire Alarm Box (manual station)**

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. All operated stations shall have a positive, visual indication of operation and utilize a key type reset.
3. 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, 1.75 inches (44 mm) or larger.

**C. Intelligent Photoelectric Smoke Detector**

1. The detectors shall use the photoelectric (light scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analogue level of smoke density.

**D. Intelligent Laser Photo Smoke Detector**

1. The intelligent laser photo smoke detector shall be a spot type detector that incorporates an extremely bright laser diode and an integral lens that focuses the light beam to a very small volume near a receiving photo sensor. The scattering of smoke particles shall activate the photo sensor.
2. The laser detector shall have conductive plastic so that dust accumulation is reduced significantly.

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3. The intelligent laser photo detector shall have nine sensitivity levels and be sensitive to a minimum obscuration of 0.02 percent per foot.
  4. The laser detector shall not require expensive conduit, special fittings or PVC pipe.
  5. The intelligent laser photo detector shall support standard, relay, isolator and sounder detector bases.
  6. The laser photo detector shall not require other cleaning requirements than those listed in CAN/ULC-S529 Smoke Detector. Replacement, refurbishment or specialized cleaning of the detector head shall not be required.
  7. The laser photo detector shall include two bi-colour LEDs that flash green in normal operation and turn on steady red in alarm.

E. Intelligent Ionization Smoke Detector

1. The detectors shall use the dual chamber ionization principal to measure products of combustion and shall, on command from the control panel, send data to the panel representing the analogue level of products of combustion.

F. Intelligent Multi Criteria Acclimating Detector

1. The intelligent multi criteria Acclimate detector shall be an addressable device that is designed to monitor a minimum of photoelectric and thermal technologies in a single sensing device. The design shall include the ability to adapt to its environment by utilizing a built in microprocessor to determine its environment and choose the appropriate sensing settings.  
The detector design shall allow a wide sensitivity window, no less than 1 to 4% per foot obscuration. This detector shall utilize advanced electronics that react to slow smouldering fires and thermal properties all within a single sensing device.
2. The microprocessor design shall be capable of selecting the appropriate sensitivity levels based on the environment type it is in (office, manufacturing, kitchen etc.) and then have the ability to automatically change the setting as the environment changes (as walls are moved or as the occupancy changes).
3. The intelligent multi criteria detection device shall include the ability to combine the signal of the thermal sensor with the signal of the photoelectric signal in an effort to react hastily in the event of a fire situation. It shall also include the inherent ability to distinguish between a fire condition and a false alarm condition by examining the characteristics of the thermal and smoke sensing chambers and comparing them to a database of actual fire and deceptive phenomena.

G. Intelligent Thermal Detectors

1. Thermal detectors shall be intelligent addressable devices rated at 135 degrees Fahrenheit (58 degrees Celsius) and have a rate of rise element rated at 15 degrees F (9.4 degrees C) per minute. It shall connect via two wires to the fire alarm control panel signalling line circuit.

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H. Not in List (NIL).

I. Addressable Dry Contact Monitor Module

1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional alarm initiating devices (any N.O. dry contact device) to one of the fire alarm control panel DCLs.
2. The IDC zone shall be suitable for Class A or B operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
3. For difficult to reach areas, the monitor module shall be available in a miniature package and shall be no larger than 23/ 4 inch (70 mm) x 11/ 4 inch (31.7 mm) x 1/2 inch (12.7 mm). This version need not include an LED.

J. Two Wire Detector Monitor Module

1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional 2wire smoke detectors or alarm initiating devices (any N.O. dry contact device).
2. The IDC zone may be wired for Class A or B operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.

K. Addressable Control Module

1. Addressable control modules shall be provided to supervise and control the operation of one conventional NACs of compatible, 24 VDC powered polarized audio/visual notification appliances.
2. The control module NAC may be wired for Class A or B with up to 1 amp of inductive A/V signal, or 2 amps of resistive A/V signal operation.
3. Audio/visual power shall be provided by a separate supervised power circuit from the main fire alarm control panel or from a supervised ULC listed remote power supply.
4. The control module shall be suitable for pilot duty applications and rated for a minimum of 0.6 amps at 30 VDC.

L. Addressable Relay Module

1. Addressable Relay Modules shall be available for HVAC control and other building functions. The relay shall be form C and rated for a minimum of 2.0 Amps resistive or 1.0 Amps inductive. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to insure that 100% of all auxiliary relay or NACs may be energized at the same time on the same pair of wires.

M. Addressable 4-20mA Monitor Module

1. Addressable 4-20mA monitor modules shall be available to connect supervised industry-standard, linear-scale, 4–20 mA protocol sensors.

2. Addressable 4-20mA monitor modules shall support up to five programmable thresholds and a 500 mA current limiter and a cut-off circuit protecting the module's electrical supply from short circuits.
3. Addressable 4-20mA monitor modules shall accept both 3-wire (device sink) and 2-wire configurations.
4. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.

**N. Isolator Module**

1. Isolator modules shall be provided to automatically isolate wire to wire short circuits on a DCL Class A or Class B branch. The isolator module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the DCL loop segment or branch. At least one isolator module shall be provided for each floor or protected zone of the building.
2. If a wire to wire short occurs, the isolator module shall automatically open circuit (disconnect) the DCL. When the short circuit condition is corrected, the isolator module shall automatically reconnect the isolated section.
3. The isolator module shall not require address setting, and its operations shall be totally automatic. It shall not be necessary to replace or reset an isolator module after its normal operation.
4. The isolator module shall provide a single LED that shall flash to indicate that the isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.

**O. NIL (Not in List).**

**P. NIL (Not in List).**

**Q. Serially Connected Annunciator Requirements**

1. The annunciator shall communicate to the fire alarm control panel via an EIA 485 (multi drop) two wire communications loop. The system shall support two 6,000 ft. EIA485 wire runs. Up to 32 annunciators, each configured up to 96 points, may be connected to the connection, for a system capacity of 3,072 points of annunciation.
2. An EIA485 repeater shall be available to extend the EIA485 wire distance in 3,000 ft. increments. An optional version shall allow the EIA485 circuit to be transmitted over fibre optics. The repeater shall be ULC listed.
3. Each annunciator shall provide up to 96 alarm and 97 trouble indications using a long life programmable colour LED's. Up to 96 control switches shall also be available for the control of Fire Alarm Control Panel functions. The annunciator will also have an "ONLINE" LED, local piezo sounder, local acknowledge and lamp test switch, and custom zone/function identification labels.
4. The annunciator may be field configured to operate as a "Fan Control Annunciator". When configured as "Fan Control," the annunciator may be used to manually control fan or damper operation and can be set to override automatic commands to all fans/dampers programmed to the annunciator.

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5. Annunciator switches may be programmed for System control such as, Global Acknowledge, Global Signal Silence, Global System Reset, and on/off control of any control point in the system.
  6. An optional module shall be available to utilize annunciator points to drive EIA485 driven relays. This shall extend the system point capacity by 3,072 remote contacts.
  7. The LED annunciator shall offer an interface to a graphic style annunciator and provide each of the features listed above.

## **2.6 BATTERIES AND EXTERNAL CHARGER:**

### **A. Battery:**

1. Shall be 12 volt, Gel Cell type.
2. Battery shall have sufficient capacity to power the fire alarm system for not less than twenty-four hours plus 5 minutes of alarm upon a normal AC power failure.
3. The batteries are to be completely maintenance free. No liquids are required. Fluid level checks refilling, spills and leakage shall not be required.

### **B. External Battery Charger:**

1. Shall be completely automatic, with constant potential charger maintaining the battery fully charged under all service conditions. Charger shall operate from a 120/240volt 50/60 hertz source.
2. Shall be rated for fully charging a completely discharged battery within 48 hours while simultaneously supplying any loads connected to the battery.
3. Shall have protection to prevent discharge through the charger.
4. Shall have protection for overloads and short circuits on both AC and DC sides.

## **PART 3.0 EXECUTION**

### **3.1. INSTALLATION:**

- A. Installation shall be in accordance with the CAN/ULC S-524 Installation of Fire Alarm standard, local and provincial codes, as shown on the drawings, and as recommended by the major equipment manufacturer.
- B. All conduit, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas. Smoke detectors shall not be installed prior to the system programming and test period. If construction is ongoing during this period, measures shall be taken to protect smoke detectors from contamination and physical damage.
- C. All fire detection and alarm system devices, control panels and remote annunciators shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas.

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- D. Manual Pull Stations shall be suitable for surface mounting or semi flush mounting as shown on the plans, and shall be installed not less than 1200mm, nor more than 1400mm above the finished floor.

**3.4. TYPICAL OPERATION:**

- A. Actuation of any manual station, smoke detector or heat detector shall cause the following operations to occur unless otherwise specified:
1. Activate all programmed NAC circuits.
  2. Actuate all strobe units until the panel is reset.

**3.5. TEST:**

- A. 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. All testing shall be in accordance with CAN/ULC S537.
- B. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.
- C. Open initiating device circuits and verify that the trouble signal actuates.
- D. Open Data Communication Link and verify that the trouble signal actuates.
- E. Open and short notification appliance circuits and verify that trouble signal actuates.
- F. Ground initiating device circuits and verify response of trouble signals.
- G. Ground Data Communication Link and verify response of trouble signals.
- H. Ground notification appliance circuits and verify response of trouble signals.
- I. Check presence and audibility of tone at all alarm notification devices.
- J. Check installation, supervision, and operation of all intelligent smoke detectors during a walk test.
- K. Each of the alarm conditions that the system is required to detect should be introduced on the system. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control points.
- L. When the system is equipped with optional features, the manufacturer's manual should be consulted to determine the proper testing procedures. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality and similar.



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**3.6 FINAL INSPECTION:**

- A. 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.

**3.7 INSTRUCTION:**

- A. Provide instruction as required for operating the system. Hands on demonstrations of the operation of all system components and the entire system including program changes and functions shall be provided.
- B. The contractor and/or the systems manufacturer's representatives shall provide a typewritten "Sequence of Operation."

**END OF SECTION**