

**Specifications**  
for

**COLLINGWOOD GENERAL AND MARINE HOSPITAL**

NUCLEAR MEDICINE SPECT/CT SUITE

459 Hume Street  
Collingwood, Ontario  
L9Y 1W9

Issued for Tender – January 6, 2025

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## **1 GENERAL**

### **1.01 PROJECT DIRECTORY**

- .1 Owner:  
Collingwood General and Marine Hospital (CGMH)  
459 Hume Street,  
Collingwood, Ontario  
L9Y 3W9  
  
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## **2 PRODUCTS**

### **2.01 NOT USED**

- .1 Not Used

**3      EXECUTION**

**3.01   NOT USED**

.1      Not Used

**END OF SECTION**

**1 GENERAL**

**1.01 CONSULTANTS**

.1 Architect:

.2 Structural Engineer:

.3 Mechanical Engineer:

.4 Electrical Engineer:

**END OF SECTION**



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23 40 00	HVAC Air Cleaning Devices	2 pages
23 81 26	Split-System Air-Conditioners	3 pages
23 82 16	Air Coils	1 pages
25 05 01	Automatic Control Systems	13 pages
25 05 02	Building Automation System	6 pages
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26 05 05	Selective Demolition for Electrical	3 pages
26 05 19	Low-Voltage Electrical Power Conductors and Cables	6 pages
26 05 26	Grounding and Bonding for Electrical Systems	6 pages
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28 01 80.71	Revisions and Upgrades of Fire Detection and Alarm	9 pages
28 10 00.00	Access Control System	3 pages

**END OF SECTION**

**1 GENERAL**

**1.01 SCOPE .1** The work of the Contract is shown on the Drawings listed below.

<b><u>DRAWING NO.</u></b>	<b><u>TITLE</u></b>
A-001	Drawing List, OBC Matrix, Building Code Review, Location Plan, Symbols Legend, General Notes, Abbreviations
A-002	Travel Distance & Fire Separation Plan
A-003	Finishes and Assemblies Schedules
A-004	Door, Hardware and Accessories Schedules
A-101	Demolition Floor Plan – Level B1
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A-202	Proposed Reflected Ceiling Plan – Level B1
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A-503	Proposed Millwork Details
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S-001	General Notes & Typical Details
S-100	Site Plan
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M-200	Mechanical Below Grade Plumbing Plan – Demolition
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M-203	Mechanical Plumbing Plan – New Work
M-300	Mechanical HVAC & Fire Protection Plan – Demolition
M-301	Mechanical HVAC & Fire Protection Plan – New Work
M-400	Mechanical Details I
M-401	Mechanical Details II
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E-001	Electrical Legend & Drawing List
E-100	Electrical Key Plan
E-201	Lighting – Demolition Work
E-202	Lighting – New Work
E-301	Power & System – Demolition
E-302	Power & System – New Work
E-700	Electrical Single Line Diagram
E-800	Electrical Details 1 of 3
E-801	Electrical Details 2 of 3
E-802	Electrical Details 3 of 3
E-900	Electrical Schedules
E-901	Electrical Panel Schedule – Demolition
E-902	Electrical Panel Schedule – New Work

**END OF SECTION**

**1 GENERAL**

**1.01 CONTRACT DOCUMENTS**

- .1 Owner's tender and bid documents.
- .2 Price Form.
- .3 CCDC 2 Stipulated Price Contract (2020) and Supplementary Conditions.
- .4 Specifications – refer to Section 00 01 10 Table of Contents.
- .5 Additional Information – refer to Section 00 31 00 Information Available for Review.
- .6 Drawings and Schedules – refer to Section 00 01 15 List of Drawings.

**END OF SECTION**

## **1 GENERAL**

### **1.01 INFORMATION AVAILABLE FOR REVIEW**

- .1 The following documents have been made available by the Owner and are appended to this Specification Section.
  - .1 Asbestos Re-assessment Report Prepared by Pinchin Environmental Ltd., May 12 2025 [120 pages].
  - .2 CGMH Contractor Policies [10 pages].
  - .3 CGMH Construction, Renovation, Maintenance, Repairs Projects: Infection Prevention and Control Measures [10 pages].
  - .4 CGMH Risk Assessment for Hospital Construction, Renovation, Maintenance or Repairs Projects [6 pages].
  - .5 Siemens Installation Drawings [3 pages].
  - .6 Savaria/Handicare Patient Lift Vendors Drawings [5 pages].
  - .7 Savaria/Handicare Patient Lift Quote [2 pages].

**END OF SECTION**



May 12, 2025

Collingwood General and Marine Hospital  
459 Hume Street  
Collingwood, Ontario L9Y 1W9

**Re: Asbestos Reassessment**

Collingwood General and Marine Hospital, 459 Hume Street, Collingwood, Ontario  
Pinchin File: 341026.000

Collingwood General and Marine Hospital (Client) retained Pinchin Ltd. (Pinchin) to conduct an asbestos-containing materials (ACM) reassessment of Collingwood General and Marine Hospital located at 459 Hume Street, Collingwood, Ontario.

Pinchin performed the assessment from April 1, 2025, to April 4, 2025. The assessor was unaccompanied during the assessment. The assessed area was occupied at the time of the assessment.

The objective of the reassessment was to evaluate the condition and quantity of previously reported ACM and develop corrective action plans as required. This assessment is only to be used for the purposes of long-term management and routine maintenance. The results of this assessment are not to be used for construction, renovation, demolition, or project tendering purposes.

The **assessed area** consisted of all accessible interior portions and limited exterior portions of the building.

The scope included the following:

- Assessment of any rooms/areas that were inaccessible during the previous assessment (where access could be obtained).
- Documentation of any asbestos abatement that was performed since the last reassessment.

Building materials outside the defined **assessed area** are not discussed in this report.

## **1.0 SUMMARY OF FINDINGS**

- Parging cement on pipe fittings
- Vinyl floor tile and mastic
- Levelling compound associated with vinyl sheet flooring
- Various lay-in ceiling tiles (presumed)



- Glue on ceiling tiles – 12"x12" Random Pinholes (presumed)
- Texture coat (presumed)
- Paint on brick and block walls (presumed)
- Vermiculite (presumed to be present)

## **2.0 RECOMMENDATIONS**

### **2.1 Further Assessment**

- Assessment of the Inaccessible Locations identified in Section 3.3 should be performed for full compliance.

### **2.2 Remedial Work**

Remedial work is not required.

### **2.3 On-going Management and Maintenance**

The following recommendations are provided regarding on-going management and maintenance work involving the ACM identified.

- Review the existing Asbestos Management Program (AMP) on new information and regulatory changes which have occurred during the last year.
- Inspect all confirmed and presumed ACM at reasonable intervals and update the written documentation **annually**.
- Update the asbestos inventory report for all new information obtained (i.e., new materials, change of condition, abatement performed).
- Remove ACM before alteration or maintenance work if ACM may be disturbed. Follow appropriate asbestos precautions for the classification of work as per applicable regulations and guidelines.

### **2.4 Construction and Demolition**

This assessment report does not provide sufficient detail to support renovation and demolition work. Therefore, perform a detailed intrusive assessment before building renovation or demolition operations. The assessment should include; destructive testing (e.g., coring, removal of building finishes and components), sampling of other hazardous materials (e.g., lead, mercury, PCBs, mould, etc.), and any other materials not tested (e.g. roofing materials, caulking, mastics).





## Asbestos Reassessment

Collingwood General and Marine Hospital, 459 Hume Street, Collingwood, Ontario  
Collingwood General and Marine Hospital

May 12, 2025  
Pinchin File: 341026.000

### 3.0 FINDINGS

#### 3.1 Assessed Area Description Summary

Description Item	Details
Building Use	Hospital
Number of Floors	The building is two storeys, plus a basement level
Total Area (square feet)	The total area of the building is 135,176 square feet
Year of Construction	1960 with major renovations in 2000, 2011, and 2015
Additions	1974
Structure	Structural steel and concrete
Exterior Cladding	Brick masonry, metal
HVAC	Rooftop HVAC units, boilers, and hot water heating to radiators
Roof	Built-up roofing
Flooring	Vinyl floor tile, vinyl sheet flooring, rubber, carpet, concrete, terrazzo, laminate, and ceramic tiles
Wall Finishes	Drywall, concrete block, concrete, plaster, brick, wood, and ceramic tiles
Ceiling Finishes	Drywall, plaster, lay-in ceiling tiles, and glue-on ceiling tiles

#### 3.2 Existing Reports

##### 3.2.1 Review of Previous Reports

Pinchin reviewed the following reports and included relevant results as appropriate:

- “Hazardous Building Materials Assessment, Collingwood General & Marine Hospital, 459 Hume Street, Collingwood, Ontario”, dated October 29, 2015, Pinchin File No. 103748.
- “Asbestos Reassessment, Collingwood General & Marine Hospital, 459 Hume Street, Collingwood, Ontario”, dated February 28, 2019, Pinchin File No. 232739.
- “Asbestos Bulk Sampling Results Letter, Collingwood General & Marine Hospital, 459 Hume Street, Collingwood, Ontario”, dated December 30, 2024, Pinchin File No. 351540.
- “Asbestos Bulk Sampling Results Letter, Collingwood General & Marine Hospital, 459 Hume Street, Collingwood, Ontario”, dated February 12, 2025, Pinchin File No. 351540.001.

##### 3.2.2 Summary of New Information since the Previous Assessment

Based on a review of the above-noted reports, and observations made during the reassessment, the following abatement work appeared to have been conducted, since completion of the previous report:



## Asbestos Reassessment

Collingwood General and Marine Hospital, 459 Hume Street, Collingwood, Ontario  
Collingswood General and Marine Hospital

May 12, 2025

Pinchin File: 341026.000

- ~80 square feet of vermiculite was removed from the Future MRI Room (Location 79) (Pinchin File No. 351540.000 and 351540.001).

Based on observations made during the reassessment, the following is new information:

- An increased quantity of asbestos-containing mastic under non-asbestos vinyl floor tiles was identified and reported in the Server Room (Location 291).

### 3.3 Inaccessible Locations

Refer to the Location Report in Appendix IV for inaccessible locations.

### 3.4 Summary of Building Materials

The following table summarizes the materials evaluated for asbestos in the assessed area. For details on locations, condition and approximate quantities of asbestos materials, refer to the Confirmed/Presumed ACM Report in Appendix V. Refer to previous reports listed in section 3.2.1 for information regarding all other materials.

Sample Number	Material Description	Type of Asbestos	Confirmed Hazard	Total Quantity Present	Material Specific Notes
S0001 A-C	Piping   Parging Cement   Parging cement-LPS pipe fitting insulation	Chrysotile	Yes	10 EA	
S0008 A-C	Floor   Vinyl Floor Tile   1212 green mottled	Chrysotile	Yes	109 SF	
S0009 A-C	Piping   Parging Cement   Hot water heating pipe system	Chrysotile	Yes	10 EA	
S0024 A-C	Floor   Vinyl Sheet Flooring   Grey (Levelling Compound)	Chrysotile	Yes	519 SF	1
V9000	Piping   Parging Cement	Confirmed Asbestos	Yes	20 EA	2
V9500	Ceiling   Ceiling tiles (glue-on)   12x12 random pinhole	Presumed Asbestos	Yes	212 SF	
V9500	Ceiling   Ceiling Tiles (lay-in)   24x24 white rough textured, 24x48 beige random pinhole, 24x24 white mottled	Presumed Asbestos	Yes	7,798 SF	3



## Asbestos Reassessment

Collingwood General and Marine Hospital, 459 Hume Street, Collingwood, Ontario  
Collingswood General and Marine Hospital

May 12, 2025  
Pinchin File: 341026.000

Sample Number	Material Description	Type of Asbestos	Confirmed Hazard	Total Quantity Present	Material Specific Notes
V9500	Floor   Mastic	Presumed Asbestos	Yes	8 SF	
V9500	Floor   Vinyl Floor Tile   12x12 teal mottled	Presumed Asbestos	Yes	29 SF	
V9500	Structure   Texture Coat	Presumed Asbestos	Yes	22 SF	
V9500	Wall   Paint   Paint on Block Wall	Presumed Asbestos	Yes	31,774 SF	

Any quantities listed in this report or data tables are estimated based on visual approximations only and are subject to variation.

### Material Specific Notes:

1. Levelling compound associated with the Grey Vinyl Sheet Flooring was confirmed to contain asbestos (b202934).
2. Parging cement fittings are concealed by plaster ceilings, and the presence was confirmed by the Client.
3. Various lay-in ceiling tiles were not sampled or assessed for a date code due to infection control procedures within the 1950 and 1974 construction phases of the building. All other ceiling tiles are considered non-asbestos based on analytical results or date of construction.

### General Notes:

Materials identified as Sample Number V9500 were either observed to be present or based on the construction of the building/equipment are likely present in concealed locations. These materials have not been sampled and are presumed to contain asbestos based on historical known use of asbestos. Sampling of these materials may be completed prior to disturbance.

Materials identified as Sample Number V9000 were determined to contain asbestos based on previous analytical results, or labelling (e.g., Transite clearly labelled by the manufacturer).



### 3.4.1 *Excluded Asbestos Materials*

The following is a list of materials which may contain asbestos and was excluded from the assessment. These materials are presumed to contain asbestos until otherwise proven to be non-asbestos by sampling and analysis:

- Roofing felts and tar, mastics
- Floor levelling compound
- Ceramic tile setting compound
- Elevator and lift brakes
- Electrical components
- Moulded plastic components (laboratory bench tops)
- Mechanical packing, ropes, and gaskets
- Vermiculite, where not sampled
- Adhesives and duct mastics
- Caulking and putties, where not sampled
- Paper products
- Soffit and fascia boards
- Fire resistant doors
- Metal clad finishes (Galbestos)
- Vibration dampers on HVAC equipment
- Terrazzo
- Ropes and gaskets in cast-iron bell and spigot joints
- Sealants on pipe threads
- Sink mastic

## 4.0 **METHODOLOGY**

Pinchin conducted an assessment to evaluate the current condition of all accessible ACM identified in the most recent assessment. The assessor made reference to any existing assessment or abatement reports (as provided by the Client).



As per the original scope of work, concealed locations such as ceiling spaces above solid ceilings, shafts and chases were accessed via existing access panels. Our investigation did not include demolition of drywall or plaster walls to view concealed conditions. Structural items or exterior building finishes were not removed to determine the presence of concealed materials.

Sampling, assessment, or verification of materials listed as exclusions in previous reports was not conducted unless otherwise indicated.

For further details on the methodology including test methods, refer to Appendix III.

## **5.0 REFERENCES**

The following legislation and documents were referenced in completing the assessment and this report:

1. Asbestos on Construction Projects and in Buildings and Repair Operations, Ontario Regulation 278/05.
2. Designated Substances, Ontario Regulation 490/09.
3. Ministry of the Environment Regulation, R.R.O. 1990 Reg. 347 as amended.

## **6.0 TERMS AND LIMITATIONS**

This work was performed subject to the Terms and Limitations presented or referenced in the proposal for this project.

Information provided by Pinchin is intended for Client use only. Pinchin will not provide results or information to any party unless disclosure by Pinchin is required by law. Any use by a third party of reports or documents authored by Pinchin or any reliance by a third party on or decisions made by a third party based on the findings described in said documents, is the sole responsibility of such third parties. Pinchin accepts no responsibility for damages suffered by any third party as a result of decisions made or actions conducted. No other warranties are implied or expressed.



## Asbestos Reassessment

Collingwood General and Marine Hospital, 459 Hume Street, Collingwood, Ontario  
Collingswood General and Marine Hospital

May 12, 2025

Pinchin File: 341026.000

### 7.0 CLOSURE

The data presented in the appendices is prepared by Pinchin's Hazardous Materials Inventory System (HMIS). The information can be made available for your real-time access through our secure web-based platform. Please contact your Pinchin representative to discuss HMIS solutions for management of your asbestos (and other hazardous materials) inventory.

Should you have any questions or concerns regarding the contents of this letter, please contact the Project Manager, Michelle Salt at 249.359.5185 or [msalt@pinchin.com](mailto:msalt@pinchin.com).

Sincerely,

**Pinchin Ltd.**

Prepared by:

Ava Smith, B.A.Sc. Hons  
Project Technologist

Project Managed by:

Michelle Salt, B.Sc. Hons  
Senior Project Manager

Reviewed by:

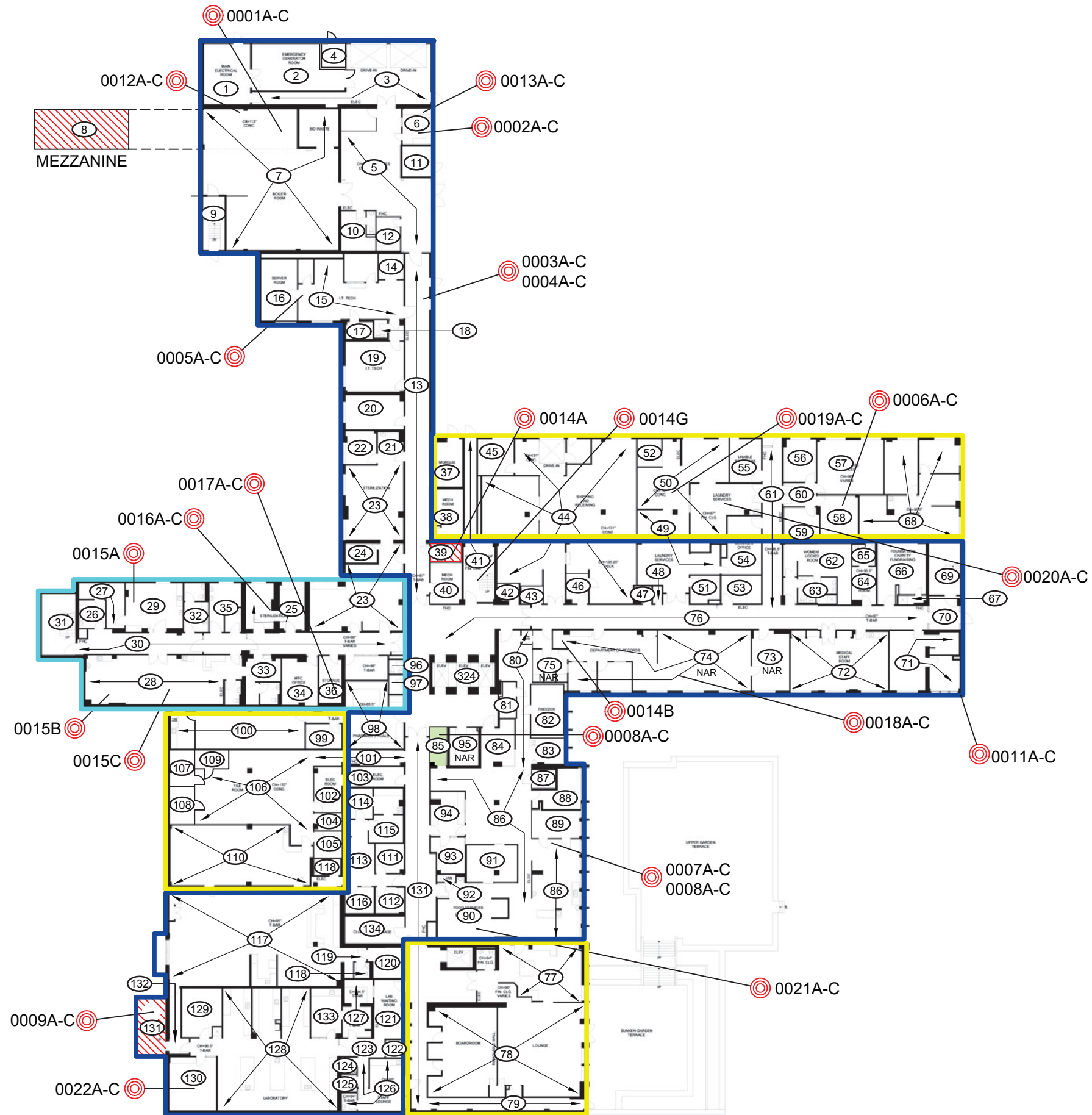
Leslie Heywood, BEngMgt  
Senior Project Manager

Encl:	APPENDIX I	Drawings
	APPENDIX II	Asbestos Analytical Certificates
	APPENDIX III	Methodology
	APPENDIX IV	Location Summary Report
	APPENDIX V	Confirmed / Presumed ACM Report
	APPENDIX VI	Photographs

\\PIN-HAM-FS02\job\341000s\0341026.000 CG&MH,459HumeStCollingwood,HAZ-AsbReass\Deliverables\341026 Asbestos Reassessment 459 Hume St Collingwood ON  
CGMH May 12 2025.docx

Template: Master Template Asbestos Reassessment, HMIS, HAZ, March 13, 2024

**APPENDIX I**  
**Drawings**



LEGEND

- (X) PINCHIN LOCATION NUMBER
- ASBESTOS BULK SAMPLE
- NAR NO ACCESS TO ROOM/AREA

- 1950
- 1974
- 2000
- 2011
- 2015

ASBESTOS-CONTAINING MATERIALS:

- VINYL FLOOR TILES & MASTIC
- LEVELLING ASSOCIATED WITH VINYL SHEET FLOORING
- MECHANICAL INSULATION

FOR CLARITY, THE FOLLOWING PRESUMED ASBESTOS-CONTAINING MATERIALS, ARE PRESENT IN THE ASSESSED AREA, BUT HAVE NOT BEEN HATCHED ON THE DRAWING:

- VARIOUS LAY-IN CEILING TILES
- GLUE ON CEILING TILES - 12"X12" RANDOM PINHOLES
- DRYWALL AND JOINT COMPOUND ON CEILINGS
- TEXTURE COAT
- PAIN ON BRICK AND BLOCK WALLS
- VERMICULITE

NOT ALL KNOWN OR SUSPECTED HAZARDOUS BUILDING MATERIALS MAY BE DEPICTED ON THE DRAWING. REFER TO THE ASBESTOS BUILDING MATERIALS ASSESSMENT REPORT FOR A COMPLETE LIST OF KNOWN AND SUSPECTED HAZARDOUS BUILDING MATERIALS.

LEGEND IS COLOUR DEPENDENT. NON-COLOUR COPIES MAY ALTER INTERPRETATION.

BASE PLAN PROVIDED BY CLIENT.



PROJECT NAME:

ASBESTOS REASSESSMENT

CLIENT NAME:

COLLINGWOOD GENERAL AND MARINE HOSPITAL

PROJECT LOCATION:

459 HUME STREET, COLLINGWOOD, ONTARIO

FIGURE NAME:

BASEMENT

PROJECT NUMBER:

341026

SCALE:

NOT TO SCALE

DRAWN BY:

IG

REVIEWED BY:

AS

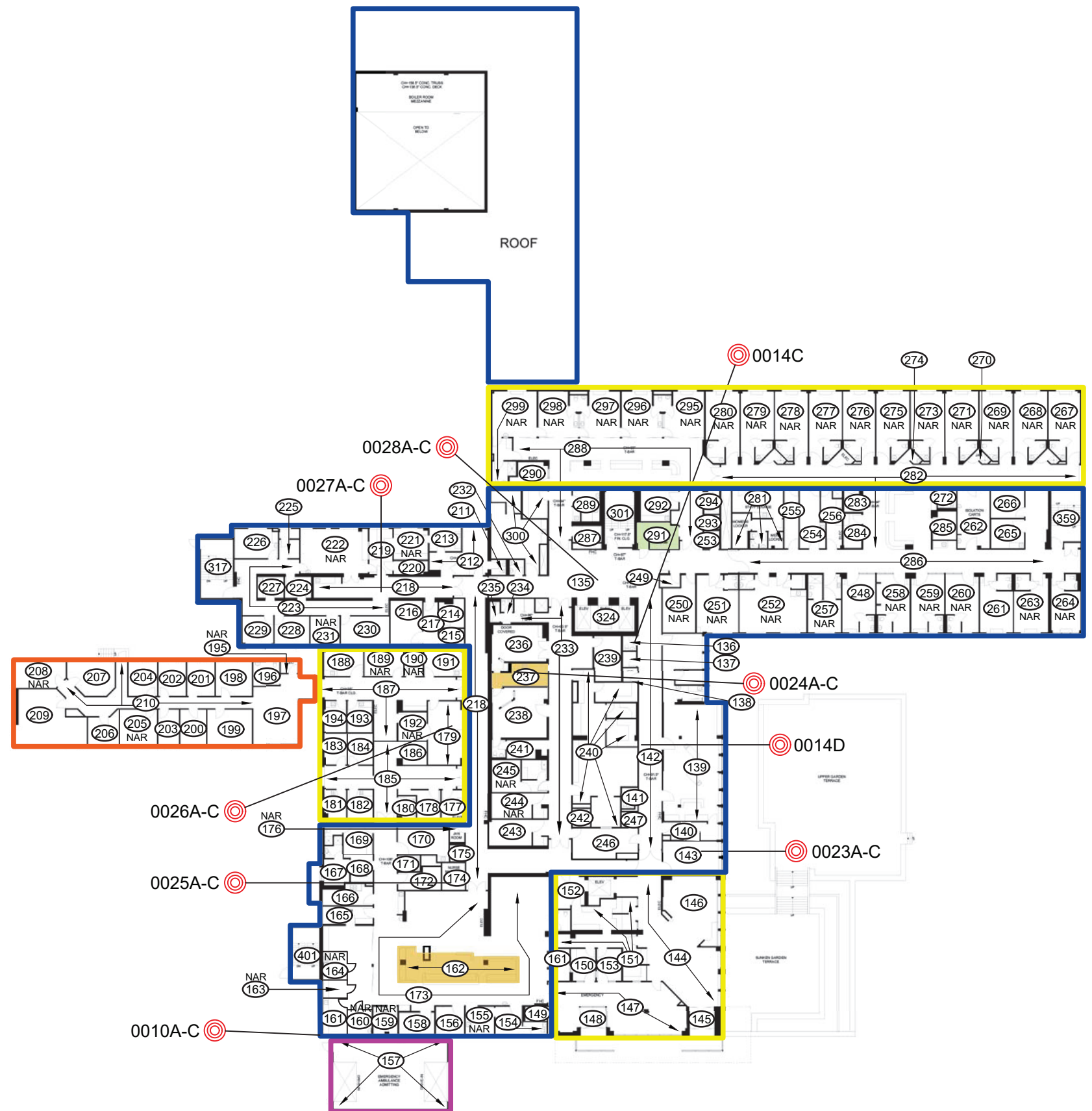
DATE:

MAY 2025

FIGURE NUMBER:

1 OF 3





**LEGEND**

- (X) PINCHIN LOCATION NUMBER
- ASBESTOS BULK SAMPLE
- NAR NO ACCESS TO ROOM/AREA

- 1950
- 1974
- 2000
- 2011
- 2015

- ASBESTOS-CONTAINING MATERIALS:**
- VINYL FLOOR TILES & MASTIC
  - LEVELLING ASSOCIATED WITH VINYL SHEET FLOORING
  - MECHANICAL INSULATION

FOR CLARITY, THE FOLLOWING PRESUMED ASBESTOS- CONTAINING MATERIALS, ARE PRESENT IN THE ASSESSED AREA, BUT HAVE NOT BEEN HATCHED ON THE DRAWING:

- VARIOUS LAY-IN CEILING TILES
- GLUE ON CEILING TILES - 12"X12" RANDOM PINHOLES
- DRYWALL AND JOINT COMPOUND ON CEILINGS
- TEXTURE COAT
- PAIN ON BRICK AND BLOCK WALLS
- VERMICULITE

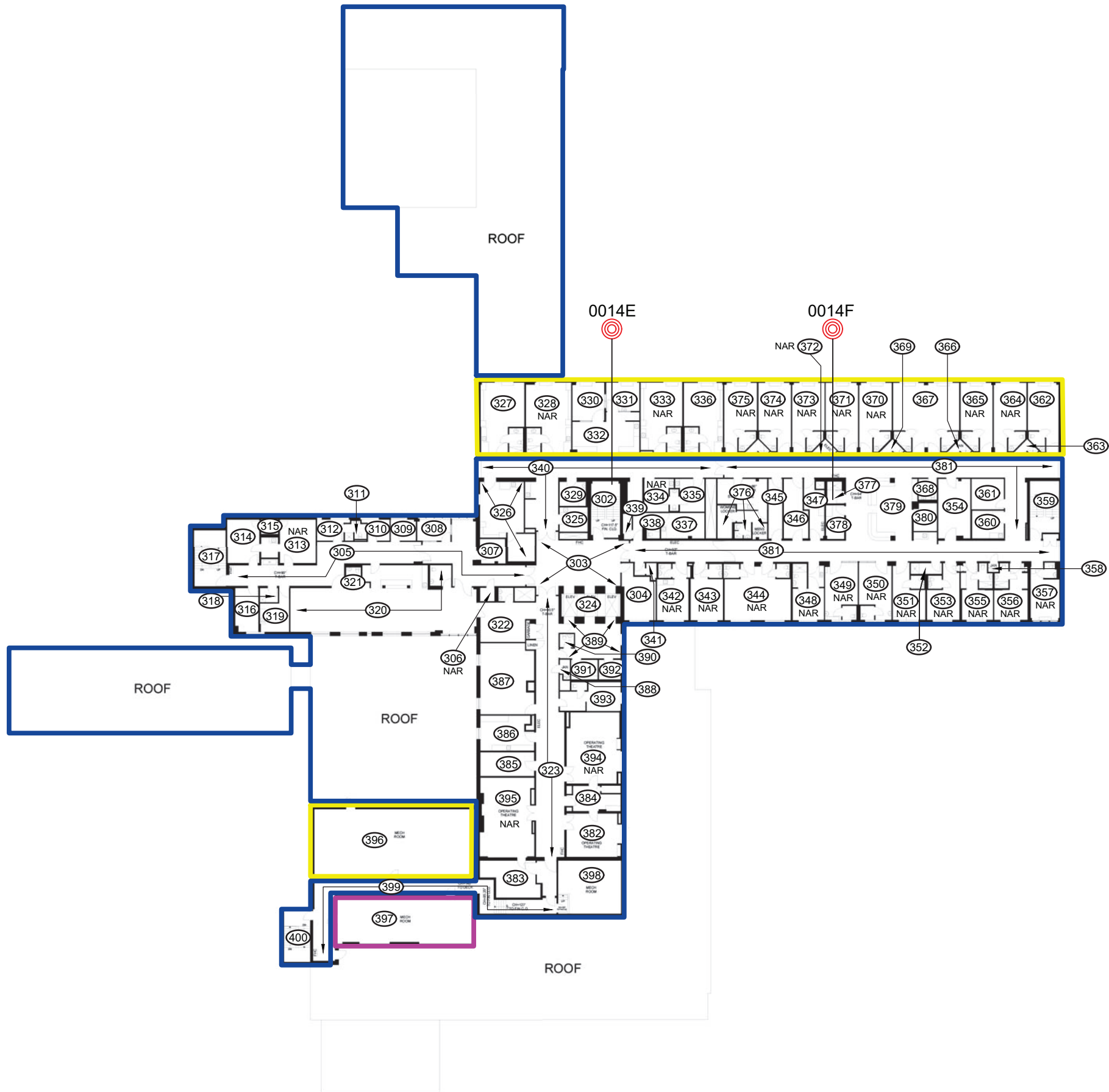
NOT ALL KNOWN OR SUSPECTED HAZARDOUS BUILDING MATERIALS MAY BE DEPICTED ON THE DRAWING. REFER TO THE ASBESTOS BUILDING MATERIALS ASSESSMENT REPORT FOR A COMPLETE LIST OF KNOWN AND SUSPECTED HAZARDOUS BUILDING MATERIALS.

LEGEND IS COLOUR DEPENDENT. NON-COLOUR COPIES MAY ALTER INTERPRETATION.

BASE PLAN PROVIDED BY CLIENT.



PROJECT NAME:	
ASBESTOS REASSESSMENT	
CLIENT NAME:	
COLLINGWOOD GENERAL AND MARINE HOSPITAL	
PROJECT LOCATION:	
459 HUME STREET, COLLINGWOOD, ONTARIO	
FIGURE NAME:	
FIRST FLOOR	
PROJECT NUMBER:	SCALE:
341026	NOT TO SCALE
DRAWN BY:	REVIEWED BY:
IG	AS
DATE:	FIGURE NUMBER:
MAY 2025	2 OF 3



**LEGEND**

- (X) PINCHIN LOCATION NUMBER
- ASBESTOS BULK SAMPLE
- NAR NO ACCESS TO ROOM/AREA

- 1950
- 1974
- 2000
- 2011
- 2015

- ASBESTOS-CONTAINING MATERIALS:**
- VINYL FLOOR TILES & MASTIC
  - LEVELLING ASSOCIATED WITH VINYL SHEET FLOORING
  - MECHANICAL INSULATION

FOR CLARITY, THE FOLLOWING PRESUMED ASBESTOS- CONTAINING MATERIALS, ARE PRESENT IN THE ASSESSED AREA, BUT HAVE NOT BEEN HATCHED ON THE DRAWING:

- VARIOUS LAY-IN CEILING TILES
- GLUE ON CEILING TILES - 12"X12" RANDOM PINHOLES
- DRYWALL AND JOINT COMPOUND ON CEILINGS
- TEXTURE COAT
- PAIN ON BRICK AND BLOCK WALLS
- VERMICULITE

NOT ALL KNOWN OR SUSPECTED HAZARDOUS BUILDING MATERIALS MAY BE DEPICTED ON THE DRAWING. REFER TO THE ASBESTOS BUILDING MATERIALS ASSESSMENT REPORT FOR A COMPLETE LIST OF KNOWN AND SUSPECTED HAZARDOUS BUILDING MATERIALS.

LEGEND IS COLOUR DEPENDENT. NON-COLOUR COPIES MAY ALTER INTERPRETATION.

BASE PLAN PROVIDED BY CLIENT.



PROJECT NAME:  
ASBESTOS REASSESSMENT

CLIENT NAME:  
COLLINGWOOD GENERAL  
AND MARINE HOSPITAL

PROJECT LOCATION:  
459 HUME STREET,  
COLLINGWOOD, ONTARIO

FIGURE NAME:  
SECOND FLOOR

PROJECT NUMBER: 341026	SCALE: NOT TO SCALE
DRAWN BY: IG	REVIEWED BY: AS
DATE: MAY 2025	FIGURE NUMBER: 3 OF 3

**APPENDIX II**  
**Asbestos Analytical Certificates**



# Bulk Asbestos Analysis

By Polarized Light Microscopy  
EPA Method: 600/R-93/116 and 600/M4-82-020



NVLAP Lab Code: 200664-0

**Customer:** Pinchin Ltd.  
2470 Milltower Court  
Mississauga ON L5N 7W5

**Attn:** Bob Young

**Lab Order ID:** 1519115  
**Analysis ID:** 1519115\_PLM  
**Date Received:** 10/2/2015  
**Date Reported:** 10/7/2015

**Project:** Collingwood Hospital, 459 Hume Street, Collingwood, ON

Sample ID	Description	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes
Lab Sample ID	Lab Notes				Treatment
0001A	Parging cement-LPS pipe fitting insulation-Boiler Room, Mezzanine	20% Chrysotile		80% Other	Gray Non Fibrous Heterogeneous
1519115PLM_1					Crushed
0001B	Parging cement-LPS pipe fitting insulation-Boiler Room, Mezzanine	Not Analyzed			
1519115PLM_2					
0001C	Parging cement-LPS pipe fitting insulation-Boiler Room, Mezzanine	Not Analyzed			
1519115PLM_3					
0002A	Drywall joint compound-Wall -Maintenance	None Detected		100% Other	White Non Fibrous Homogeneous
1519115PLM_4					Crushed
0002B	Drywall joint compound-Wall -Maintenance	None Detected		100% Other	White Non Fibrous Homogeneous
1519115PLM_5					Crushed
0002C	Drywall joint compound-Wall -Maintenance	None Detected		100% Other	White Non Fibrous Homogeneous
1519115PLM_6					Crushed
0003A - A	Vinyl sheet flooring-Brown shapes-Basement, Corridor	None Detected	60% Cellulose 10% Fiber Glass 10% Synthetic Fibers	20% Other	Tan Fibrous Heterogeneous
1519115PLM_7	backing				Teased
0003A - B	Vinyl sheet flooring-Brown shapes-Basement, Corridor	None Detected		100% Other	Yellow Non Fibrous Homogeneous
1519115PLM_28	mastic				Dissolved

**Disclaimer:** Due to the nature of the EPA 600 method, asbestos may not be detected in samples containing low levels of asbestos. We strongly recommend that analysis of floor tiles, vermiculite, and/or heterogeneous soil samples be conducted by TEM for confirmation of "None Detected" by PLM. This report relates only to the samples tested and may not be reproduced, except in full, without the written approval of SAI. This report may not be used by the client to claim product endorsement by NVLAP or any other agency of the U.S. government. Estimated MDL is 0.1%.

Bart Huber (36)

Analyst

Approved Signatory



# Bulk Asbestos Analysis

By Polarized Light Microscopy  
EPA Method: 600/R-93/116 and 600/M4-82-020



NVLAP Lab Code: 200664-0

**Customer:** Pinchin Ltd.  
2470 Milltower Court  
Mississauga ON L5N 7W5

**Attn:** Bob Young

**Lab Order ID:** 1519115  
**Analysis ID:** 1519115\_PLM  
**Date Received:** 10/2/2015  
**Date Reported:** 10/7/2015

**Project:** Collingwood Hospital, 459 Hume Street, Collingwood, ON

Sample ID	Description	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes
Lab Sample ID	Lab Notes				Treatment
0003B - A	Vinyl sheet flooring-Brown shapes-Basement, Corridor	None Detected	60% Cellulose 10% Fiber Glass 10% Synthetic Fibers	20% Other	Tan Fibrous Heterogeneous
1519115PLM_8	backing				Teased
0003B - B	Vinyl sheet flooring-Brown shapes-Basement, Corridor	None Detected		100% Other	Yellow Non Fibrous Homogeneous
1519115PLM_29	mastic				Dissolved
0003C - A	Vinyl sheet flooring-Brown shapes-Basement, Corridor	None Detected	60% Cellulose 10% Fiber Glass 10% Synthetic Fibers	20% Other	Tan Fibrous Heterogeneous
1519115PLM_9	backing				Teased
0003C - B	Vinyl sheet flooring-Brown shapes-Basement, Corridor	None Detected		100% Other	Yellow Non Fibrous Homogeneous
1519115PLM_30	mastic				Dissolved
0004A	Ceiling tile-2'x 4', white, random pinhole-Basement, Corridor	None Detected	45% Cellulose 45% Fiber Glass	10% Other	White Fibrous Homogeneous
1519115PLM_10					Teased
0004B	Ceiling tile-2'x 4', white, random pinhole-Basement, Corridor	None Detected	45% Cellulose 45% Fiber Glass	10% Other	White Fibrous Homogeneous
1519115PLM_11					Teased
0004C	Ceiling tile-2'x 4', white, random pinhole-Basement, Corridor	None Detected	45% Cellulose 45% Fiber Glass	10% Other	White Fibrous Homogeneous
1519115PLM_12					Teased
0005A	Ceiling tile-2'x 4', white, texture finish-Business Office	None Detected	45% Cellulose 45% Fiber Glass	10% Other	White Fibrous Homogeneous
1519115PLM_13					Teased

**Disclaimer:** Due to the nature of the EPA 600 METHOD, asbestos may not be detected in samples containing low levels of asbestos. We strongly recommend that analysis of floor tiles, vermiculite, and/or heterogeneous soil samples be conducted by TEM for confirmation of "None Detected" by PLM. This report relates only to the samples tested and may not be reproduced, except in full, without the written approval of SAI. This report may not be used by the client to claim product endorsement by NVLAP or any other agency of the U.S. government. Estimated MDL is 0.1%.

Bart Huber (36)

Analyst

Approved Signatory



# Bulk Asbestos Analysis

By Polarized Light Microscopy  
EPA Method: 600/R-93/116 and 600/M4-82-020



**Customer:** Pinchin Ltd.  
2470 Milltower Court  
Mississauga ON L5N 7W5

**Attn:** Bob Young

**Lab Order ID:** 1519115  
**Analysis ID:** 1519115\_PLM  
**Date Received:** 10/2/2015  
**Date Reported:** 10/7/2015

**Project:** Collingwood Hospital, 459 Hume Street, Collingwood, ON

Sample ID	Description	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes
Lab Sample ID	Lab Notes				Treatment
0005B	Ceiling tile-2'x 4', white, texture finish-Business Office	None Detected	45% Cellulose 45% Fiber Glass	10% Other	White Fibrous Homogeneous
1519115PLM_14					Teased
0005C	Ceiling tile-2'x 4', white, texture finish-Business Office	None Detected	45% Cellulose 45% Fiber Glass	10% Other	White Fibrous Homogeneous
1519115PLM_15					Teased
0006A - A	Vinyl sheet flooring-Reddish shapes-Women's Locker Room	None Detected	60% Cellulose 10% Fiber Glass 10% Synthetic Fibers	20% Other	Tan Fibrous Heterogeneous
1519115PLM_16	backing				Teased
0006A - B	Vinyl sheet flooring-Reddish shapes-Women's Locker Room	None Detected		100% Other	Yellow Non Fibrous Homogeneous
1519115PLM_31	mastic				Dissolved
0006B - A	Vinyl sheet flooring-Reddish shapes-Women's Locker Room	None Detected	60% Cellulose 10% Fiber Glass 10% Synthetic Fibers	20% Other	Tan Fibrous Heterogeneous
1519115PLM_17	backing				Teased
0006B - B	Vinyl sheet flooring-Reddish shapes-Women's Locker Room	None Detected		100% Other	Yellow Non Fibrous Homogeneous
1519115PLM_32	mastic				Dissolved
0006C - A	Vinyl sheet flooring-Reddish shapes-Women's Locker Room	None Detected	60% Cellulose 10% Fiber Glass 10% Synthetic Fibers	20% Other	Tan Fibrous Heterogeneous
1519115PLM_18	backing				Teased
0006C - B	Vinyl sheet flooring-Reddish shapes-Women's Locker Room	None Detected		100% Other	Yellow Non Fibrous Homogeneous
1519115PLM_33	mastic				Dissolved

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Bart Huber (36)

Analyst

Approved Signatory





# Bulk Asbestos Analysis

By Polarized Light Microscopy  
EPA Method: 600/R-93/116 and 600/M4-82-020



**Customer:** Pinchin Ltd.  
2470 Milltower Court  
Mississauga ON L5N 7W5

**Attn:** Bob Young

**Lab Order ID:** 1519115  
**Analysis ID:** 1519115\_PLM  
**Date Received:** 10/2/2015  
**Date Reported:** 10/7/2015

**Project:** Collingwood Hospital, 459 Hume Street, Collingwood, ON

Sample ID	Description	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes
Lab Sample ID	Lab Notes				Treatment
0007A	Ceiling tile-2'x 4', white, pebble finish-Kitchen	None Detected	45% Cellulose 45% Fiber Glass	10% Other	White Fibrous Homogeneous
1519115PLM_19					Teased
0007B	Ceiling tile-2'x 4', white, pebble finish-Kitchen	None Detected	45% Cellulose 45% Fiber Glass	10% Other	White Fibrous Homogeneous
1519115PLM_20					Teased
0007C	Ceiling tile-2'x 4', white, pebble finish-Kitchen	None Detected	45% Cellulose 45% Fiber Glass	10% Other	White Fibrous Homogeneous
1519115PLM_21					Teased
0008A - A	Vinyl floor tile-12"x 12", green mottled-Kitchen, Storage Room	None Detected		100% Other	Green Non Fibrous Homogeneous
1519115PLM_22	tile				Dissolved
0008A - B	Vinyl floor tile-12"x 12", green mottled-Kitchen, Storage Room	5% Chrysotile		95% Other	Black Non Fibrous Homogeneous
1519115PLM_34	mastic				Dissolved
0008B - A	Vinyl floor tile-12"x 12", green mottled-Kitchen, Storage Room	None Detected		100% Other	Green Non Fibrous Homogeneous
1519115PLM_23	tile				Dissolved
0008B - B	Vinyl floor tile-12"x 12", green mottled-Kitchen, Storage Room	Not Analyzed			
1519115PLM_35	mastic				
0008C - A	Vinyl floor tile-12"x 12", green mottled-Kitchen, Storage Room	None Detected		100% Other	Green Non Fibrous Homogeneous
1519115PLM_24	tile-ashed				Ashed

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Bart Huber (36)

Analyst

Approved Signatory



# Bulk Asbestos Analysis

By Polarized Light Microscopy  
EPA Method: 600/R-93/116 and 600/M4-82-020



**Customer:** Pinchin Ltd.  
2470 Milltower Court  
Mississauga ON L5N 7W5

**Attn:** Bob Young

**Lab Order ID:** 1519115  
**Analysis ID:** 1519115\_PLM  
**Date Received:** 10/2/2015  
**Date Reported:** 10/7/2015

**Project:** Collingwood Hospital, 459 Hume Street, Collingwood, ON

Sample ID	Description	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes
Lab Sample ID	Lab Notes				Treatment
0008C - B	Vinyl floor tile-12"x 12", green mottled-Kitchen, Storage Room	Not Analyzed			
1519115PLM_36	mastic				
0009A	Parging cement-Hot Water Heating pipe fitting insulation-Lab, Stair	20% Chrysotile		80% Other	Gray Non Fibrous Heterogeneous
1519115PLM_25					Crushed
0009B	Parging cement-Hot Water Heating pipe fitting insulation-Lab, Stair	Not Analyzed			
1519115PLM_26					
0009C	Parging cement-Hot Water Heating pipe fitting insulation-Lab, Stair	Not Analyzed			
1519115PLM_27					

**Disclaimer:** Due to the nature of the EPA 600 method, asbestos may not be detected in samples containing low levels of asbestos. We strongly recommend that analysis of floor tiles, vermiculite, and/or heterogeneous soil samples be conducted by TEM for confirmation of "None Detected" by PLM. This report relates only to the samples tested and may not be reproduced, except in full, without the written approval of SAI. This report may not be used by the client to claim product endorsement by NVLAP or any other agency of the U.S. government. Estimated MDL is 0.1%.

Bart Huber (36)

Analyst

Approved Signatory



**Client:** Pinchin Ltd.  
**Contact:** Bob Young  
 2470 Milltower Court, Mississauga,  
 ON, Canada  
**Address:**  
**Phone:** 905-363-0678  
**Fax:** 905-363-0681  
**Email:** byoung@pinchin.com  
  
**Project:** Collingwood Hospital, 459 Hume  
 Street, Collingwood, ON  
  
**Client Notes:**  
  
**P.O. #:** October 1st 2015  
**Date Submitted:**  
  
**Analysis:** PLM - Stop Positive  
**TurnAroundTime:** 4 days

**\*Instructions:**

Use Column "B" for your contact info

To See an Example Click the  
bottom Example Tab.

Enter samples between "<<" and ">>"

Begin Samples with a "<<" above the first sample  
and end with a ">>" below the last sample.  
Only Enter your data on the first sheet "Sheet1"

Note: Data 1 and Data 2 are optional  
fields that do not show up on the official  
report, however they will be included  
in the electronic data returned to you  
to facilitate your reintegration of the report data.

Version 1-15-2012

Invoice to:

Contact name here

Email address here

Scientific  
Analytical  
Institute



4604 Dundas Dr.  
 Greensboro, NC 27407  
 Phone: 336.292.3888  
 Fax: 336.292.3313  
 Email: lab@sailab.com

Sample Number	Data 1 (Lab use only)	Sample Description	Data 2 (Lab use only)
<<			
0001A		Parging cement-LPS pipe fitting insulation-Boiler Room, Mezzanine	
0001B		Parging cement-LPS pipe fitting insulation-Boiler Room, Mezzanine	
0001C		Parging cement-LPS pipe fitting insulation-Boiler Room, Mezzanine	
0002A		Drywall joint compound-Wall-Maintenance	
0002B		Drywall joint compound-Wall-Maintenance	
0002C		Drywall joint compound-Wall-Maintenance	
0003A		Vinyl sheet flooring-Brown shapes-Basement, Corridor	
0003B		Vinyl sheet flooring-Brown shapes-Basement, Corridor	
0003C		Vinyl sheet flooring-Brown shapes-Basement, Corridor	
0004A		Ceiling tile-2'x 4', white, random pinhole-Basement, Corridor	
0004B		Ceiling tile-2'x 4', white, random pinhole-Basement, Corridor	
0004C		Ceiling tile-2'x 4', white, random pinhole-Basement, Corridor	
0005A		Ceiling tile-2'x 4', white, texture finish-Business Office	
0005B		Ceiling tile-2'x 4', white, texture finish-Business Office	
0005C		Ceiling tile-2'x 4', white, texture finish-Business Office	
0006A		Vinyl sheet flooring-Reddish shapes-Women's Locker Room	
0006B		Vinyl sheet flooring-Reddish shapes-Women's Locker Room	
0006C		Vinyl sheet flooring-Reddish shapes-Women's Locker Room	
0007A		Ceiling tile-2'x 4', white, pebble finish-Kitchen	
0007B		Ceiling tile-2'x 4', white, pebble finish-Kitchen	
0007C		Ceiling tile-2'x 4', white, pebble finish-Kitchen	
0008A		Vinyl floor tile-12"x 12", green mottled-Kitchen, Storage Room	
0008B		Vinyl floor tile-12"x 12", green mottled-Kitchen, Storage Room	
0008C		Vinyl floor tile-12"x 12", green mottled-Kitchen, Storage Room	
0009A		Parging cement-Hot Water Heating pipe fitting insulation-Lab, Stair	
0009B		Parging cement-Hot Water Heating pipe fitting insulation-Lab, Stair	
0009C		Parging cement-Hot Water Heating pipe fitting insulation-Lab, Stair	
>>			

Accepted



Rejected



MC 10/2 10A

1519115



## Pinchin Ltd. Asbestos Laboratory Certificate of Analysis

Project Name:	Collingwood Hospital, 459 Hume Street, Collingwood, ON		
Project No.:	103748		
Prepared For:	B. Young	Date Received:	October 27, 2015
Lab Reference No.:	b124427	Date Analyzed:	October 27, 2015
Analyst(s):	B. Hicks	# Samples submitted:	6
		# Phases analyzed:	6

### Method of Analysis:

**EPA 600/R-93/116 - Method for the Determination of Asbestos in Bulk Building Materials dated July, 1993**

Bulk samples are checked visually and scanned under a stereomicroscope. Slides are prepared and observed under a Polarized Light Microscope (PLM) at magnifications of 40X, 100X or 400X as appropriate. Asbestos fibres are identified by a combination of morphology, colour, refractive index, extinction, sign of elongation, birefringence and dispersion staining colours. A visual estimate is made of the percentage of asbestos present. A reported concentration of less than (<) the regulatory threshold (see chart below) indicates the presence of confirmed asbestos in trace quantities, limited to only a few fibres or fibre bundles in an entire sample. This method complies with provincial regulatory requirements where applicable. Multiple phases within a sample are analyzed and reported separately.

Provincial Jurisdiction	Regulatory Threshold	Provincial Jurisdiction	Regulatory Threshold
Ontario, British Columbia, Nova Scotia	0.5%	Manitoba	0.1% friable 1% non-friable
Quebec	0.1%	Saskatchewan	0.5% friable 1% non-friable
Alberta, NWT, Yukon, Nunavut	1%	Newfoundland and Labrador, PEI and New Brunswick	1%

All bulk samples submitted to this laboratory for asbestos analysis are retained for a minimum of three months. Samples may be retrieved, upon request, for re-examination at any time during that period.

Pinchin Ltd. is accredited by the National Institute of Standards and Technology, National Voluntary Laboratory Accreditation Program (NVLAP Lab Code 101270-0) for the 'EPA-600/M4-82-020: Interim Method for the Determination of Asbestos in Bulk Insulation Samples' and meets all requirements of ISO/IEC 17025:2005.

This report relates only to the items tested.

**NOTE:** *This test report may not be reproduced, except in full, without the written approval of the laboratory. The client may not use this report to claim product endorsement by NVLAP or any agency of the U.S. Government. This report is valid only when signed in blue ink by the analyst. Vinyl asbestos floor tiles contain very fine fibres of asbestos and may be missed by some laboratories using the PLM method. Internal verification studies performed by Pinchin indicate that the chance of missing asbestos in floor tiles is no higher than about 2%. The vinyl tile study and laboratory documentation on measurement uncertainty is available upon request. The analysis of dust samples by PLM cannot be used as an indicator of past or present airborne asbestos fibre levels.*



**Pinchin Ltd. Asbestos Laboratory**  
***Certificate of Analysis***

**Project Name:** Collingwood Hospital, 459 Hume Street, Collingwood, ON  
**Project No.:** 103748  
**Prepared For:** B. Young

**Lab Reference No.:** b124427  
**Date Analyzed:** October 27, 2015

**BULK SAMPLE ANALYSIS**

SAMPLE IDENTIFICATION	SAMPLE DESCRIPTION	% COMPOSITION (VISUAL ESTIMATE)	
		ASBESTOS	OTHER
0010A Brown Caulking - Ambulance Bay Doors	Homogeneous, brown, caulking material.	None Detected	Non-Fibrous Material > 75%
0010B Brown Caulking - Ambulance Bay Doors	Homogeneous, brown, caulking material.	None Detected	Non-Fibrous Material > 75%
0010C Brown Caulking - Ambulance Bay Doors	Homogeneous, brown, caulking material.	None Detected	Non-Fibrous Material > 75%
0011A Brown Caulking - East Elevation - 1st Floor, Window	Homogeneous, brown, caulking material.	None Detected	Non-Fibrous Material > 75%
0011B Brown Caulking - East Elevation - 1st Floor, Window	Homogeneous, brown, caulking material.	None Detected	Non-Fibrous Material > 75%
0011C Brown Caulking - East Elevation - 1st Floor, Window	Homogeneous, brown, caulking material.	None Detected	Non-Fibrous Material > 75%

REVIEWED BY

ANALYST



## Pinchin Ltd. Asbestos Laboratory

### q AnaxpNa y dVTN.Oa

**Project Name:** Collingwood Marine & General Hospital  
 459 Hume Street, Collingwood, Ontario  
**Project No.:** 0232739.000  
**Prepared For:** B. Young / L. Cantar  
**Lab Reference No.:** b202933  
**Analyst(s):** J. Dacquel / C. Luong  
**Date Received:** January 8, 2019 **# Samples submitted:** 28  
**Date Analyzed:** January 23, 2019 **# Phases analyzed:** 58

#### Method of Analysis:

EPA 600/R-93/116 - Method for the Determination of Asbestos in Bulk Building Materials dated July, 1993

Bulk samples are checked visually and scanned under a stereomicroscope. Slides are prepared and observed under a Polarized Light Microscope (PLM) at magnifications of 40X, 100X or 400X as appropriate. Asbestos fibres are identified by a combination of morphology, colour, refractive index, extinction, sign of elongation, birefringence and dispersion staining colours. A visual estimate is made of the percentage of asbestos present. A reported concentration of less than (<) the regulatory threshold (see chart below) indicates the presence of confirmed asbestos in trace quantities, limited to only a few fibres or fibre bundles in an entire sample. This method complies with provincial regulatory requirements where applicable. Multiple phases within a sample are analyzed and reported separately.

Provincial Jurisdiction	Regulatory Threshold	Provincial Jurisdiction	Regulatory Threshold
Ontario, British Columbia, Nova Scotia	0.5%	Alberta	Undefined
Quebec	0.1%	Saskatchewan	0.5% friable 1% non-friable
PEI, NWT, Yukon, Nunavut, Newfoundland and Labrador, and New Brunswick	1%	Manitoba	0.1% friable 1% non-friable

All bulk samples submitted to this laboratory for asbestos analysis are retained for a minimum of three months. Samples may be retrieved, upon request, for re-examination at any time during that period.

Pinchin Ltd. is accredited by the National Institute of Standards and Technology, National Voluntary Laboratory Accreditation Program (NVLAP Lab Code 101270-0) for the 'EPA-600/M4-82-020: Interim Method for the Determination of Asbestos in Bulk Insulation Samples,' and the 'EPA 600/R-93/116: Method for the Determination of Asbestos in Bulk Building Materials'; and meets all requirements of ISO/IEC 17025:2005.

This report relates only to the items tested.

Ce r t i f i c a t e o f A n a l y s i s  
 AT: ynaAs ATOE C v. VL ynNTONPATpOydd AgWwSyxAnTs ATovrf a nAl yroa xNc yTLD, f AT adPTA: d EuhA dGEO d ANTNDaow d QunAEaaya dyynaa  
 pyTdnd xAnOdTA dEnAa ydNaEAaya NT: s NOEAs aAa: EOays A uEynNyrnaa hadP d AL. k s Ad y: wTtoAnTNuxAnaxpNayT ad: aA l Andrs A: EOL d pf d  
 d: qnNa d Nod Apf NTpA yds aadP NaEAaya d dyynaa a Ty f d Pf And NT NEyhol 2 wr f AxdQuaa ad: ONT: uEynNyrnO: yphs ATdNayT yT s ANahrAs ATo  
 hTpAndNTOa NkNaNEuA hl yT nA%hAaovrf ANTNDaayd: haoaNs l uA EOL. k pNTTyEA haA: Na NT d: qNgyndl Naoynl nAaAToNnEynTA NaEAaya dEnA uAxuaw



## Pinchin Ltd. Asbestos Laboratory

### q AnaxtpNoA y dVTN.OaCa

**Project Name:** Collingwood Marine & General Hospital  
**Project No.:** 0232739.000  
**Prepared For:** B. Young / L. Cantar

**Lab Reference No.:** b202933  
**Date Analyzed:** January 23, 2019

### BULK SAMPLE ANALYSIS

SAMPLE IDENTIFICATION	SAMPLE DESCRIPTION	% COMPOSITION (VISUAL ESTIMATE)	
		ASBESTOS	OTHER
0012A Parging cement on flanges of Heat Exchanger - Basement, Boiler Room, Mezzanine	Non-homogeneous, beige and white, soft, cementitious material.	None Detected	Man-made Vitreous Fibres 0.5-5% Non-Fibrous Material > 75%
Comments:	Man-made vitreous fibres are present on the surface of this sample.		
0012B Parging cement on flanges of Heat Exchanger - Basement, Boiler Room, Mezzanine	Non-homogeneous, beige and white, soft, cementitious material.	None Detected	Man-made Vitreous Fibres 0.5-5% Non-Fibrous Material > 75%
Comments:	Man-made vitreous fibres are present on the surface of this sample.		
0012C Parging cement on flanges of Heat Exchanger - Basement, Boiler Room, Mezzanine	Non-homogeneous, beige and white, soft, cementitious material.	None Detected	Man-made Vitreous Fibres 0.5-5% Non-Fibrous Material > 75%
0013A Vinyl sheet flooring, Brown mottled - Basement, Maintenance	2 Phases: a) Homogeneous, beige, woven, fibrous material on the back of vinyl sheet flooring.	None Detected	Cellulose > 75% Non-Fibrous Material 0.5-5%
	b) Homogeneous, yellow, adhesive material.	None Detected	Non-Fibrous Material > 75%
Comments:	Phase b) is small in size. For more reliable results, a larger sample is required.		
0013B Vinyl sheet flooring, Brown mottled - Basement, Maintenance	2 Phases: a) Homogeneous, beige, woven, fibrous material on the back of vinyl sheet flooring.	None Detected	Cellulose > 75% Non-Fibrous Material 0.5-5%
	b) Homogeneous, yellow, adhesive material.	None Detected	Non-Fibrous Material > 75%





## Pinchin Ltd. Asbestos Laboratory

### *q AnaxpNa y dVTN Qa ca*

**Project Name:** Collingwood Marine & General Hospital  
**Project No.:** 0232739.000  
**Prepared For:** B. Young / L. Cantar

**Lab Reference No.:** b202933  
**Date Analyzed:** January 23, 2019

### BULK SAMPLE ANALYSIS

SAMPLE IDENTIFICATION	SAMPLE DESCRIPTION	% COMPOSITION (VISUAL ESTIMATE)	
		ASBESTOS	OTHER
0013C Vinyl sheet flooring, Brown mottled - Basement, Maintenance	2 Phases: a) Homogeneous, beige, woven, fibrous material on the back of vinyl sheet flooring.	None Detected	Cellulose > 75% Non-Fibrous Material 0.5-5%
	b) Homogeneous, yellow, adhesive material.	None Detected	Non-Fibrous Material > 75%
0014A Plaster, wall - Basement, Room B30, Fire Alarm Control Centre	2 Phases: a) Homogeneous, grey, hard, cementitious, plaster base coat.	None Detected	Non-Fibrous Material > 75%
	b) Homogeneous, white, hard, cementitious, plaster top coat.	None Detected	Non-Fibrous Material > 75%
0014B Plaster, wall - Basement, Kitchen	2 Phases: a) Homogeneous, off-white, drywall joint compound.	None Detected	Non-Fibrous Material > 75%
	b) Homogeneous, white, drywall joint compound.	None Detected	Non-Fibrous Material > 75%
0014C Plaster, wall - 1st Floor, Washroom	2 Phases: a) Homogeneous, grey, hard, cementitious, plaster base coat.	None Detected	Non-Fibrous Material > 75%
	b) Homogeneous, white, hard, cementitious, plaster top coat.	None Detected	Non-Fibrous Material > 75%



## Pinchin Ltd. Asbestos Laboratory

### q AnaxtpNoA y dVTN Qaga

**Project Name:** Collingwood Marine & General Hospital  
**Project No.:** 0232739.000  
**Prepared For:** B. Young / L. Cantar

**Lab Reference No.:** b202933  
**Date Analyzed:** January 23, 2019

### BULK SAMPLE ANALYSIS

SAMPLE IDENTIFICATION	SAMPLE DESCRIPTION	% COMPOSITION (VISUAL ESTIMATE)	
		ASBESTOS	OTHER
0014D Plaster, wall - 1st Floor, Corridor	4 Phases:		
	a) Homogeneous, grey, hard, cementitious, plaster base coat.	None Detected	Non-Fibrous Material > 75%
	b) Homogeneous, white, hard, cementitious, plaster top coat.	None Detected	Non-Fibrous Material > 75%
	c) Homogeneous, white, drywall joint compound.	None Detected	Cellulose 0.5-5% Non-Fibrous Material > 75%
	d) Homogeneous, white, drywall joint compound.	None Detected	Non-Fibrous Material > 75%
Comments:	Phase d) is small in size.		
0014E Plaster, wall - 2nd Floor, Stair	2 Phases:		
	a) Homogeneous, grey, hard, cementitious, plaster base coat.	None Detected	Non-Fibrous Material > 75%
	b) Homogeneous, white, hard, cementitious, plaster top coat.	None Detected	Non-Fibrous Material > 75%
Comments:	Phase a) is small in size. For more reliable results, a larger sample is required.		
0014F Plaster, wall - 2nd Floor, East Wing, Shower Room	2 Phases:		
	a) Homogeneous, off-white, drywall joint compound.	None Detected	Non-Fibrous Material > 75%
	b) Homogeneous, white, drywall joint compound.	None Detected	Non-Fibrous Material > 75%
Comments:	Another phase is present but there was insufficient material submitted to analyze. Man-made vitreous fibres are present on the surface of this sample.		



## Pinchin Ltd. Asbestos Laboratory

### *q AnaxtpNoA ydVTN.OaCa*

**Project Name:** Collingwood Marine & General Hospital  
**Project No.:** 0232739.000  
**Prepared For:** B. Young / L. Cantar

**Lab Reference No.:** b202933  
**Date Analyzed:** January 23, 2019

### BULK SAMPLE ANALYSIS

SAMPLE IDENTIFICATION	SAMPLE DESCRIPTION	% COMPOSITION (VISUAL ESTIMATE)	
		ASBESTOS	OTHER
0014G Plaster, wall - Basement, Stair	2 Phases: a) Homogeneous, grey, hard, cementitious, plaster base coat.	None Detected	Non-Fibrous Material > 75%
	b) Homogeneous, white, hard, cementitious, plaster top coat.	None Detected	Non-Fibrous Material > 75%
0015A Vinyl sheet flooring, Beige - Basement, Endoscopy	2 Phases: a) Homogeneous, beige, consolidated, flooring material.	None Detected	Non-Fibrous Material > 75%
	b) Homogeneous, yellow, adhesive material.	None Detected	Non-Fibrous Material > 75%
0015B Vinyl sheet flooring, Beige - Basement, Endoscopy	2 Phases: a) Homogeneous, beige, consolidated, flooring material.	None Detected	Non-Fibrous Material > 75%
	b) Homogeneous, yellow, adhesive material.	None Detected	Non-Fibrous Material > 75%
0015C Vinyl sheet flooring, Beige - Basement, Endoscopy	2 Phases: a) Homogeneous, beige, consolidated, flooring material.	None Detected	Non-Fibrous Material > 75%
	b) Homogeneous, yellow, adhesive material.	None Detected	Non-Fibrous Material > 75%
0016A Vinyl sheet flooring, Speckled No-skid - Basement, Decontamination Room	2 Phases: a) Homogeneous, white, consolidated, fibrous material on the back of vinyl sheet flooring.	None Detected	Cellulose 25-50% Man-made Vitreous Fibres 5-10% Synthetic Fibres 25-50% Non-Fibrous Material 10-25%
	b) Homogeneous, yellow, adhesive material.	None Detected	Non-Fibrous Material > 75%





## Pinchin Ltd. Asbestos Laboratory

### *q AnaxtpNoA y dVTN.OaCa*

**Project Name:** Collingwood Marine & General Hospital  
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**Lab Reference No.:** b202933  
**Date Analyzed:** January 23, 2019

### BULK SAMPLE ANALYSIS

SAMPLE IDENTIFICATION	SAMPLE DESCRIPTION	% COMPOSITION (VISUAL ESTIMATE)	
		ASBESTOS	OTHER
0016B Vinyl sheet flooring, Speckled No-skid - Basement, Decontamination Room	2 Phases: a) Homogeneous, white, consolidated, fibrous material on the back of vinyl sheet flooring.	None Detected	Cellulose 25-50% Man-made Vitreous Fibres 5-10% Synthetic Fibres 25-50% Non-Fibrous Material 10-25%
	b) Homogeneous, yellow, adhesive material.	None Detected	Non-Fibrous Material > 75%
0016C Vinyl sheet flooring, Speckled No-skid - Basement, Decontamination Room	2 Phases: a) Homogeneous, white, consolidated, fibrous material on the back of vinyl sheet flooring.	None Detected	Cellulose 25-50% Man-made Vitreous Fibres 5-10% Synthetic Fibres 25-50% Non-Fibrous Material 10-25%
	b) Homogeneous, yellow, adhesive material.	None Detected	Non-Fibrous Material > 75%
0017A Vinyl sheet flooring, Grey stripes - Basement, Room 161, Infection Control Co- ordinator	2 Phases: a) Homogeneous, grey, consolidated, flooring material.	None Detected	Non-Fibrous Material > 75%
	b) Homogeneous, yellow, adhesive material.	None Detected	Non-Fibrous Material > 75%
0017B Vinyl sheet flooring, Grey stripes - Basement, Room 161, Infection Control Co- ordinator	3 Phases: a) Homogeneous, grey, consolidated, flooring material.	None Detected	Non-Fibrous Material > 75%
	b) Homogeneous, yellow, adhesive material.	None Detected	Non-Fibrous Material > 75%
	c) Homogeneous, grey, soft, cementitious material.	None Detected	Cellulose 0.5-5% Non-Fibrous Material > 75%



## Pinchin Ltd. Asbestos Laboratory

### q AnaxtpNoA y dVTN Qaga

**Project Name:** Collingwood Marine & General Hospital  
**Project No.:** 0232739.000  
**Prepared For:** B. Young / L. Cantar

**Lab Reference No.:** b202933  
**Date Analyzed:** January 23, 2019

### BULK SAMPLE ANALYSIS

SAMPLE IDENTIFICATION	SAMPLE DESCRIPTION	% COMPOSITION (VISUAL ESTIMATE)	
		ASBESTOS	OTHER
0017C Vinyl sheet flooring, Grey stripes - Basement, Room 161, Infection Control Co-ordinator	3 Phases:		
	a) Homogeneous, grey, consolidated, flooring material.	None Detected	Non-Fibrous Material > 75%
	b) Homogeneous, yellow, adhesive material.	None Detected	Non-Fibrous Material > 75%
	c) Homogeneous, grey, soft, cementitious material.	None Detected	Cellulose 0.5-5% Non-Fibrous Material > 75%
0018A Vinyl sheet flooring, Green w/black specks, No skid - Basement, Kitchen	3 Phases:		
	a) Homogeneous, green, consolidated, fibrous material on the back of vinyl sheet flooring.	None Detected	Cellulose 50-75% Man-made Vitreous Fibres 5-10% Synthetic Fibres 10-25% Non-Fibrous Material 10-25%
	b) Homogeneous, pale yellow, soft, sticky material on the back of vinyl flooring.	None Detected	Non-Fibrous Material > 75%
	c) Homogeneous, grey, soft, cementitious material.	None Detected	Non-Fibrous Material > 75%
0018B Vinyl sheet flooring, Green w/black specks, No skid - Basement, Kitchen	2 Phases:		
	a) Homogeneous, green, consolidated, fibrous material on the back of vinyl sheet flooring.	None Detected	Cellulose 50-75% Man-made Vitreous Fibres 5-10% Synthetic Fibres 10-25% Non-Fibrous Material 10-25%
	b) Non-homogeneous, pale yellow and grey, soft, sticky material on the back of vinyl flooring.	None Detected	Non-Fibrous Material > 75%



## Pinchin Ltd. Asbestos Laboratory

### *q AnaxpNa y dVTN QaCa*

**Project Name:** Collingwood Marine & General Hospital  
**Project No.:** 0232739.000  
**Prepared For:** B. Young / L. Cantar

**Lab Reference No.:** b202933  
**Date Analyzed:** January 23, 2019

### BULK SAMPLE ANALYSIS

SAMPLE IDENTIFICATION	SAMPLE DESCRIPTION	% COMPOSITION (VISUAL ESTIMATE)	
		ASBESTOS	OTHER
0018C Vinyl sheet flooring, Green w/black specks, No-skid - Basement, Kitchen	2 Phases: a) Homogeneous, green, consolidated, fibrous material on the back of vinyl sheet flooring.	None Detected	Cellulose 10-25% Man-made Vitreous Fibres 5-10% Synthetic Fibres 50-75% Non-Fibrous Material 10-25%
	b) Non-homogeneous, pale yellow and grey, soft, sticky material on the back of vinyl floor tile.	None Detected	Non-Fibrous Material > 75%
Comments:	Phase b) is small in size.		
0019A Vinyl sheet flooring, Pink w/black specks, No-skid - Basement, Laundry	2 Phases: a) Homogeneous, pink, consolidated, fibrous material on the back of vinyl sheet flooring.	None Detected	Cellulose 50-75% Man-made Vitreous Fibres 5-10% Synthetic Fibres 10-25% Non-Fibrous Material 10-25%
	b) Homogeneous, yellow, soft, sticky material on the back of vinyl flooring.	None Detected	Non-Fibrous Material > 75%
0019B Vinyl sheet flooring, Pink w/black specks, No-skid - Basement, Laundry	2 Phases: a) Homogeneous, pink, consolidated, fibrous material on the back of vinyl sheet flooring.	None Detected	Cellulose 50-75% Man-made Vitreous Fibres 5-10% Synthetic Fibres 10-25% Non-Fibrous Material 10-25%
	b) Homogeneous, yellow, soft, sticky material on the back of vinyl flooring.	None Detected	Non-Fibrous Material > 75%



**Pinchin Ltd. Asbestos Laboratory**  
**q AnactpNa y dVTNtQaCa**

**Project Name:** Collingwood Marine & General Hospital  
**Project No.:** 0232739.000  
**Prepared For:** B. Young / L. Cantar


**Lab Reference No.:** b202933  
**Date Analyzed:** January 23, 2019


**BULK SAMPLE ANALYSIS**

SAMPLE IDENTIFICATION	SAMPLE DESCRIPTION	% COMPOSITION (VISUAL ESTIMATE)	
		ASBESTOS	OTHER
0019C Vinyl sheet flooring, Pink w/black specks, No-skid - Basement, Laundry	2 Phases: a) Homogeneous, pink, consolidated, fibrous material on the back of vinyl sheet flooring.	None Detected	Cellulose 50-75% Man-made Vitreous Fibres 5-10% Synthetic Fibres 10-25% Non-Fibrous Material 10-25%
	b) Homogeneous, yellow, soft, sticky material on the back of vinyl flooring.	None Detected	Non-Fibrous Material > 75%

**Reviewed by:**

**Reporting Analyst:**

  
Digitally signed by  
Julieth Oran  
Date: 2019.01.23  
17:16:08 -05'00'

  
Digitally signed by  
Julieth Oran  
Date: 2019.01.23  
17:15:57 -05'00'

ON Hold Jan 14/19 - OFF Hold Jan. 16/19

Analyzed by: *[Signature]*

Reviewed by: *[Signature]*

Report Sent by: *[Signature]*

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**Special Instructions:**

**Pinchin Ltd. - Asbestos Laboratory  
Internal Asbestos Bulk Sample Chain of Custody**

<b>Client Name:</b>	Collingwood Marine & General Hospital	<b>Project Address:</b>	459 Hume Street, Collingwood, Ontario
<b>Portfolio/Building No:</b>		<b>Pinchin File:</b>	232739
<b>Submitted by:</b>	B. Young	<b>Email:</b>	
<b>CC Results to:</b>	L. Cantar	<b>CC Email:</b>	
<b>Invoice to:</b>		<b>Invoice Email:</b>	
<b>Date Submitted:</b>	January 8 2019	<b>Required by:</b>	January 15 2019
<b># of Samples:</b>	55 28	<b>Priority:</b>	5 Day Turnaround
<b>Year of Building Construction (Mandatory Field):</b>	1950		
<b>Do NOT Stop on Positive (Sample Numbers):</b>	0014A to 0014G		
<b>Pinchin Group Company (Mandatory Field):</b>	Pinchin		

To be Completed by Lab Personnel Only:			
<b>Lab Reference #:</b>	b202933		<b>Time:</b> 24 hour clock
<b>Received by:</b>	JAN 08 2019 <i>[Signature]</i>		<b>Date:</b> Month Day Year
<b>Name(s) of Analyst(s):</b>	J. Macgillivray / C. Wong JAN. 23, 2019		
Sample Prefix	Sample No.	Sample Suffix	Sample Description/Location (Mandatory)
	0012	A	Parging cement on flanges of Heat Exchanger - Basement, Boiler Room, Mezzanine <i>ND</i>
	0012	B	Parging cement on flanges of Heat Exchanger - Basement, Boiler Room, Mezzanine <i>ND</i>
	0012	C	Parging cement on flanges of Heat Exchanger - Basement, Boiler Room, Mezzanine <i>ND</i>
	0013	A	Vinyl sheet flooring, Brown mottled - Basement, Maintenance <i>2.5ND 5.5ND</i>
	0013	B	Vinyl sheet flooring, Brown mottled - Basement, Maintenance <i>2.5ND 5.5ND</i>
	0013	C	Vinyl sheet flooring, Brown mottled - Basement, Maintenance <i>2.5ND 5.5ND</i>

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Sample Prefix	Sample No.	Sample Suffix	Sample Description/Location (Mandatory)
	0014	A	Plaster, wall - Basement, Room B30, Fire Alarm Control Centre a.) NID b.) NID
	0014	B	Plaster, wall - Basement, Kitchen a.) NID b.) NID
	0014	C	Plaster, wall - 1st Floor, Washroom a.) NID b.) NID
	0014	D	Plaster, wall - 1st Floor, Corridor a.) NID b.) NID c.) NID d.) NID
	0014	E	Plaster, wall - 2nd Floor, Stair a.) NID b.) NID
	0014	F	Plaster, wall - 2nd Floor, East Wing, Shower Room a.) NID b.) NID
	0014	G	Plaster, wall - Basement, Stair a.) NID b.) NID
	0015	A	Vinyl sheet flooring, Beige - Basement, Endoscopy a.) NID b.) NID
	0015	B	Vinyl sheet flooring, Beige - Basement, Endoscopy a.) NID b.) NID
	0015	C	Vinyl sheet flooring, Beige - Basement, Endoscopy a.) NID b.) NID
	0016	A	Vinyl sheet flooring, Speckled No-skid - Basement, Decontamination Room a.) NID b.) NID
	0016	B	Vinyl sheet flooring, Speckled No-skid - Basement, Decontamination Room a.) NID b.) NID
	0016	C	Vinyl sheet flooring, Speckled No-skid - Basement, Decontamination Room a.) NID b.) NID
	0017	A	Vinyl sheet flooring, Grey stripes - Basement, Room 161, Infection Control Coordinator a.) NID b.) NID
	0017	B	Vinyl sheet flooring, Grey stripes - Basement, Room 161, Infection Control Coordinator a.) NID b.) NID c.) NID
	0017	C	Vinyl sheet flooring, Grey stripes - Basement, Room 161, Infection Control Coordinator a.) NID b.) NID c.) NID

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Sample Prefix	Sample No.	Sample Suffix	Sample Description/Location (Mandatory)
	0018	A	Vinyl sheet flooring, Green w/black specks, No-skid - Basement, Kitchen a) ND b) ND c) ND
	0018	B	Vinyl sheet flooring, Green w/black specks, No-skid - Basement, Kitchen a) ND b) ND
	0018	C	Vinyl sheet flooring, Green w/black specks, No-skid - Basement, Kitchen a) ND b) ND
	0019	A	Vinyl sheet flooring, Pink w/black specks, No-skid - Basement, Laundry a) ND b) ND
	0019	B	Vinyl sheet flooring, Pink w/black specks, No-skid - Basement, Laundry a) ND b) ND
	0019	C	Vinyl sheet flooring, Pink w/black specks, No-skid - Basement, Laundry a) ND b) ND
	0020	A	Vinyl sheet flooring, Pink w/black specks, No-skid - Basement, Laundry
	0020	B	Vinyl sheet flooring, Pink w/black specks, No-skid - Basement, Laundry
	0020	C	Vinyl sheet flooring, Pink w/black specks, No-skid - Basement, Laundry
	0021	A	Vinyl sheet flooring, Blue w/white dots - Basement, Dishwashing
	0021	B	Vinyl sheet flooring, Blue w/white dots - Basement, Dishwashing
	0021	C	Vinyl sheet flooring, Blue w/white dots - Basement, Dishwashing
	0022	A	Vinyl sheet flooring, Pink w/small shapes - Basement, Lab
	0022	B	Vinyl sheet flooring, Pink w/small shapes - Basement, Lab
	0022	C	Vinyl sheet flooring, Pink w/small shapes - Basement, Lab
	0023	A	Vinyl sheet flooring, Pink/blue - 1st Floor, Office

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<b>Project Name:</b>	<b>Collingwood Marine &amp; General Hospital</b>		
	<b>459 Hume Street, Collingwood, Ontario</b>		
<b>Project No.:</b>	<b>0232739.000</b>		
<b>Prepared For:</b>	<b>B. Young / L. Cantar</b>	<b>Date Received:</b>	<b>January 8, 2019</b>
<b>Lab Reference No.:</b>	<b>b202934</b>	<b>Date Analyzed:</b>	<b>January 23, 2019</b>
<b>Analyst(s):</b>	<b>T. Tran / L. DeCurtis</b>	<b># Samples submitted:</b>	<b>27</b>
		<b># Phases analyzed:</b>	<b>64</b>

**EPA 600/R-93/116 - Method for the Determination of Asbestos in Bulk Building Materials dated July, 1993**

Bulk samples are checked visually and scanned under a stereomicroscope. Slides are prepared and observed under a Polarized Light Microscope (PLM) at magnifications of 40X, 100X or 400X as appropriate. Asbestos fibres are identified by a combination of morphology, colour, refractive index, extinction, sign of elongation, birefringence and dispersion staining colours. A visual estimate is made of the percentage of asbestos present. A reported concentration of less than (<) the regulatory threshold (see chart below) indicates the presence of confirmed asbestos in trace quantities, limited to only a few fibres or fibre bundles in an entire sample. This method complies with provincial regulatory requirements where applicable. Multiple phases within a sample are analyzed and reported separately.

Provincial Jurisdiction	Regulatory Threshold	Provincial Jurisdiction	Regulatory Threshold
Ontario, British Columbia, Nova Scotia	0.5%	Alberta	Undefined
Quebec	0.1%	Saskatchewan	0.5% friable 1% non-friable
PEI, NWT, Yukon, Nunavut, Newfoundland and Labrador, and New Brunswick	1%	Manitoba	0.1% friable 1% non-friable

All bulk samples submitted to this laboratory for asbestos analysis are retained for a minimum of three months. Samples may be retrieved, upon request, for re-examination at any time during that period.

Pinchin Ltd. is accredited by the National Institute of Standards and Technology, National Voluntary Laboratory Accreditation Program (NVLAP Lab Code 101270-0) for the 'EPA-600/M4-82-020: Interim Method for the Determination of Asbestos in Bulk Insulation Samples,' and the 'EPA 600/R-93/116: Method for the Determination of Asbestos in Bulk Building Materials'; and meets all requirements of ISO/IEC 17025:2005.

This report relates only to the items tested.

Certi rfa aAonAI yros NOTyoEAnI ry: hpa: nAbpAI oC dhuw df yhoC d, naAT NI nyxNuydf A uNEyrNgrOvr f ApuATos NOTyoaA d a nAI yroq puNs I ry: hpo AT: yraAs AToEOCv. VL ynNTONPATpOydd AgWuSyxAnTs ATovrf a nAI yroa xNc yTuD, f AT a dPTA: d EuhA dGEO d ANTNDaow d QunEAaAga dyynwAa pyTdNc xAo dTA dEnAa ydNEAaAga NT: s NOEAs aAa: EOAs A uNEyrNgrOa ha dP d AL. k s Ad y: wIToAnT NuxArpNoyT ad: aA I Anrys A: EOL d pf d d: qnAo d Nod Apf NTPAyds aadTP NAaAga d dyynwAa a Ty f dP ANd NT Nhyol 2 wrf Ax dQuwAa d: ONT: uNEyrNgrO: yphs AT dNoyT yT s ANahnAs ATo hTPANdC d a NkNEuAa hI vT nAaAaovrf ANTNDaA vd: haooNs I uA EOL. k pNTTvoEAaAa: Na NT d: wN: nnyvd Naovnl nAa AToNgrEvntA NAaAa a dEnA uAaAw





**Pinchin Ltd. Asbestos Laboratory**  
*q AnadpNoA ydVTN0a ca*

**Project Name:** Collingwood Marine & General Hospital  
 459 Hume Street, Collingwood, Ontario  
**Project No.:** 0232739.000  
**Prepared For:** B. Young / L. Cantar

**Lab Reference No.:** b202934  
**Date Analyzed:** January 23, 2019

**BULK SAMPLE ANALYSIS**

SAMPLE IDENTIFICATION	SAMPLE DESCRIPTION	% COMPOSITION (VISUAL ESTIMATE)	
		ASBESTOS	OTHER
0020A Vinyl sheet flooring, Pink w/black specks, No-skid - Basement, Laundry	3 Phases:		
	a) Homogeneous, beige, consolidated material.	None Detected	Non-Fibrous Material > 75%
	b) Homogeneous, pale yellow, soft, sticky material.	None Detected	Non-Fibrous Material > 75%
0020B Vinyl sheet flooring, Pink w/black specks, No-skid - Basement, Laundry	c) Homogeneous, off- white, consolidated, fibrous material.	None Detected	Cellulose > 75% Synthetic Fibres 0.5-5% Man-made Vitreous 0.5-5% Fibres Non-Fibrous Material 1-5%
	2 Phases:		
	a) Homogeneous, beige, consolidated material.	None Detected	Non-Fibrous Material > 75%
0020C Vinyl sheet flooring, Pink w/black specks, No-skid - Basement, Laundry	b) Homogeneous, pale yellow, soft, sticky material.	None Detected	Non-Fibrous Material > 75%
	Homogeneous, beige, consolidated material.	None Detected	Non-Fibrous Material > 75%
Comments:	Adhesive phase is present but there was insufficient material submitted to analyze.		



## Pinchin Ltd. Asbestos Laboratory

### *q AnadpNoA ydVTN0a ca*

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**Project No.:** 0232739.000  
**Prepared For:** B. Young / L. Cantar

**Lab Reference No.:** b202934  
**Date Analyzed:** January 23, 2019

### BULK SAMPLE ANALYSIS

SAMPLE IDENTIFICATION	SAMPLE DESCRIPTION	% COMPOSITION (VISUAL ESTIMATE)	
		ASBESTOS	OTHER
0021A Vinyl sheet flooring, Blue w/white dots - Basement, Dishwashing	Homogeneous, off-white, woven, fibrous material on the back of vinyl sheet flooring.	None Detected	Cellulose 10-25% Synthetic Fibres 50-75% Man-made Vitreous Fibres 5-10% Non-Fibrous Material 5-10%
Comments:	There was no mastic in this sample to be analyzed.		
0021B Vinyl sheet flooring, Blue w/white dots - Basement, Dishwashing	2 Phases: a) Homogeneous, off-white, woven, fibrous material on the back of vinyl sheet flooring.	None Detected	Cellulose 10-25% Synthetic Fibres 50-75% Man-made Vitreous Fibres 5-10% Non-Fibrous Material 5-10%
	b) Homogeneous, pale yellow, soft, sticky material.	None Detected	Non-Fibrous Material > 75%
0021C Vinyl sheet flooring, Blue w/white dots - Basement, Dishwashing	2 Phases: a) Homogeneous, off-white, woven, fibrous material on the back of vinyl sheet flooring.	None Detected	Cellulose 10-25% Synthetic Fibres 50-75% Man-made Vitreous Fibres 5-10% Non-Fibrous Material 5-10%
	b) Homogeneous, pale yellow, soft, sticky material.	None Detected	Non-Fibrous Material > 75%
Comments:	Phase b) is small in size. For more reliable results, a larger sample is required.		



**Pinchin Ltd. Asbestos Laboratory**  
*q AnadpNoA ydVTN0a ca*

**Project Name:** Collingwood Marine & General Hospital  
 459 Hume Street, Collingwood, Ontario  
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**Prepared For:** B. Young / L. Cantar

**Lab Reference No.:** b202934  
**Date Analyzed:** January 23, 2019

**BULK SAMPLE ANALYSIS**

SAMPLE IDENTIFICATION	SAMPLE DESCRIPTION	% COMPOSITION (VISUAL ESTIMATE)	
		ASBESTOS	OTHER
0022A Vinyl sheet flooring, Pink w/small shapes - Basement, Lab	2 Phases: a) Homogeneous, off- white, consolidated, fibrous material on the back of vinyl sheet flooring.	None Detected	Cellulose > 75% Non-Fibrous Material 10-25%
	b) Homogeneous, yellow, soft, sticky material.	None Detected	Non-Fibrous Material > 75%
0022B Vinyl sheet flooring, Pink w/small shapes - Basement, Lab	2 Phases: a) Homogeneous, off- white, consolidated, fibrous material on the back of vinyl sheet flooring.	None Detected	Cellulose > 75% Non-Fibrous Material 10-25%
	b) Homogeneous, yellow, soft, sticky material.	None Detected	Non-Fibrous Material > 75%
0022C Vinyl sheet flooring, Pink w/small shapes - Basement, Lab	2 Phases: a) Homogeneous, off- white, consolidated, fibrous material on the back of vinyl sheet flooring.	None Detected	Cellulose > 75% Non-Fibrous Material 10-25%
	b) Homogeneous, yellow, soft, sticky material.	None Detected	Non-Fibrous Material > 75%



**Pinchin Ltd. Asbestos Laboratory**  
**q AnadpNoA ydVTN0a ca**

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459 Hume Street, Collingwood, Ontario  
**Project No.:** 0232739.000  
**Prepared For:** B. Young / L. Cantar

**Lab Reference No.:** b202934  
**Date Analyzed:** January 23, 2019

**BULK SAMPLE ANALYSIS**

SAMPLE IDENTIFICATION	SAMPLE DESCRIPTION	% COMPOSITION (VISUAL ESTIMATE)	
		ASBESTOS	OTHER
0023A Vinyl sheet flooring, Pink/blue - 1st Floor, Office	3 Phases: a) Homogeneous, beige, consolidated material.	None Detected	Non-Fibrous Material > 75%
	b) Homogeneous, yellow, soft, mastic material.	None Detected	Non-Fibrous Material > 75%
	c) Non-homogeneous, colourless and black, adhesive material.	None Detected	Tar and other non- fibrous > 75%
Comments:	Phase c) is small in size.		
0023B Vinyl sheet flooring, Pink/blue - 1st Floor, Office	3 Phases: a) Homogeneous, beige, consolidated material.	None Detected	Non-Fibrous Material > 75%
	b) Homogeneous, yellow, soft, mastic material.	None Detected	Non-Fibrous Material > 75%
	c) Homogeneous, beige, soft, rubbery, consolidated material.	None Detected	Non-Fibrous Material > 75%



**Pinchin Ltd. Asbestos Laboratory**  
*q AnadpNoA ydVTN0a ca*

**Project Name:** Collingwood Marine & General Hospital  
 459 Hume Street, Collingwood, Ontario  
**Project No.:** 0232739.000  
**Prepared For:** B. Young / L. Cantar

**Lab Reference No.:** b202934  
**Date Analyzed:** January 23, 2019

**BULK SAMPLE ANALYSIS**

SAMPLE IDENTIFICATION	SAMPLE DESCRIPTION	% COMPOSITION (VISUAL ESTIMATE)	
		ASBESTOS	OTHER
0023C Vinyl sheet flooring, Pink/blue - 1st Floor, Office	3 Phases: a) Homogeneous, beige, consolidated material.	None Detected	Non-Fibrous Material > 75%
	b) Homogeneous, yellow, soft, mastic material.	None Detected	Non-Fibrous Material > 75%
	c) Non-homogeneous, colourless and grey, hard, adhesive and cementitious material.	None Detected	Non-Fibrous Material > 75%
0024A Vinyl sheet flooring, Grey - 1st Floor, X-Ray Office	3 Phases: a) Homogeneous, grey, soft, consolidated material.	None Detected	Man-made Vitreous Fibres 0.5-5% Non-Fibrous Material > 75%
	b) Homogeneous, yellow, soft, sticky material.	None Detected	Non-Fibrous Material > 75%
	c) Homogeneous, grey, levelling compound.	None Detected	Cellulose < 0.5% Non-Fibrous Material > 75%



**Pinchin Ltd. Asbestos Laboratory**  
*q AnadpNoA ydVTN0a ca*

**Project Name:** Collingwood Marine & General Hospital  
 459 Hume Street, Collingwood, Ontario  
**Project No.:** 0232739.000  
**Prepared For:** B. Young / L. Cantar

**Lab Reference No.:** b202934  
**Date Analyzed:** January 23, 2019

**BULK SAMPLE ANALYSIS**

SAMPLE IDENTIFICATION	SAMPLE DESCRIPTION	% COMPOSITION (VISUAL ESTIMATE)	
		ASBESTOS	OTHER
0024B Vinyl sheet flooring, Grey - 1st Floor, X-Ray Office	3 Phases: a) Homogeneous, grey, soft, consolidated material.	None Detected	Man-made Vitreous Fibres 0.5-5% Non-Fibrous Material > 75%
	b) Homogeneous, yellow, soft, sticky material.	None Detected	Non-Fibrous Material > 75%
	c) Homogeneous, grey, levelling compound.	None Detected	Cellulose < 0.5% Non-Fibrous Material > 75%
0024C Vinyl sheet flooring, Grey - 1st Floor, X-Ray Office	4 Phases: a) Homogeneous, grey, soft, consolidated material.	None Detected	Man-made Vitreous Fibres 0.5-5% Non-Fibrous Material > 75%
	b) Homogeneous, yellow, soft, sticky material.	None Detected	Non-Fibrous Material > 75%
	c) Non-homogeneous, grey and off-white, levelling compound.	None Detected	Cellulose < 0.5% Non-Fibrous Material > 75%
	d) Non-homogeneous, black, granular, cementitious material.	Chrysotile 0.5-5%	Tar and other non-fibrous > 75%



**Pinchin Ltd. Asbestos Laboratory**  
*q AnadpNoA ydVTN.Oa ca*

**Project Name:** Collingwood Marine & General Hospital  
**459 Hume Street, Collingwood, Ontario**  
**Project No.:** 0232739.000  
**Prepared For:** B. Young / L. Cantar

**Lab Reference No.:** b202934  
**Date Analyzed:** January 23, 2019

**BULK SAMPLE ANALYSIS**

SAMPLE IDENTIFICATION	SAMPLE DESCRIPTION	% COMPOSITION (VISUAL ESTIMATE)	
		ASBESTOS	OTHER
0025A Vinyl sheet flooring, Grey - 1st Floor, X-Ray Office	2 Phases:		
	a) Homogeneous, grey, consolidated material.	None Detected	Non-Fibrous Material > 75%
	b) Homogeneous, yellow, soft, sticky material.	None Detected	Non-Fibrous Material > 75%
0025B Vinyl sheet flooring, Grey - 1st Floor, X-Ray Office	2 Phases:		
	a) Homogeneous, grey, consolidated material.	None Detected	Non-Fibrous Material > 75%
	b) Homogeneous, yellow, soft, sticky material.	None Detected	Non-Fibrous Material > 75%
0025C Vinyl sheet flooring, Grey - 1st Floor, X-Ray Office	Homogeneous, grey, consolidated material.	None Detected	Non-Fibrous Material > 75%
Comments:		There was no mastic in this sample to be analyzed.	
0026A Vinyl sheet flooring, Reddish mottled - 1st Floor, Ambulatory Care Waiting Room	2 Phases:		
	a) Homogeneous, tan, woven material on the back of vinyl sheet flooring.	None Detected	Cellulose > 75% Non-Fibrous Material 0.5-5%
	b) Homogeneous, brown, soft, sticky material on the back of vinyl sheet flooring.	None Detected	Non-Fibrous Material > 75%



**Pinchin Ltd. Asbestos Laboratory**  
*q AnadpNoA ydVTN0a ca*

**Project Name:** Collingwood Marine & General Hospital  
**459 Hume Street, Collingwood, Ontario**  
**Project No.:** 0232739.000  
**Prepared For:** B. Young / L. Cantar

**Lab Reference No.:** b202934  
**Date Analyzed:** January 23, 2019

**BULK SAMPLE ANALYSIS**

SAMPLE IDENTIFICATION	SAMPLE DESCRIPTION	% COMPOSITION (VISUAL ESTIMATE)	
		ASBESTOS	OTHER
0026B Vinyl sheet flooring, Reddish mottled - 1st Floor, Ambulatory Care Waiting Room	2 Phases: a) Homogeneous, tan, woven material on the back of vinyl sheet flooring. b) Homogeneous, brown, soft, sticky material on the back of vinyl sheet flooring.	None Detected  None Detected	Cellulose > 75% Non-Fibrous Material 0.5-5%  Non-Fibrous Material > 75%
0026C Vinyl sheet flooring, Reddish mottled - 1st Floor, Ambulatory Care Waiting Room	Homogeneous, tan, woven material on the back of vinyl sheet flooring.	None Detected	Cellulose > 75% Non-Fibrous Material 0.5-5%
0027A Vinyl sheet flooring, Light Blue mottled - 1st Floor, CT Scan, Corridor	2 Phases: a) Homogeneous, tan, woven material on the back of vinyl sheet flooring. b) Homogeneous, yellow, soft, sticky material on the back of vinyl sheet flooring.	None Detected  None Detected	Cellulose > 75% Non-Fibrous Material 0.5-5%  Non-Fibrous Material > 75%
Comments:	Phase b) is small in size.		
0027B Vinyl sheet flooring, Light Blue mottled - 1st Floor, CT Scan, Corridor	2 Phases: a) Homogeneous, tan, woven material on the back of vinyl sheet flooring. b) Homogeneous, yellow, soft, sticky material on the back of vinyl sheet flooring.	None Detected  None Detected	Cellulose > 75% Non-Fibrous Material 0.5-5%  Non-Fibrous Material > 75%
Comments:	Phase b) is small in size.		





**Pinchin Ltd. Asbestos Laboratory**  
*q AnadpNoA ydVTN0a ca*

**Project Name:** Collingwood Marine & General Hospital  
 459 Hume Street, Collingwood, Ontario  
**Project No.:** 0232739.000  
**Prepared For:** B. Young / L. Cantar

**Lab Reference No.:** b202934  
**Date Analyzed:** January 23, 2019

**BULK SAMPLE ANALYSIS**

SAMPLE IDENTIFICATION	SAMPLE DESCRIPTION	% COMPOSITION (VISUAL ESTIMATE)	
		ASBESTOS	OTHER
0027C Vinyl sheet flooring, Light Blue mottled - 1st Floor, CT Scan, Corridor	2 Phases: a) Homogeneous, tan, woven material on the back of vinyl sheet flooring.	None Detected	Cellulose > 75% Non-Fibrous Material 0.5-5%
	b) Homogeneous, yellow, soft, sticky material on the back of vinyl sheet flooring.	None Detected	Non-Fibrous Material > 75%
0028A Vinyl sheet flooring, Green mottled - 1st Floor, Elevator Lobby	4 Phases: a) Homogeneous, tan, woven material on the back of vinyl sheet flooring.	None Detected	Cellulose > 75% Non-Fibrous Material 0.5-5%
	b) Homogeneous, yellow, soft, sticky material on the back of vinyl sheet flooring.	None Detected	Non-Fibrous Material > 75%
	c) Homogeneous, white, soft, cementitious material.	None Detected	Non-Fibrous Material > 75%
	d) Homogeneous, green, rubbery material.	None Detected	Non-Fibrous Material > 75%
Comments:	Another phase is present but there was insufficient material submitted to analyze.		



**Pinchin Ltd. Asbestos Laboratory**  
*q AnadpNoA ydVTN.Oa ca*

**Project Name:** Collingwood Marine & General Hospital  
**459 Hume Street, Collingwood, Ontario**  
**Project No.:** 0232739.000  
**Prepared For:** B. Young / L. Cantar


**Lab Reference No.:** b202934  
**Date Analyzed:** January 23, 2019

**BULK SAMPLE ANALYSIS**

SAMPLE IDENTIFICATION	SAMPLE DESCRIPTION	% COMPOSITION (VISUAL ESTIMATE)	
		ASBESTOS	OTHER
0028B Vinyl sheet flooring, Green mottled - 1st Floor, Elevator Lobby	4 Phases:		
	a) Homogeneous, tan, woven material on the back of vinyl sheet flooring.	None Detected	Cellulose > 75% Non-Fibrous Material 0.5-5%
	b) Homogeneous, yellow, soft, sticky material on the back of vinyl sheet flooring.	None Detected	Non-Fibrous Material > 75%
	c) Homogeneous, white, soft, cementitious material.	None Detected	Non-Fibrous Material > 75%
	d) Homogeneous, green, rubbery material.	None Detected	Non-Fibrous Material > 75%
Comments:	Phase c) is small in size.		
0028C Vinyl sheet flooring, Green mottled - 1st Floor, Elevator Lobby	4 Phases:		
	a) Homogeneous, tan, woven material on the back of vinyl sheet flooring.	None Detected	Cellulose > 75% Non-Fibrous Material 0.5-5%
	b) Homogeneous, yellow, soft, sticky material on the back of vinyl sheet flooring.	None Detected	Non-Fibrous Material > 75%
	c) Homogeneous, white, soft, cementitious material.	None Detected	Non-Fibrous Material > 75%
	d) Homogeneous, green, rubbery material.	Chrysotile < 0.5%	Non-Fibrous Material > 75%
Comments:	Phase c) is small in size.		

**Reviewed by:**

**Reporting Analyst:**

 Digitally signed by  
 Julieth Oran  
 Date: 2019.01.23  
 17:17:40 -05'00'

 Digitally signed by  
 Julieth Oran  
 Date: 2019.01.23  
 17:17:29 -05'00'

ON Hold Jan. 14/19 - off Hold Jan 16, 2019

Analyzed by: [Signature]

Reviewed by: [Signature]

Report Sent by: [Signature]

**Special Instructions:**

**Pinchin Ltd. - Asbestos Laboratory  
Internal Asbestos Bulk Sample Chain of Custody**

<b>Client Name:</b>	Collingwood Marine & General Hospital	<b>Project Address:</b>	459 Hume Street, Collingwood, Ontario
<b>Portfolio/Building No:</b>		<b>Pinchin File:</b>	232739
<b>Submitted by:</b>	B. Young	<b>Email:</b>	
<b>CC Results to:</b>	L. Cantar	<b>CC Email:</b>	
<b>Invoice to:</b>		<b>Invoice Email:</b>	
<b>Date Submitted:</b>	January 8 2019	<b>Required by:</b>	January 15 2019
<b># of Samples:</b>	27	<b>Priority:</b>	5 Day Turnaround
<b>Year of Building Construction (Mandatory Field):</b>	1950		
<b>Do NOT Stop on Positive (Sample Numbers):</b>	0014A to 0014G		
<b>Pinchin Group Company (Mandatory Field):</b>	Pinchin		

**To be Completed by Lab Personnel Only:**

<b>Lab Reference #:</b>	b202934	<b>Time:</b>	24 hour clock		
<b>Received by:</b>	Jan 8, 2018 JR	<b>Date:</b>	Month	Day	Year
<b>Name(s) of Analyst(s):</b>	Ther / L.D. — Jan 23 2019				
Sample Prefix	Sample No.	Sample Suffix	Sample Description/Location (Mandatory)		
	0020	A	Vinyl sheet flooring, Pink w/black specks, No-skid - Basement, Laundry A) ND B) ND C) ND		
	0020	B	Vinyl sheet flooring, Pink w/black specks, No-skid - Basement, Laundry A) ND B) ND		
	0020	C	Vinyl sheet flooring, Pink w/black specks, No-skid - Basement, Laundry ND.		
	0021	A	Vinyl sheet flooring, Blue w/white dots - Basement, Dishwashing ND		
	0021	B	Vinyl sheet flooring, Blue w/white dots - Basement, Dishwashing A) ND B) ND		
	0021	C	Vinyl sheet flooring, Blue w/white dots - Basement, Dishwashing A) ND B) ND		

(11)

37

Page 2 of 3



6202934

Sample Prefix	Sample No.	Sample Suffix	Sample Description/Location (Mandatory)
↑	0027	B	Vinyl sheet flooring, Light Blue mottled - 1st Floor, CT Scan, Corridor a) ND b) ND
↑	0027	C	Vinyl sheet flooring, Light Blue mottled - 1st Floor, CT Scan, Corridor a) ND b) ND
LD	0028	A	Vinyl sheet flooring, Green mottled - 1st Floor, Elevator Lobby a) ND b) ND c) ND d) ND
↓	0028	B	Vinyl sheet flooring, Green mottled - 1st Floor, Elevator Lobby a) ND b) ND c) ND d) ND
↓	0028	C	Vinyl sheet flooring, Green mottled - 1st Floor, Elevator Lobby a) ND b) ND c) ND d) ND chka 57,
	0000		

(16)



## Pinchin Ltd. Asbestos Laboratory *Certificate of Analysis*

**Project No.:** 0351540.000  
**Prepared For:** A. Smith / M. Salt

**Lab Reference No.:** b328668  
**Analyst(s):** K. Cockburn

<b>Date Received:</b>	<b>December 4, 2024</b>	<b>Samples Submitted:</b>	<b>3</b>
<b>Date Analyzed:</b>	<b>December 4, 2024</b>	<b>Phases Analyzed:</b>	<b>1</b>

---

The Pinchin Ltd. Mississauga asbestos laboratory is accredited by the National Institute of Standards and Technology, National Voluntary Laboratory Accreditation Program (NVLAP Lab Code 101270-0) for the 'EPA – 40 CFR Appendix E to Subpart E of Part 763, Interim Method of the Determination of Asbestos in Bulk Insulation Samples,' and the 'EPA 600/R-93/116: Method for the Determination of Asbestos in Bulk Building Materials'; and meets all requirements of ISO/IEC 17025:2017. The Pinchin asbestos laboratory uses the aforementioned methods of analysis for all bulk materials. Please be advised that bulk materials do not include debris, dust, and tape-lift samples, and the analysis and reporting of these materials does not conform with Pinchin Ltd.'s NVLAP accreditation.

Bulk samples are checked visually and scanned under a stereomicroscope. Slides are prepared and observed under a Polarized Light Microscope (PLM) at magnifications of 40X, 100X or 400X as appropriate. Asbestos fibres are identified by a combination of morphology, colour, refractive index, extinction, sign of elongation, birefringence and dispersion staining colours. A visual estimate is made of the percentage of asbestos present. A reported concentration of less than (<) the regulatory threshold indicates the presence of confirmed asbestos in trace quantities, limited to only a few fibres or fibre bundles in an entire sample. This method complies with provincial regulatory requirements where applicable. Multiple phases within a sample are analyzed and reported separately.

All bulk samples submitted to this laboratory for asbestos analysis are retained for a minimum of three months. Samples may be retrieved, upon request, for re-examination at any time during that period.

This report relates only to the items tested.

*This report relates only to the items tested and is valid only when signed with a protected, authorized, electronic signature. This report may not be reproduced, except in full, without the written approval of Pinchin Ltd. The client may not use this report to claim product endorsement by NVLAP or any agency of the U.S. Government. Internal verification studies, quality assurance / control data and laboratory documentation on measurement uncertainty are available upon request.*



**Pinchin Ltd. Asbestos Laboratory**  
***Certificate of Analysis***

**Project No.:** 0351540.000  
**Prepared For:** A. Smith / M. Salt  
**Lab Reference No.:** b328668  
**Date Analyzed:** December 4, 2024

**BULK SAMPLE ANALYSIS**

SAMPLE IDENTIFICATION	SAMPLE DESCRIPTION	% COMPOSITION (VISUAL ESTIMATE)	
		ASBESTOS	OTHER
S0100A Wall, Vermiculite, South Wall	Homogeneous, grey, beige, and brown, loose particulate, micaceous material.	Libby Amphibole Confirmed Asbestos	Vermiculite > 75% Other Non-Fibrous 0.5-5%
Comments:	This sample originated from Libby Montana (a mine known to be contaminated with amphibole asbestos and is sold under the brand name Zonolite) and was confirmed in our laboratory to contain asbestos fibres. The laboratory does not report a percentage due to the variable asbestos content of the vermiculite from bag to bag or even between sampling locations in the same installation. The overall percentage of asbestos in Libby Vermiculite has been shown to range up to 6% (Atkinson et al. 1982; Amandus et al. 1987). Pinchin recommends that once the material is confirmed to be Libby Zonolite, it be treated as an asbestos containing material (>0.5% asbestos).		
S0100B Wall, Vermiculite, South Wall			Not Analyzed
Comments:	Analysis was stopped due to a previous positive result.		
S0100C Wall, Vermiculite, South Wall			Not Analyzed
Comments:	Analysis was stopped due to a previous positive result.		

**Reviewed by:**

Digitally signed  
by Pinchin Ltd.  
Date: 2024.12.04  
13:55:44-05'00'

**Reporting Analyst:**

Digitally signed by  
Pinchin Ltd.  
Date: 2024.12.04  
13:55:28-05'00'

Rec'd 12pm

Analyzed by: AK

Reviewed by: NB

Report Sent by: LD

**Pinchin Ltd. - Asbestos Laboratory**  
**Internal Asbestos Bulk Sample Chain of Custody**

**Special Instructions:**

Client Name:		Project Address:	ON
Portfolio/Building No:		Pinchin File:	351540
Submitted by:	Ava Smith	Email:	<a href="mailto:asmith@pinchin.com">asmith@pinchin.com</a>
CC Results to:	Michelle Salt	CC Email:	<a href="mailto:msalt@pinchin.com">msalt@pinchin.com</a>
Date Submitted:	December 4 2024	Required by:	December 4 2024
# of Samples:	3	Priority:	Rush Turnaround
Year of Building Construction (Mandatory, Years ONLY):	1950		
Do NOT Stop on Positive (Sample Numbers):			
Pinchin Group Company (Mandatory Field):	Pinchin		
HMIS2 Building Reference #:			
To be Completed by Lab Personnel Only:			
Lab Reference #:	b328668 <u>LD</u>		
Received by:	DEC 04 2024		
Name(s) of Analyst(s):	Time: 24 hour clock Date: Month <u>12</u> Day <u>04</u> Year <u>2024</u>		
Sample Prefix	Sample No.	Sample Suffix	Sample Description/Location (Mandatory)
S	0100	A	Wall, Vermiculite, South Wall <u>Libby confirmed</u>
S	0100	B	Wall, Vermiculite, South Wall <u>- NA -</u>
S	0100	C	Wall, Vermiculite, South Wall <u>- NA -</u>





## Pinchin Ltd. Asbestos Laboratory *Certificate of Analysis*

**Project No.:** 0351540.001  
**Prepared For:** A. Smith

**Lab Reference No.:** b330446 Revision 1  
**Analyst(s):** K. Bertuzzi

<b>Date Received:</b>	<b>January 14, 2025</b>	<b>Samples Submitted:</b>	<b>3</b>
<b>Date Analyzed:</b>	<b>January 15, 2025</b>	<b>Phases Analyzed:</b>	<b>1</b>

---

The Pinchin Ltd. Mississauga asbestos laboratory is accredited by the National Institute of Standards and Technology, National Voluntary Laboratory Accreditation Program (NVLAP Lab Code 101270-0) for the 'EPA – 40 CFR Appendix E to Subpart E of Part 763, Interim Method of the Determination of Asbestos in Bulk Insulation Samples,' and the 'EPA 600/R-93/116: Method for the Determination of Asbestos in Bulk Building Materials'; and meets all requirements of ISO/IEC 17025:2017. The Pinchin asbestos laboratory uses the aforementioned methods of analysis for all bulk materials. Please be advised that bulk materials do not include debris, dust, and tape-lift samples, and the analysis and reporting of these materials does not conform with Pinchin Ltd.'s NVLAP accreditation.

Bulk samples are checked visually and scanned under a stereomicroscope. Slides are prepared and observed under a Polarized Light Microscope (PLM) at magnifications of 40X, 100X or 400X as appropriate. Asbestos fibres are identified by a combination of morphology, colour, refractive index, extinction, sign of elongation, birefringence and dispersion staining colours. A visual estimate is made of the percentage of asbestos present. A reported concentration of less than (<) the regulatory threshold indicates the presence of confirmed asbestos in trace quantities, limited to only a few fibres or fibre bundles in an entire sample. This method complies with provincial regulatory requirements where applicable. Multiple phases within a sample are analyzed and reported separately.

All bulk samples submitted to this laboratory for asbestos analysis are retained for a minimum of three months. Samples may be retrieved, upon request, for re-examination at any time during that period.

This report relates only to the items tested.

### Revision History:

Revision 1 (2025-01-16)	Sample Identification revised for all samples
-------------------------	-----------------------------------------------

*This report relates only to the items tested and is valid only when signed with a protected, authorized, electronic signature. This report may not be reproduced, except in full, without the written approval of Pinchin Ltd. The client may not use this report to claim product endorsement by NVLAP or any agency of the U.S. Government. Internal verification studies, quality assurance / control data and laboratory documentation on measurement uncertainty are available upon request.*



## Pinchin Ltd. Asbestos Laboratory Certificate of Analysis

Project No.: 0351540.001  
Prepared For: A. Smith

Lab Reference No.: b330446 Revision 1  
Date Analyzed: January 15, 2025

### BULK SAMPLE ANALYSIS

SAMPLE IDENTIFICATION	SAMPLE DESCRIPTION	% COMPOSITION (VISUAL ESTIMATE)	
		ASBESTOS	OTHER
S0101A Wall, Vermiculite, South Wall, Basement Former Kitchen and Office Area	Homogeneous, grey, beige, and brown, loose particulate, micaceous material.	Libby Amphibole Confirmed Asbestos	Vermiculite > 75%
Comments:	This sample originated from Libby Montana (a mine known to be contaminated with amphibole asbestos and is sold under the brand name Zonolite) and was confirmed in our laboratory to contain asbestos fibres. The laboratory does not report a percentage due to the variable asbestos content of the vermiculite from bag to bag or even between sampling locations in the same installation. The overall percentage of asbestos in Libby Vermiculite has been shown to range up to 6% (Atkinson et al. 1982; Amandus et al. 1987). Pinchin recommends that once the material is confirmed to be Libby Zonolite, it be treated as an asbestos containing material (>0.5% asbestos).		
S0101B Wall, Vermiculite, South Wall, Basement Former Kitchen and Office Area			Not Analyzed
Comments:	Analysis was stopped due to a previous positive result.		
S0101C Wall, Vermiculite, South Wall, Basement Former Kitchen and Office Area			Not Analyzed
Comments:	Analysis was stopped due to a previous positive result.		

Reviewed by:

Digitally signed  
by Pinchin Ltd.  
Date: 2025.01.16  
13:23:27-05'00'

Reporting Analyst:

Digitally signed  
by Pinchin Ltd.  
Date: 2025.01.16  
13:23:37-05'00'

**Pinchin Ltd. - Asbestos Laboratory**  
**Internal Asbestos Bulk Sample Chain of Custody**

Analysed by: KB  
 Reviewed by: [Signature]  
 Measured Salt by: OK

rec'd 3pm Jan 14

**Special Instructions:**

<b>Client Name:</b>		<b>Project Address:</b>	ON
<b>Portfolio/Building No:</b>		<b>Pinchin File:</b>	351540.001
<b>Submitted by:</b>	Ava Smith	<b>Email:</b>	asmith@pinchin.com
<b>CC Results to:</b>	Michelle Salt	<b>CC Email:</b>	msalt@pinchin.com
<b>Date Submitted:</b>	January 14 2025	<b>Required by:</b>	January 14 2025
<b># of Samples:</b>	3	<b>Priority:</b>	Rush Turnaround
<b>Year of Building Construction (Mandatory, Years ONLY):</b> 1950			
<b>Do NOT Stop on Positive (Sample Numbers):</b>			
<b>Pinchin Group Company (Mandatory Field):</b> Pinchin			
<b>HMIS2 Building Reference #:</b>			
<b>To be Completed by Lab Personnel Only:</b>			
<b>Lab Reference #:</b>	6330446 2025	<b>Time:</b>	24 hour clock
<b>Received by:</b>	JAN 14 2025	<b>Date:</b>	Month Day Year
<b>Name(s) of Analyst(s):</b> Jan 15/25			
Sample Prefix	Sample No.	Sample Suffix	Sample Description/Location (Mandatory)
S	0101	A	Wall, Vermiculite, South Wall, Basement Former Kitchen and Office Area Libby Conf.
S	0101	B	Wall, Vermiculite, South Wall, Basement Former Kitchen and Office Area NA
S	0101	C	Wall, Vermiculite, South Wall, Basement Former Kitchen and Office Area NA

## **APPENDIX III**

### **Methodology**

## 1.0 GENERAL

Pinchin conducted an investigation of previously identified asbestos-containing materials (ACM) to evaluate the current condition of all accessible ACM identified in the most recent assessment.

The surveyor made reference to any existing assessment or abatement reports (as provided by the Client).

Materials listed as exclusions in the previous reports have remained as exclusions. Sampling, assessment or verification of excluded materials was not conducted.

Existing sampling data, where available, was reviewed and relied upon.

Analytical results were compared to the following criteria:

Jurisdiction*	Friable	Non-Friable
Ontario	0.5%	0.5%

Where building materials are described in the report as “non-asbestos” or “does not contain asbestos”, this means that either no asbestos was detected by the analytical method utilized in any of the multiple samples or, if detected, it is below the lower limit of an asbestos-containing material in the applicable regulation. Additionally, these terms are used for materials which historically are known to not include asbestos in their manufacturing.

Asbestos materials are evaluated in order to make recommendations regarding remedial work. The priority for remedial action is based on several factors:

- Friability (friable or non-friable)
- Condition (good, fair, poor, debris)
- Accessibility (ranking from accessible to all building users to inaccessible)
- Visibility (whether the material is obscured by other building components)
- Efficiency of the work (for example, if damaged ACM is being removed in an area, it may be most practical to remove all ACM in the area even if it is in good condition)

For a complete description of the Evaluation Criteria and Basis of Recommendations, refer to Annex A.

Template: Methodology for Asbestos Reassessment, HAZ, November 13, 2024

## **METHODOLOGY ANNEX A EVALUATION CRITERIA**

## 1.0 EVALUATION CRITERIA AND BASIS OF RECOMMENDATIONS

The detailed asbestos assessment provides information regarding the location, condition, accessibility and friability of the asbestos-containing materials (ACM). In order to make recommendations for compliance with current regulations, Pinchin developed the following criteria.

## 2.0 EVALUATION OF CONDITION

### 2.1 Friable Sprayed or Trowelled Fireproofing, Thermal Insulation and Texture Finishes (Surfacing Materials)

To evaluate the condition of ACM sprayed or trowelled on fireproofing, sprayed or trowelled thermal insulation (non-mechanical), or texture, decorative or acoustic finishes, the following criteria are applied:

<b>Good</b>	Surface of material shows no significant signs of damage, deterioration or delamination. Good condition includes unencapsulated or unpainted fireproofing or texture finishes, where no or limited delamination or damage is observed, or encapsulated fireproofing or texture finishes where the encapsulant or paint has been applied after the damage or fallout occurred.
<b>Poor</b>	A sprayed material that shows signs of significant damage or is significantly delaminating or deteriorating. This may be limited to surface delamination or some portion of the substrate may be exposed.

In Locations where damage exists in isolated areas, both good and poor condition may be applicable. The extent of each condition will be recorded. Fair condition is not utilized in the evaluation of ACM sprayed or trowelled fireproofing, sprayed or trowelled thermal insulation (non-mechanical), or texture, decorative or acoustic finishes.

The evaluation of the above products above ceilings may be limited by the number of observations and by building components such as ducts or full height walls that obstruct the above ceiling observations.

### 2.2 Friable Mechanical or Thermal System Insulation (TSI)

To evaluate the condition of mechanical insulation on vessels, boilers, breeching, ducts, pipes, fan units, equipment etc. the following criteria are applied:

<b>Good</b>	Insulation is completely covered in jacketing and exhibits no evidence of damage or deterioration. No insulation is exposed. Includes conditions where the jacketing has minor damage (i.e. scuffs or stains), but the jacketing is not penetrated.
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<b>Fair</b>	Minor penetrating damage to jacketed insulation (cuts, tears, nicks, deterioration or delamination) or undamaged insulation that has never been jacketed. Insulation is exposed but not showing surface disintegration. The extent of missing insulation ranges from minor to none. Damage can be repaired.
<b>Poor</b>	Original insulation jacket is missing, damaged, deteriorated or delaminated. Insulation is exposed and significant areas have been dislodged. Damage cannot be readily repaired. Includes components where insulation may have been removed incompletely.

The evaluation of mechanical insulation may be limited by the number of observations made and building components such as ducts or full height walls that obstruct observations. It is often not possible to observe each foot of mechanical insulation from all angles.

### 2.3 Potentially Friable Materials and Miscellaneous Friable Materials

Potentially friable ACM are products that are basically non-friable while in place but have the potential to generate friable dust upon removal or if significantly disturbed without appropriate procedures. These products may become friable if damaged. Potentially friable materials include materials such as acoustic ceiling tiles and plaster. To evaluate the condition of potentially friable materials, the following criteria are applied:

<b>Good</b>	No significant damage or deterioration. Still serving its intended use as a building material or finish.
<b>Fair</b>	Showing signs of some cracking or breakage, but is not deteriorating (e.g. cracked plaster, broken but in place ceiling tile, missing tile or section of plaster etc.). The condition is such that it is still serving its intended use as a building material or finish but may require repair for mainly cosmetic purposes.
<b>Poor</b>	Significant deterioration or breaking apart of the material. Material has deteriorated to the point it is not serving its intended use as building material or finish. Material has deteriorated to a point it has become friable. Normally potentially friable ACM in Poor condition is not repairable and requires at least localized removal and replacement.

### 2.4 Non-Friable Materials

Non-friable ACM cover a wide range of products with a wide variation in their tendency to release dust or asbestos fibres to the air. Many of these materials, (particularly where the matrix is an unweathered bitumen, asphalt or tar material) do not release fibres except in very unusual circumstances or during significant disturbance (e.g. use of abrasive power tools). Others with a cementitious matrix (asbestos-cement products) can more readily release dust due to abrasion, demolition, weathering, etc. The



potential for asbestos release from non-friable ACM is always lower than from friable ACM. To evaluate the condition of non-friable Materials, the following criteria are applied:

<b>Good</b>	No significant damage or deterioration. Still serving its intended use as a building material or finish.
<b>Fair</b>	Showing signs of some cracking or breakage but is not deteriorating (e.g. cracked vinyl floor tile, missing piece of tile or transite, etc.). The condition is such that it is still serving its intended use as a building material or finish but may require repair for mainly cosmetic purposes.
<b>Poor</b>	Significant deterioration or breaking apart of the material to the point at which it cannot be repaired, and it will require at least local removal. Material has deteriorated to the point it is not serving its intended use as building material or finish. Material may have deteriorated to a point where traffic or disturbance may cause it to become friable.

## 2.5 Evaluation of ACM Debris

The identification of the exact location or presence of debris on the top of ceiling tiles is limited by the number of observations made and the presence of building components such as ducts or full height walls that obstruct observations.

The presence of fallen or dislodged ACM is noted separately from the ACM source and is referred to as Debris. Debris may be friable if from a friable ACM source or a badly deteriorated non-friable ACM source. Debris may also be non-friable (such as fallen pieces of transite sheet or mastic fittings, or broken, dislodged floor tiles).

<b>Debris</b>	Debris may be friable or non-friable but is always identified as “debris” as the component of an observation and quantified as Poor condition.
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## 2.6 Evaluation of Presumed Asbestos-Containing Material (PACM)

Presumed asbestos-containing materials (PACM), are building materials that may contain asbestos but were not sampled or analyzed due to inaccessibility or the need to perform destructive testing to obtain a reasonable sample set. Evaluation of these materials is based on the assumption that these PACM are asbestos-containing.

A list of PACM is provided in the report and they are generally not included in the detailed room by room reports. Typically, they are excluded because they are inaccessible or present in very small quantities. If PACM are evaluated, Pinchin uses the criteria that correspond with the type (and friability) of the material listed above.

### 3.0 EVALUATION OF ACCESSIBILITY

The accessibility of building materials known or suspected of being ACM is rated according to the following criteria:

<b>Access (A)</b>	Common areas of the building within reach of all building users (approximately 8' - 9' from floor or standard ceiling height). Includes other areas where occupant activities may result in disturbance of material that is not normally within reach from floor level, but may be disturbed by common activities (e.g. gymnasiums, workshops, warehouses.)
<b>Access (B)</b>	Areas of the building accessed primarily by Maintenance/Caretaking/Janitorial Staff and within reach without use of a ladder. Includes areas within reach in Boiler Rooms, Electrical Rooms, Janitors Closets, Elevator Rooms, Mechanical Rooms, etc. Includes materials within reach from fixed ladders or catwalks, mezzanines, and accessible pipe chases.
<b>Access (C) and Visible</b>	Areas of the building above 8' - 9' where use of a ladder or scaffold is required to reach the ACM. Only includes ACM that are visible to view without the removal or opening of other building components such as ceiling tiles or service access panels.
<b>Access (C) and not Visible / Limited Visibility</b>	Areas of the building above 8' - 9' where use of a ladder or scaffold is required to reach the ACM. Includes ACM that are not visible or partially visible to view and require the removal of a building component to see, such as ceilings tiles or access panels to view and access. Includes rarely entered crawl spaces, attic spaces, etc. Observations will be limited to the extent visible from the access points.
<b>Access (D)</b>	Areas of the building behind inaccessible solid ceiling systems, walls or equipment etc. where demolition of the ceiling, wall or equipment etc. is required to reach the ACM. Material inaccessible due to height or location or is only accessed under unusual situations. Evaluation of condition and extent of ACM is limited or impossible, depending on the surveyor's ability to visually examine materials in Access D.

### 4.0 ACTION MATRIX AND DEFINITIONS

Pinchin's evaluation of the viability of a specific asbestos control option is based on the consideration of the friability, condition, accessibility and visibility of a material. The logic used is that damaged ACM located in an area frequently accessed by all building occupants is of a higher priority than damaged ACM located in an infrequently accessed service area. The action matrix considers the potential for fibre release (primarily from friable ACM) and the possible concerns from regulatory bodies and many building occupants to all damaged ACM (including non-friable).

In any building with asbestos, many current regulations require an Asbestos Management Program be implemented. Depending on the condition and the accessibility, more active measures such as repair or removal may be recommended. The following matrix provides guidance for recommended Actions in the absence of renovation or demolition. In the event of construction or maintenance activity which will disturb ACM more aggressive control or removal will be required.

#### 4.1 Action Matrix

The following tables outline the action decisions based on the relationship of assessed factors. Table I applies to friable ACM. Table II applies to non-friable ACM.

**Table I Decision Matrix for Friable ACM**

Access	Condition			Debris
	Good	Fair	Poor	
(A)	Action 5 <sup>1</sup>	Action 5 <sup>2</sup>	Action 3	Action 1
(B)	Action 7	Action 6 <sup>3</sup>	Action 3	Action 1
(C) Visible	Action 7	Action 6	Action 3	Action 2
(C) Not Visible / Limited Visibility	Action 7	Action 7	Action 4	Action 2
(D)	Action 7	Action 7	Action 7	Action 7

**Table II Decision Matrix for Potentially Friable and Non-Friable ACM**

Access	Condition			Debris
	Good	Fair	Poor	
(A)	Action 7	Action 7 <sup>4</sup>	Action 3	Action 1
(B)	Action 7	Action 7	Action 3	Action 1
(C) Visible	Action 7	Action 7	Action 4	Action 2
(C) Not Visible / Limited Visibility	Action 7	Action 7	Action 4	Action 2
(D)	Action 7	Action 7	Action 7	Action 7

<sup>1</sup> If friable ACM in access (A)/Good condition is not proactively removed Action 7 (Manage) is recommended.

<sup>2</sup> If friable ACM in access (A)/Fair condition is not proactively removed repair is recommended.

<sup>3</sup> If friable ACM in access (B)/Fair condition is likely to be disturbed after repair proactive removal is recommended.

<sup>4</sup> Action 7 is recommended for all non-friable ACM in Fair condition however some clients may wish to repair or take some action primarily for cosmetic reasons

## 4.2 Action Definitions

The following are the definitions in the Action Matrix Table presented above:

Action Definitions	
<b>Action 1</b>	Clean-Up of ACM Debris Restrict access that is likely to cause a disturbance of the ACM Debris and clean up ACM Debris. Utilize appropriate asbestos precautions.
<b>Action 2</b>	Precautions for Access Which may Disturb ACM Debris Use appropriate means to isolate the debris or to limit entry to the area which may disturb the material. At locations where ACM Debris can remain in place in lieu of removal or clean-up (e.g. Debris on top of ceiling tiles or behind lockable door), Utilize appropriate asbestos precautions to enter the area if this will disturb debris. The precautions will be required until the ACM Debris has been cleaned up.
<b>Action 3</b>	ACM Removal Remove ACM. Utilize asbestos procedures appropriate to the scope of the removal work. Until it is removed, restrict access to the material so it is not disturbed.
<b>Action 4</b>	Precautions for Work Which may Disturb ACM in Poor Condition. Utilize appropriate asbestos precautions if ACM may be disturbed by work on or near ACM. This does not require restricting access to the area, only control of work which may contact or disturb the ACM. Removal is the only viable option if work will disturb ACM.
<b>Action 5</b>	Proactive ACM Removal Remove friable ACM where the presence of friable asbestos in Good condition is not desirable. If friable ACM in Fair condition is not removed, then Repair friable ACM.
<b>Action 6</b>	ACM Repair Repair friable ACM in Fair condition which is not likely to be damaged again or disturbed by normal use of the area or room. Pinchin recommends proactive removal if friable ACM is likely to be damaged or disturbed during normal use of the area or room.
<b>Action 7</b>	Asbestos Management Program with Routine Surveillance Implement an Asbestos Management Program, including routine surveillance of ACM. Reassess materials regularly (typically once per year).

Master Template: Methodology Annex A to Appendix I Evaluation Criteria, HAZ, April 3, 2024

**APPENDIX IV**  
**Location Summary Report**

Client: Collingwood General and Marine Hospital

Site: 459 Hume Street, Collingwood, ON

Building Name: Collingwood General and Marine Hospital

Survey Date:

Last Re-Assessment: 2025-04-01

Building Phases: A: 1960 , B: 1974 , C: 2000 , D: 2011 , E: 2015

Location No.	Name or Description	Area ft <sup>2</sup>	Floor No.	Bldg. Phase	Notes
0	Samples	0		A	
1	Electrical Room	320	B	A	
2	Emergency Generator Room	486	B	A	
3	Loading Bay	460	B	A	
4	Electrical Room	109	B	A	
5	Maintenance Shop	1042	B	A	
6	Maintenance Office	120	B	A	
7	Boiler Room	2200	B	A	
8	Boiler Room Mezzanine	565	B	A	
9	Stairwell	132		A	
10	Maintenance Locker Room/Washroom	149	B	A	
11	Paint Room	109	B	A	
12	Office 1	100	B	A	
13	Corridor 1	1720	B	A	
14	Office 2	73	B	A	
15	IT Department	830	B	A	
16	Server Room	250	B	A	
17	IT Supply Room	50	B	A	
18	IT Washroom	30	B	A	
19	Office 3	331	B	A	
20	Biomedical Engineering	288	B	A	
21	Medical Device Reprocessing Office 1	91	B	A	
22	Medical Device Reprocessing Lunch Room	115	B	A	
23	Medical Device Reprocessing Sterilization	605	B	B	
24	Medical Device Reprocessing Sterilization Mechanical Room	67	B	A	
25	Sterilization Dirty Room	303	B	D	
26	Endoscopy Sterilization Dirty Room	82	B	D	
27	Endoscopy Sterilization Clean Room	136	B	D	
28	Endoscopy Recovery Room	833	B	D	
29	Endoscopy Procedure Room	311	B	D	
30	Endoscopy Corridor	387	B	D	
31	Stairwell	227		D	
32	Endoscopy Lunch Room	123	B	D	
33	Endoscopy Waiting Room	182	B	D	
34	Office 4	187	B	D	
35	Office 5	118	B	D	
36	Office 6	113	B	D	
37	Morgue	154	B	C	
38	Medical Gas Room	182	B	C	
39	Fire Alarm Control Centre	58	B	A	
40	Mechanical Room	144	B	A	
41	Stairwell	357		A	
42	Telecommunications Room	47	B	A	
43	Universal Washroom	44	B	A	
44	Shipping And Receiving	2375	B	C	
45	Capital Planning Office	142	B	C	
46	Office 7	74	B	A	
47	Universal Washroom	32	B	A	
48	Cleaning Supply Closet	17	B	A	
49	Clean Laundry Storage	478	B	A	
50	Laundry Room	777	B	C	
51	Laundry Office	91	B	A	

Location No.	Name or Description	Area ft <sup>2</sup>	Floor No.	Bldg. Phase	Notes
52	Laundry Storage Room	121	B	C	
53	Office 8	122	B	A	
54	Linen Storage Room	227	B	C	
55	Dialysis RO Room	205	B	C	
56	Office 9	156	B	C	
57	Corporate Office	409	B	C	
58	Meeting Room	201	B	C	
59	Office 10	144	B	C	
60	Office Corridor	87	B	C	
61	Corridor 2	345	B	C	
62	Women's Locker Room	334	B	A	
63	Women's Staff Washroom	119	B	A	
64	Men's Locker Room	105	B	A	
65	Men's Staff Washroom	55	B	A	
66	Foundation Office	438	B	A	
67	Foundation Office Storage Closet	25	B	A	
68	Foundation Office	811	B	C	
69	Stairwell	177		A	
70	Vestibule 1	105		A	
71	Volunteer Office And Storage Room	468	B	A	
72	Medical Staff Room	671	B	A	
73	Storage Room	0	B	A	NO ACCESS - Under construction
74	Future MRI Room	0	B	A	NO ACCESS - Under construction
75	Storage Room	0	B	A	NO ACCESS - Under construction
76	Corridor 3	1542	B	A	
77	Cafeteria	668	B	C	
78	Dining Area	1600	B	C	
79	Corridor 4	223	B	C	
80	Food Receiving Area	189	B	A	
81	Fridge	63	B	A	
82	Freezer	185	B	A	
83	Preparation Area	139	B	A	
84	Storage Area	123	B	A	
85	Supply Storage Room	69	B	A	
86	Preparation Area	1202	B	A	
87	Cooler	52	B	A	
88	Dry Food Storage	162	B	A	
89	Cold Storage	144	B	A	
90	Dishwashing Station	505	B	A	
91	Equipment Storage Room	217	B	A	
92	Custodial Closet	18	B	A	
93	Office 11	116	B	A	
94	Office 12	172	B	A	
95	Business Centre	0	B	A	NO ACCESS - No key for access
96	Universal Washroom	22	B	A	
97	EVS Admin Closet	29	B	A	
98	Pharmaceuticals Office	437	B	A	
99	Pharmaceuticals Manager Office	105	B	C	
100	Pharmaceuticals Storage	563	B	C	
101	Training Room Corridor	366	B	A	
102	Electrical Room	138	B	C	
103	Electrical Room	136	B	A	
104	Mechanical Room	54	B	C	
105	Elevator Machine Room	83	B	C	
106	Training Room	747	B	C	
107	Fire Pump Room	127	B	C	
108	Training Room Storage	126	B	C	
109	Training Supply Room	134	B	C	
110	Transfusion Clinic	992	B	C	
111	Office 13	101	B	A	
112	Office 14	85	B	A	
113	Desk Area	168	B	A	



Location No.	Name or Description	Area ft <sup>2</sup>	Floor No.	Bldg. Phase	Notes
114	Office 15	94	B	A	
115	Office 16	215	B	A	
116	Telemedicine Office	83	B	A	
117	Physiotherapy Centre	2023	B	A	
118	Physiotherapy Washroom	55	B	A	
119	Physiotherapy Corridor	33	B	A	
120	Physiotherapy Coat Room	129	B	A	
121	Lab Waiting Room	209	B	A	
122	Lab Supply Closet	32	B	A	
123	Lab Corridor	108	B	A	
124	Supply Closet	28	B	A	
125	Universal Washroom	29	B	A	
126	Lab Staff Room	260	B	A	
127	Lab Reception/Office Area	182	B	A	
128	Lab	2036	B	A	
129	Lab Storage Room	220	B	A	
130	Lab Work Room	280	B	A	
131	Stairwell	176		A	
132	Corridor 5	79	B	A	
133	Lab Office	172	B	A	
134	EVS Supply Room	178	B	A	
135	First Floor Elevator Lobby	662	1	A	
136	Universal Washroom	24	1	A	
137	Dialysis Staff Washroom	24	1	A	
138	Dialysis Storage Supply Closet	30	1	A	
139	Dialysis Unit	1329	1	A	
140	Dialysis Staff Area	70	1	A	
141	Universal Washroom	43	1	A	
142	Corridor 6	687	1	A	
143	Dialysis Supply Storage Room	228	1	A	
144	Check In Area	1020	1	C	
145	Vestibule	66	1	C	
146	Gift Shop	353	1	C	
147	Emergency Waiting Room	1994	1	C	
148	Emergency Room Vestibule	70	1	C	
149	Emergency Room Washroom	51	1	C	
150	Triage	130	1	C	
151	Reception Area	365	1	C	
152	Mental Health Office	111	1	C	
153	Emergency Room Check In	91	1	C	
154	Emergency Patient Room 8	132	1	A	
155	Emergency Patient Room 9	0	1	A	NO ACCESS - Patient present
156	Emergency Patient Room 10	94	1	A	
157	Ambulance Bay	1023	1	B	
158	Ambulance Entry Vestibule	93	1	A	
159	Emergency Patient Room 11	0	1	A	NO ACCESS - Patient present
160	Trauma Patient Room 1	0	1	A	NO ACCESS - Patient present
161	Examination Room	91	1	C	
162	Emergency Room Staff Area	417	1	A	
163	Trauma Patient Room 2	0	1	A	NO ACCESS - Patient present
164	Trauma Patient Room 3	0	1	A	NO ACCESS - Patient present
165	Medication Storage Room	102	1	A	
166	Waste Disposal Room	132	1	A	
167	Emergency Patient Room 12	152	1	A	
168	Security Office	67	1	A	
169	Emergency Patient Room 13	156	1	A	
170	Nurses Break Room	200	1	A	
171	Emergency Staff Washroom	43	1	A	
172	Clean Supply Room	111	1	A	
173	Emergency Room	2206	1	A	
174	Emergency Services Manager Office	75	1	A	
175	Staff Washroom	31	1	A	

Location No.	Name or Description	Area ft <sup>2</sup>	Floor No.	Bldg. Phase	Notes
176	EVS ER Closet	0	1	A	NO ACCESS - No key for access
177	See And Treat Clean Supply Room	106	1	C	
178	See And Treat Break Room	78	1	C	
179	See And Treat Mid Acuity Zone	286	1	C	
180	See And Treat Washroom	52	1	C	
181	See And Treat Exam Room 2	86	1	C	
182	See And Treat Exam Room 1	86	1	C	
183	See And Treat Exam Room 3	86	1	C	
184	See And Treat Exam Room 4	86	1	C	
185	See And Treat Corridor	585	1	C	
186	See And Treat Rapid Assessment Zone	91	1	C	
187	Corridor 7	345	1	C	
188	See And Treat AMB Care 3	135	1	C	
189	See And Treat AMB Care 2	0	1	C	NO ACCESS - Patient present
190	Physician Office	0	1	C	NO ACCESS - No key for access
191	See And Treat AMB Care 1	158	1	C	
192	See And Treat AMB Care 6	0	1	C	NO ACCESS - Patient present
193	See And Treat AMB Care 7	100	1	C	
194	See And Treat AMB Care 8	88	1	C	
195	Electrical Room	0	1	E	NO ACCESS - No key for access
196	Ambulatory Care Washroom	78	1	E	
197	Ambulatory Care Waiting Room	393	1	E	
198	Ambulatory Care Reception Office	161	1	E	
199	Ambulatory Care Cast Room	157	1	E	
200	Ambulatory Care Staff Lounge	81	1	E	
201	Ambulatory Care Sterile Supply Room	121	1	E	
202	Ambulatory Care Dictation Room	117	1	E	
203	Ambulatory Care Dirty Utility Room	83	1	E	
204	Ambulatory Care Exam Room 3	123	1	E	
205	Ambulatory Care Exam Room 2	0	1	E	NO ACCESS - Patient present
206	Ambulatory Care Washroom	71	1	E	
207	Ambulatory Care Exam Room 10	117	1	E	
208	Ambulatory Care Exam Room 5	122	1	E	NO ACCESS - Patient present
209	Ambulatory Care Exam Bays 1-4	339	1	E	
210	Ambulatory Care Corridor	381	1	E	
211	Cardiology Washroom	29	1	A	
212	Cardiology Waiting Room	217	1	A	
213	Cardiology Staff Room	88	1	A	
214	Stress Room	93	1	A	
215	Physicians Interpretation Room	50	1	A	
216	Stress Test Room	177	1	A	
217	Cardiology Hallway	69	1	A	
218	Corridor 8	361	1	A	
219	CT Control Room	130	1	A	
220	CT Mechanical Room	55	1	A	
221	Booking Room	0	1	A	NO ACCESS - No key for access
222	CT Scan Room	0	1	A	NO ACCESS - Patient present
223	Corridor 9	460	1	A	
224	Universal Washroom	71	1	A	
225	Mammogram Waiting Area/Changeroom	68	1	A	
226	Mammogram Exam Room	159	1	A	
227	Locker Room	73	1	A	
228	Pulmonary Function Testing Room	127	1	A	
229	Bone Density Exam Room	112	1	A	
230	Staff Room	172	1	A	
231	Ultrasound Room	0	1	A	NO ACCESS - Exam in progress
232	Universal Washroom	30	1	A	
233	Corridor 10	654	1	A	
234	Washroom 112B	19	1	A	

Location No.	Name or Description	Area ft <sup>2</sup>	Floor No.	Bldg. Phase	Notes
235	Washroom 122A	140	1	A	
236	X Ray Room	253	1	A	
237	X Ray Control Room	102	1	A	
238	X Ray Room	342	1	A	
239	ECHO Room	168	1	A	
240	Radiology	1287	1	A	
241	Patient Changeroom Area	125	1	A	
242	Universal Washroom	39	1	A	
243	Ultrasound Room 2	178	1	A	
244	Ultrasound Room 1	0	1	A	NO ACCESS - Exam in progress
245	Ultrasound Room 3	0	1	A	NO ACCESS - Exam in progress
246	Radiology Waiting Room	250	1	A	
247	Universal Washroom	29	1	A	
248	Inpatient Room 164	233	1	A	
249	Lift Room	13	1	A	
250	Inpatient Room 169	0	1	A	NO ACCESS - Patient present
251	Inpatient Room 168	0	1	A	NO ACCESS - Patient present
252	Inpatient Room 166	0	1	A	NO ACCESS - Patient present
253	EVS Medical Closet	32	1	A	
254	Medical Supply Room	148	1	A	
255	Linen Room	108	1	A	
256	Solid Utility Room	157	1	A	
257	Inpatient Room 165	0	1	A	NO ACCESS - Patient present
258	Inpatient Room 163	0	1	A	NO ACCESS - Patient present
259	Inpatient Room 162	0	1	A	NO ACCESS - Patient present
260	Inpatient Room 161	0	1	A	NO ACCESS - Patient present
261	Inpatient Room 160	238	1	A	
262	Supply Storage Room	241	1	A	
263	Inpatient Room 159	0	1	A	NO ACCESS - Patient present
264	Inpatient Room 158	0	1	A	NO ACCESS - Patient present
265	Wheelchair Storage Room	125	1	A	
266	Inpatient Manager Office	128	1	A	
267	Inpatient Room 101	0	1	C	NO ACCESS - Patient present
268	Inpatient Room 103	0	1	C	NO ACCESS - Patient present
269	Inpatient Room 104	0	1	C	NO ACCESS - Patient present
270	IV Pump Storage	25	1	C	
271	Inpatient Room 106	0	1	C	NO ACCESS - Patient present
272	Universal Washroom	48	1	C	
273	Inpatient Room 107	0	1	C	NO ACCESS - Patient present
274	Hand Wash Station	20	1	C	
275	Inpatient Room 109	0	1	C	NO ACCESS - Patient present
276	Inpatient Room 110	0	1	C	NO ACCESS - Patient present
277	Inpatient Room 112	0	1	C	NO ACCESS - Patient present
278	Inpatient Room 113	0	1	C	NO ACCESS - Patient present
279	Inpatient Room 115	0	1	C	NO ACCESS - Patient present
280	Inpatient Room 116	0	1	C	NO ACCESS - Patient present
281	Inpatient Staff Room	365	1	C	
282	Inpatient Corridor 1	2310	1	C	
283	Shower Room	52	1	C	
284	Storage Supply Room	77	1	C	
285	Office 17	0	1	A	
286	Inpatient Corridor 2	2300	1	A	
287	ICU Supply Room	58	1	C	
288	ICU Corridor	1705	1	C	
289	Storage Closet	51	1	C	
290	ICU Break Room	117	1	C	
291	Server Room	134	1	A	
292	Supply Room	141	1	A	
293	ICU Washroom	26	1	A	
294	ICU Shower Room	47	1	A	
295	ICU Patient Room 118	0	1	C	NO ACCESS - Patient present
296	ICU Patient Room 120	0	1	C	NO ACCESS - Patient present
297	ICU Patient Room 121	0	1	C	NO ACCESS - Patient present

Location No.	Name or Description	Area ft <sup>2</sup>	Floor No.	Bldg. Phase	Notes
298	ICU Patient Room 123	0	1	C	NO ACCESS - Patient present
299	ICU Patient Room 124	0	1	C	NO ACCESS - Patient present
300	Nuclear Medicine	417	1	A	
301	Stairwell	212		A	
302	Stairwell	212		A	
303	Second Floor Elevator Lobby	665	2	A	
304	Quiet Space	208	2	A	
305	Surgical Registration Corridor	1120	2	A	
306	Closet	0	2	A	NO ACCESS - No key for access
307	Scrub Room	84	2	A	
308	Registration Office	92	2	A	
309	Patient Services Manager Office	69	2	A	
310	Sleep Room	58	2	A	
311	Washroom	51	2	A	
312	Sleep Room	72	2	A	
313	Temporary Gynecology Clinic	0	2	A	NO ACCESS - Patient present
314	Break Room	186	2	A	
315	Break Room Washroom	39	2	A	
316	Kitchen	134	2	A	
317	Stairwell	229		A	
318	Storage Closet	36	2	A	
319	Locker Room	115	2	A	
320	Recovery Room	1086	2	A	
321	Recovery Washroom	35	2	A	
322	Patient Prep Area	326	2	A	
323	OR Corridor	749	2	A	
324	Elevators	120	2	A	
325	Obstetrics Supply Room	87	2	A	
326	OB Room 225	419	2	A	
327	OB Room 223	416	2	C	
328	OB Room 222	0	2	C	NO ACCESS - Patient present
329	Supply Room	87	2	A	
330	Monitoring Room	158	2	C	
331	Break Room	120	2	C	
332	Nursing Station	360	2	C	
333	OB Room 217	0	2	C	NO ACCESS - Patient present
334	OB Room 233	0	2	A	NO ACCESS - Patient present
335	OB Room 235	107	2	A	
336	OB Room 216	348	2	C	
337	Office 18	139	2	A	
338	Washroom	24	2	A	
339	Server Room	30	2	A	
340	Obstetrics Corridor	914	2	C	
341	Lift Room	16	2	A	
342	Surgical Patient Room 268	0	2	A	NO ACCESS - Patient present
343	Surgical Patient Room 267	0	2	A	NO ACCESS - Patient present
344	Surgical Patient Room 265	0	2	A	NO ACCESS - Patient present
345	Linen Storage	107	2	A	
346	Supply Storage Room	188	2	A	
347	Waste Room	111	2	A	
348	Surgical Patient Room 264	0	2	A	NO ACCESS - Patient present
349	Surgical Patient Room 263	0	2	A	NO ACCESS - Patient present
350	Surgical Patient Room 262	0	2	A	NO ACCESS - Patient present
351	Surgical Patient Room 261	0	2	A	NO ACCESS - Patient present
352	IV Pump Station	42	2	A	
353	Surgical Patient Room 259	0	2	A	NO ACCESS - Patient present
354	Storage Room	354	2	A	
355	Surgical Patient Room 258	0	2	A	NO ACCESS - Patient present
356	Surgical Patient Room 257	0	2	A	NO ACCESS - Patient present
357	Surgical Patient Room 256	0	2	A	NO ACCESS - Patient present
358	Janitor's Closet	15	2	A	
359	Stairwell	191	2	A	
360	Wheelchair Storage Room	110	2	A	

Location No.	Name or Description	Area ft <sup>2</sup>	Floor No.	Bldg. Phase	Notes
361	Surgical Managers Office	124	2	A	
362	Surgical Patient Room 201	310	2	C	
363	Shower	0	2	C	NO ACCESS - No key for access
364	Surgical Patient Room 203	0	2	C	NO ACCESS - Patient present
365	Surgical Patient Room 204	0	2	C	NO ACCESS - Patient present
366	EVS Supply Closet	0	2	C	NO ACCESS - No key for access
367	Surgical Patient Room 206	0	2	C	NO ACCESS - Patient present
368	Washroom	48	2	A	
369	Hand Wash Station	20	2	C	
370	Surgical Patient Room 209	0	2	C	NO ACCESS - Patient present
371	Surgical Patient Room 210	0	2	C	NO ACCESS - Patient present
372	Electrical Room	0	2	C	NO ACCESS - No key for access
373	Surgical Patient Room 212	0	2	C	NO ACCESS - Patient present
374	Surgical Patient Room 213	0	2	C	NO ACCESS - Patient present
375	Surgical Patient Room 215	0	2	C	NO ACCESS - Patient present
376	Staff Room	161	2	A	
377	Shower Room	51	2	A	
378	Supply Room	80	2	A	
379	Nurses Station	367	2	A	
380	Office 19	82	2	A	
381	Surgical Corridor	2362	2	A	
382	OR 2	289	2	A	
383	Storage Room	230	2	A	
384	Scrub Sink Area	184	2	A	
385	Storage Room	165	2	A	
386	Dirty Utility Room	245	2	A	
387	Storage Room	495	2	A	
388	EVS supply Room	31	2	A	
389	Doctor's Lounge	205	2	A	
390	Washroom	26	2	A	
391	Men's Changeroom	59	2	A	
392	Women's Changeroom	48	2	A	
393	Office 20	224	2	A	
394	OR 1	0	2	A	NO ACCESS - Patient present
395	OR 2	0	2	A	NO ACCESS - Patient present
396	Mechanical Room	1429	2	C	
397	Mechanical Room	832	2	B	
398	Mechanical Room	426	2	A	
399	Corridor	607	2	A	
400	Stairwell	190		A	
401	Stairwell	190		A	
402	Elevator	40		A	
403	Exterior	0		A	

**APPENDIX V**  
**Confirmed / Presumed ACM Report**

## CONFIRMED AND PRESUMED HAZARDOUS MATERIALS REPORT

**Client:** Collingwood General and Marine Hospital    **Site:** 459 Hume Street, Collingwood, ON

**Building Name:** Collingwood General and Marine Hospital

**Location:** #0 : Samples

**Floor:**

**Room #:**

**Area (sqft):** 0

**Survey Date:** 2025-04-01

**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Floor		Vinyl Sheet Flooring, Grey										S0024ABC	Chrysotile	0.5-5%	Confirmed Asbestos	PF
Floor		Vinyl Floor Tile, 12"x12" green mottled										S0008ABC	Chrysotile	0.5-5%	Confirmed Asbestos	NF
Piping		Parging Cement, Parging cement-LPS pipe fitting insulation										S0001ABC	Chrysotile	10-25%	Confirmed Asbestos	F
Piping	Hot Water Heating	Parging Cement, Hot water heating pipe system										S0009ABC	Chrysotile	10-25%	Confirmed Asbestos	F
Wall <sup>1</sup>		Vermiculite/concrete block walls										V0100	Libby Amphibole Detected	>75%	Confirmed Asbestos	F

1 - Vermiculite is presumed to be present in block walls with the 1950 construction phase.

**Client:** Collingwood General and Marine Hospital    **Site:** 459 Hume Street, Collingwood, ON

**Building Name:** Collingwood General and Marine Hospital

**Location:** #5 : Maintenance Shop

**Floor:** B

**Room #:**

**Area (sqft):** 1042

**Survey Date:** 2025-04-01

**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Wall		Paint, Paint on block wall			A	Y		2000(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF



## CONFIRMED AND PRESUMED HAZARDOUS MATERIALS REPORT

**Client:** Collingwood General and Marine Hospital

**Site:** 459 Hume Street, Collingwood, ON

**Building Name:** Collingwood General and Marine Hospital

**Location:** #6 : Maintenance Office

**Floor:** B

**Room #:**

**Area (sqft):** 120

**Survey Date:** 2025-04-01

**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Wall		Paint			A	Y		95(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF

**Client:** Collingwood General and Marine Hospital

**Site:** 459 Hume Street, Collingwood, ON

**Building Name:** Collingwood General and Marine Hospital

**Location:** #7 : Boiler Room

**Floor:** B

**Room #:**

**Area (sqft):** 2200

**Survey Date:** 2025-04-01

**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Wall		Paint, Paint on block wall			A	Y		2100(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF

## CONFIRMED AND PRESUMED HAZARDOUS MATERIALS REPORT

**Client:** Collingwood General and Marine Hospital    **Site:** 459 Hume Street, Collingwood, ON  
**Location:** #8 : Boiler Room Mezzanine    **Floor:** B  
**Survey Date:** 2025-04-01

**Building Name:** Collingwood General and Marine Hospital  
**Room #:**    **Area (sqft):** 565  
**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Piping		Parging Cement, Parging cement-LPS pipe fitting insulation			C	Y						S0001	Chrysotile	10-25%	Confirmed Asbestos	F
Piping		Parging Cement, Parging cement-LPS pipe fitting insulation										S0001	Chrysotile	10-25%	Confirmed Asbestos	F
Piping		Parging Cement, Parging cement-LPS pipe fitting insulation			C	Y		10(7)			EA	S0001	Chrysotile	10-25%	Confirmed Asbestos	F
Wall		Paint, Paint on block wall			A	Y		760(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF

**Client:** Collingwood General and Marine Hospital    **Site:** 459 Hume Street, Collingwood, ON  
**Location:** #9 : Stairwell    **Floor:**     
**Survey Date:** 2025-04-01

**Building Name:** Collingwood General and Marine Hospital  
**Room #:**    **Area (sqft):** 132  
**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Wall		Paint, Paint on block wall			A	Y		700(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF

## CONFIRMED AND PRESUMED HAZARDOUS MATERIALS REPORT

**Client:** Collingwood General and Marine Hospital    **Site:** 459 Hume Street, Collingwood, ON

**Building Name:** Collingwood General and Marine Hospital

**Location:** #10 : Maintenance Locker  
**Room/Washroom**

**Floor:** B

**Room #:**

**Area (sqft):** 149

**Survey Date:** 2025-04-01

**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Wall		Paint, Paint on block wall			A	Y		490(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF

**Client:** Collingwood General and Marine Hospital    **Site:** 459 Hume Street, Collingwood, ON

**Building Name:** Collingwood General and Marine Hospital

**Location:** #12 : Office 1

**Floor:** B

**Room #:**

**Area (sqft):** 100

**Survey Date:** 2025-04-01

**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Wall		Paint			A	Y		200(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF

## CONFIRMED AND PRESUMED HAZARDOUS MATERIALS REPORT

**Client:** Collingwood General and Marine Hospital

**Site:** 459 Hume Street, Collingwood, ON

**Building Name:** Collingwood General and Marine Hospital

**Location:** #13 : Corridor 1

**Floor:** B

**Room #:**

**Area (sqft):** 1720

**Survey Date:** 2025-04-01

**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Wall		Paint			A	Y		2450(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF

**Client:** Collingwood General and Marine Hospital

**Site:** 459 Hume Street, Collingwood, ON

**Building Name:** Collingwood General and Marine Hospital

**Location:** #18 : IT Washroom

**Floor:** B

**Room #:**

**Area (sqft):** 30

**Survey Date:** 2025-04-01

**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Wall		Paint			A	Y		200(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF

## CONFIRMED AND PRESUMED HAZARDOUS MATERIALS REPORT

**Client:** Collingwood General and Marine Hospital    **Site:** 459 Hume Street, Collingwood, ON  
**Location:** #39 : Fire Alarm Control Centre    **Floor:** B  
**Survey Date:** 2025-04-01

**Building Name:** Collingwood General and Marine Hospital  
**Room #:**  
**Last Re-Assessment:** 2025-04-01

**Area (sqft):** 58

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Piping		Parging Cement, Fittings above plaster ceiling, as identified by the client. Not accessible			D	N		20(7)			EA	V9000	Confirmed Asbestos		Confirmed Asbestos	F
Wall		Paint, Paint on block wall			A	Y		213(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF

**Client:** Collingwood General and Marine Hospital    **Site:** 459 Hume Street, Collingwood, ON  
**Location:** #41 : Stairwell    **Floor:**  
**Survey Date:** 2025-04-01

**Building Name:** Collingwood General and Marine Hospital  
**Room #:**  
**Last Re-Assessment:** 2025-04-01

**Area (sqft):** 357

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Wall		Paint			A	Y		720(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF

## CONFIRMED AND PRESUMED HAZARDOUS MATERIALS REPORT

**Client:** Collingwood General and Marine Hospital

**Site:** 459 Hume Street, Collingwood, ON

**Building Name:** Collingwood General and Marine Hospital

**Location:** #42 : Telecommunications Room

**Floor:** B

**Room #:**

**Area (sqft):** 47

**Survey Date:** 2025-04-01

**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Wall		Paint			A	Y		270(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF

**Client:** Collingwood General and Marine Hospital

**Site:** 459 Hume Street, Collingwood, ON

**Building Name:** Collingwood General and Marine Hospital

**Location:** #43 : Universal Washroom

**Floor:** B

**Room #:**

**Area (sqft):** 44

**Survey Date:** 2025-04-01

**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Wall		Paint			A	Y		28(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF

## CONFIRMED AND PRESUMED HAZARDOUS MATERIALS REPORT

**Client:** Collingwood General and Marine Hospital

**Site:** 459 Hume Street, Collingwood, ON

**Building Name:** Collingwood General and Marine Hospital

**Location:** #46 : Office 7

**Floor:** B

**Room #:**

**Area (sqft):** 74

**Survey Date:** 2025-04-01

**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Wall		Paint, Paint on block wall			A	Y		350(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF

**Client:** Collingwood General and Marine Hospital

**Site:** 459 Hume Street, Collingwood, ON

**Building Name:** Collingwood General and Marine Hospital

**Location:** #48 : Cleaning Supply Closet

**Floor:** B

**Room #:**

**Area (sqft):** 17

**Survey Date:** 2025-04-01

**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Wall		Paint			A	Y		130(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF



## CONFIRMED AND PRESUMED HAZARDOUS MATERIALS REPORT

**Client:** Collingwood General and Marine Hospital

**Site:** 459 Hume Street, Collingwood, ON

**Building Name:** Collingwood General and Marine Hospital

**Location:** #49 : Clean Laundry Storage

**Floor:** B

**Room #:**

**Area (sqft):** 478

**Survey Date:** 2025-04-01

**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Wall		Paint			A	Y		880(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF

**Client:** Collingwood General and Marine Hospital

**Site:** 459 Hume Street, Collingwood, ON

**Building Name:** Collingwood General and Marine Hospital

**Location:** #51 : Laundry Office

**Floor:** B

**Room #:**

**Area (sqft):** 91

**Survey Date:** 2025-04-01

**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Wall		Paint			A	Y		130(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF

## CONFIRMED AND PRESUMED HAZARDOUS MATERIALS REPORT

**Client:** Collingwood General and Marine Hospital

**Site:** 459 Hume Street, Collingwood, ON

**Building Name:** Collingwood General and Marine Hospital

**Location:** #53 : Office 8

**Floor:** B

**Room #:**

**Area (sqft):** 122

**Survey Date:** 2025-04-01

**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Wall		Paint			A	Y		67(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF

**Client:** Collingwood General and Marine Hospital

**Site:** 459 Hume Street, Collingwood, ON

**Building Name:** Collingwood General and Marine Hospital

**Location:** #62 : Women's Locker Room

**Floor:** B

**Room #:**

**Area (sqft):** 334

**Survey Date:** 2025-04-01

**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Wall		Paint			A	Y		835(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF

## CONFIRMED AND PRESUMED HAZARDOUS MATERIALS REPORT

**Client:** Collingwood General and Marine Hospital

**Site:** 459 Hume Street, Collingwood, ON

**Building Name:** Collingwood General and Marine Hospital

**Location:** #64 : Men's Locker Room

**Floor:** B

**Room #:**

**Area (sqft):** 105

**Survey Date:** 2025-04-01

**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Wall		Paint			A	Y		410(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF

**Client:** Collingwood General and Marine Hospital

**Site:** 459 Hume Street, Collingwood, ON

**Building Name:** Collingwood General and Marine Hospital

**Location:** #67 : Foundation Office Storage Closet

**Floor:** B

**Room #:**

**Area (sqft):** 25

**Survey Date:** 2025-04-01

**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Wall		Paint			A	Y		30(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF

## CONFIRMED AND PRESUMED HAZARDOUS MATERIALS REPORT

**Client:** Collingwood General and Marine Hospital

**Site:** 459 Hume Street, Collingwood, ON

**Building Name:** Collingwood General and Marine Hospital

**Location:** #69 : Stairwell

**Floor:**

**Room #:**

**Area (sqft):** 177

**Survey Date:** 2025-04-01

**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Wall		Paint			A	Y		540(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF

**Client:** Collingwood General and Marine Hospital

**Site:** 459 Hume Street, Collingwood, ON

**Building Name:** Collingwood General and Marine Hospital

**Location:** #70 : Vestibule 1

**Floor:**

**Room #:**

**Area (sqft):** 105

**Survey Date:** 2025-04-01

**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Wall		Paint			A	Y		350(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF

## CONFIRMED AND PRESUMED HAZARDOUS MATERIALS REPORT

**Client:** Collingwood General and Marine Hospital    **Site:** 459 Hume Street, Collingwood, ON

**Location:** #71 : Volunteer Office And Storage Room    **Floor:** B

**Survey Date:** 2025-04-01

**Building Name:** Collingwood General and Marine Hospital

**Room #:**

**Last Re-Assessment:** 2025-04-01

**Area (sqft):** 468

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Wall		Paint			A	Y		90(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF

**Client:** Collingwood General and Marine Hospital    **Site:** 459 Hume Street, Collingwood, ON

**Location:** #72 : Medical Staff Room

**Floor:** B

**Survey Date:** 2025-04-01

**Building Name:** Collingwood General and Marine Hospital

**Room #:**

**Last Re-Assessment:** 2025-04-01

**Area (sqft):** 671

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Wall		Paint			A	Y		20(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF

## CONFIRMED AND PRESUMED HAZARDOUS MATERIALS REPORT

**Client:** Collingwood General and Marine Hospital    **Site:** 459 Hume Street, Collingwood, ON  
**Location:** #76 : Corridor 3    **Floor:** B  
**Survey Date:** 2025-04-01

**Building Name:** Collingwood General and Marine Hospital  
**Room #:**    **Area (sqft):** 1542  
**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling		Ceiling Tiles (lay-in), 24x24 white rough textured			C	Y		300(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	PF
Wall		Paint			A	Y		3840(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF

**Client:** Collingwood General and Marine Hospital    **Site:** 459 Hume Street, Collingwood, ON  
**Location:** #80 : Food Receiving Area    **Floor:** B  
**Survey Date:** 2025-04-02

**Building Name:** Collingwood General and Marine Hospital  
**Room #:**    **Area (sqft):** 189  
**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling		Ceiling Tiles (lay-in), 24x48 beige random pinhole			C	Y		168(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	PF

## CONFIRMED AND PRESUMED HAZARDOUS MATERIALS REPORT

**Client:** Collingwood General and Marine Hospital    **Site:** 459 Hume Street, Collingwood, ON  
**Location:** #83 : Preparation Area    **Floor:** B  
**Survey Date:** 2025-04-02

**Building Name:** Collingwood General and Marine Hospital  
**Room #:**    **Area (sqft):** 139  
**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling		Ceiling Tiles (lay-in), 24x48 beige random pinhole			C	Y		139(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	PF
Wall		Paint			A	Y		400(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF

**Client:** Collingwood General and Marine Hospital    **Site:** 459 Hume Street, Collingwood, ON  
**Location:** #84 : Storage Area    **Floor:** B  
**Survey Date:** 2025-04-02

**Building Name:** Collingwood General and Marine Hospital  
**Room #:**    **Area (sqft):** 123  
**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling		Ceiling Tiles (lay-in), 24x48 beige random pinhole			C	Y		168(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	PF
Wall		Paint			A	Y		340(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF



## CONFIRMED AND PRESUMED HAZARDOUS MATERIALS REPORT

**Client:** Collingwood General and Marine Hospital    **Site:** 459 Hume Street, Collingwood, ON  
**Location:** #85 : Supply Storage Room    **Floor:** B  
**Survey Date:** 2025-04-02

**Building Name:** Collingwood General and Marine Hospital  
**Room #:**  
**Last Re-Assessment:** 2025-04-01

**Area (sqft):** 69

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Floor <sup>1</sup>		Vinyl Floor Tile, 12x12 green mottled			A	Y		69(7)			SF	S0008ABC	Chrysotile	0.5-5%	Confirmed Asbestos	NF
Wall		Paint			A	Y		300(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF

1 - 16 sf of tiles removed, mastic exposed but in good condition

**Client:** Collingwood General and Marine Hospital    **Site:** 459 Hume Street, Collingwood, ON  
**Location:** #86 : Preparation Area    **Floor:** B  
**Survey Date:** 2025-04-02

**Building Name:** Collingwood General and Marine Hospital  
**Room #:**  
**Last Re-Assessment:** 2025-04-01

**Area (sqft):** 1202

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling		Ceiling Tiles (lay-in), 24x48 beige random pinhole			C	Y		1300(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	PF
Wall		Paint			A	Y		400(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF

## CONFIRMED AND PRESUMED HAZARDOUS MATERIALS REPORT

**Client:** Collingwood General and Marine Hospital    **Site:** 459 Hume Street, Collingwood, ON  
**Location:** #88 : Dry Food Storage    **Floor:** B  
**Survey Date:** 2025-04-02

**Building Name:** Collingwood General and Marine Hospital  
**Room #:**    **Area (sqft):** 162  
**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling		Ceiling Tiles (lay-in), 24x48 beige random pinhole			C	Y		158(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	PF
Wall		Paint			A	Y		400(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF

**Client:** Collingwood General and Marine Hospital    **Site:** 459 Hume Street, Collingwood, ON  
**Location:** #90 : Dishwashing Station    **Floor:** B  
**Survey Date:** 2025-04-02

**Building Name:** Collingwood General and Marine Hospital  
**Room #:**    **Area (sqft):** 505  
**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Wall		Paint			A	Y		150(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF

## CONFIRMED AND PRESUMED HAZARDOUS MATERIALS REPORT

**Client:** Collingwood General and Marine Hospital

**Site:** 459 Hume Street, Collingwood, ON

**Building Name:** Collingwood General and Marine Hospital

**Location:** #91 : Equipment Storage Room

**Floor:** B

**Room #:**

**Area (sqft):** 217

**Survey Date:** 2025-04-02

**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Wall		Paint			A	Y		60(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF

**Client:** Collingwood General and Marine Hospital

**Site:** 459 Hume Street, Collingwood, ON

**Building Name:** Collingwood General and Marine Hospital

**Location:** #92 : Custodial Closet

**Floor:** B

**Room #:**

**Area (sqft):** 18

**Survey Date:** 2025-04-02

**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Wall		Paint			A	Y		120(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF

## CONFIRMED AND PRESUMED HAZARDOUS MATERIALS REPORT

**Client:** Collingwood General and Marine Hospital    **Site:** 459 Hume Street, Collingwood, ON  
**Location:** #93 : Office 11    **Floor:** B  
**Survey Date:** 2025-04-02

**Building Name:** Collingwood General and Marine Hospital  
**Room #:**    **Area (sqft):** 116  
**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling		Ceiling Tiles (lay-in), 24x48 beige random pinhole			C	Y		116(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	PF

**Client:** Collingwood General and Marine Hospital    **Site:** 459 Hume Street, Collingwood, ON  
**Location:** #94 : Office 12    **Floor:** B  
**Survey Date:** 2025-04-02

**Building Name:** Collingwood General and Marine Hospital  
**Room #:**    **Area (sqft):** 172  
**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling		Ceiling Tiles (lay-in), 24x48 beige random pinhole			C	Y		172(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	PF

## CONFIRMED AND PRESUMED HAZARDOUS MATERIALS REPORT

**Client:** Collingwood General and Marine Hospital

**Site:** 459 Hume Street, Collingwood, ON

**Building Name:** Collingwood General and Marine Hospital

**Location:** #97 : EVS Admin Closet

**Floor:** B

**Room #:**

**Area (sqft):** 29

**Survey Date:** 2025-04-02

**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Wall		Paint			A	Y		90(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF

**Client:** Collingwood General and Marine Hospital

**Site:** 459 Hume Street, Collingwood, ON

**Building Name:** Collingwood General and Marine Hospital

**Location:** #101 : Training Room Corridor

**Floor:** B

**Room #:**

**Area (sqft):** 366

**Survey Date:** 2025-04-02

**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Wall		Paint			A	Y		680(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF

## CONFIRMED AND PRESUMED HAZARDOUS MATERIALS REPORT

**Client:** Collingwood General and Marine Hospital    **Site:** 459 Hume Street, Collingwood, ON  
**Location:** #103 : Electrical Room    **Floor:** B  
**Survey Date:** 2025-04-02

**Building Name:** Collingwood General and Marine Hospital  
**Room #:**    **Area (sqft):** 136  
**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Wall		Paint			A	Y		490(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF

**Client:** Collingwood General and Marine Hospital    **Site:** 459 Hume Street, Collingwood, ON  
**Location:** #120 : Physiotherapy Coat Room    **Floor:** B  
**Survey Date:** 2025-04-02

**Building Name:** Collingwood General and Marine Hospital  
**Room #:**    **Area (sqft):** 129  
**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling		Ceiling Tiles (lay-in), 24x48 beige random pinhole			C	Y		129(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	PF

## CONFIRMED AND PRESUMED HAZARDOUS MATERIALS REPORT

**Client:** Collingwood General and Marine Hospital

**Site:** 459 Hume Street, Collingwood, ON

**Building Name:** Collingwood General and Marine Hospital

**Location:** #121 : Lab Waiting Room

**Floor:** B

**Room #:**

**Area (sqft):** 209

**Survey Date:** 2025-04-03

**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Wall		Paint			A	Y		70(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF

**Client:** Collingwood General and Marine Hospital

**Site:** 459 Hume Street, Collingwood, ON

**Building Name:** Collingwood General and Marine Hospital

**Location:** #123 : Lab Corridor

**Floor:** B

**Room #:**

**Area (sqft):** 108

**Survey Date:** 2025-04-03

**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Wall		Paint			A	Y		160(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF

## CONFIRMED AND PRESUMED HAZARDOUS MATERIALS REPORT

**Client:** Collingwood General and Marine Hospital

**Site:** 459 Hume Street, Collingwood, ON

**Building Name:** Collingwood General and Marine Hospital

**Location:** #124 : Supply Closet

**Floor:** B

**Room #:**

**Area (sqft):** 28

**Survey Date:** 2025-04-03

**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Wall		Paint			A	Y		70(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF

**Client:** Collingwood General and Marine Hospital

**Site:** 459 Hume Street, Collingwood, ON

**Building Name:** Collingwood General and Marine Hospital

**Location:** #125 : Universal Washroom

**Floor:** B

**Room #:**

**Area (sqft):** 29

**Survey Date:** 2025-04-03

**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Wall		Paint			A	Y		70(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF



## CONFIRMED AND PRESUMED HAZARDOUS MATERIALS REPORT

**Client:** Collingwood General and Marine Hospital

**Site:** 459 Hume Street, Collingwood, ON

**Building Name:** Collingwood General and Marine Hospital

**Location:** #126 : Lab Staff Room

**Floor:** B

**Room #:**

**Area (sqft):** 260

**Survey Date:** 2025-04-03

**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Wall		Paint			A	Y		110(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF

**Client:** Collingwood General and Marine Hospital

**Site:** 459 Hume Street, Collingwood, ON

**Building Name:** Collingwood General and Marine Hospital

**Location:** #127 : Lab Reception/Office Area

**Floor:** B

**Room #:**

**Area (sqft):** 182

**Survey Date:** 2025-04-03

**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Wall		Paint			A	Y		300(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF

## CONFIRMED AND PRESUMED HAZARDOUS MATERIALS REPORT

**Client:** Collingwood General and Marine Hospital

**Site:** 459 Hume Street, Collingwood, ON

**Building Name:** Collingwood General and Marine Hospital

**Location:** #128 : Lab

**Floor:** B

**Room #:**

**Area (sqft):** 2036

**Survey Date:** 2025-04-03

**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Wall		Paint			A	Y		1380(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF

**Client:** Collingwood General and Marine Hospital

**Site:** 459 Hume Street, Collingwood, ON

**Building Name:** Collingwood General and Marine Hospital

**Location:** #129 : Lab Storage Room

**Floor:** B

**Room #:**

**Area (sqft):** 220

**Survey Date:** 2025-04-03

**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Wall		Paint			A	Y		500(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF

## CONFIRMED AND PRESUMED HAZARDOUS MATERIALS REPORT

**Client:** Collingwood General and Marine Hospital    **Site:** 459 Hume Street, Collingwood, ON  
**Location:** #130 : Lab Work Room    **Floor:** B  
**Survey Date:** 2025-04-03

**Building Name:** Collingwood General and Marine Hospital  
**Room #:**    **Area (sqft):** 280  
**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Wall		Paint			A	Y		280(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF

**Client:** Collingwood General and Marine Hospital    **Site:** 459 Hume Street, Collingwood, ON  
**Location:** #131 : Stairwell    **Floor:**     
**Survey Date:** 2025-04-03

**Building Name:** Collingwood General and Marine Hospital  
**Room #:**    **Area (sqft):** 176  
**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Piping	Hot Water Heating	Parging Cement, Hot water heating pipe system			C	Y		10(7)			EA	S0009ABC	Chrysotile	10-25%	Confirmed Asbestos	F

## CONFIRMED AND PRESUMED HAZARDOUS MATERIALS REPORT

**Client:** Collingwood General and Marine Hospital

**Site:** 459 Hume Street, Collingwood, ON

**Building Name:** Collingwood General and Marine Hospital

**Location:** #132 : Corridor 5

**Floor:** B

**Room #:**

**Area (sqft):** 79

**Survey Date:** 2025-04-03

**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Wall		Paint			A	Y		122(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF

**Client:** Collingwood General and Marine Hospital

**Site:** 459 Hume Street, Collingwood, ON

**Building Name:** Collingwood General and Marine Hospital

**Location:** #133 : Lab Office

**Floor:** B

**Room #:**

**Area (sqft):** 172

**Survey Date:** 2025-04-03

**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Wall		Paint			A	Y		542(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF

## CONFIRMED AND PRESUMED HAZARDOUS MATERIALS REPORT

**Client:** Collingwood General and Marine Hospital    **Site:** 459 Hume Street, Collingwood, ON  
**Location:** #134 : EVS Supply Room    **Floor:** B  
**Survey Date:** 2025-04-03

**Building Name:** Collingwood General and Marine Hospital  
**Room #:**    **Area (sqft):** 178  
**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Wall		Paint			A	Y		178(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF

**Client:** Collingwood General and Marine Hospital    **Site:** 459 Hume Street, Collingwood, ON  
**Location:** #135 : First Floor Elevator Lobby    **Floor:** 1  
**Survey Date:** 2025-04-03

**Building Name:** Collingwood General and Marine Hospital  
**Room #:**    **Area (sqft):** 662  
**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling		Ceiling Tiles (lay-in), 24x24 white mottled			C	Y		662(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	PF

CONFIRMED AND PRESUMED HAZARDOUS MATERIALS REPORT

**Client:** Collingwood General and Marine Hospital  
**Location:** #138 : Dialysis Storage Supply Closet  
**Survey Date:** 2025-04-03

**Site:** 459 Hume Street, Collingwood, ON  
**Floor:** 1

**Building Name:** Collingwood General and Marine Hospital  
**Room #:**  
**Last Re-Assessment:** 2025-04-01

**Area (sqft):** 30

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Wall		Paint			A	Y		100(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF

**Client:** Collingwood General and Marine Hospital  
**Location:** #144 : Check In Area  
**Survey Date:** 2025-04-03

**Site:** 459 Hume Street, Collingwood, ON  
**Floor:** 1

**Building Name:** Collingwood General and Marine Hospital  
**Room #:**  
**Last Re-Assessment:** 2025-04-01

**Area (sqft):** 1020

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling		Ceiling Tiles (lay-in), 24x24 white mottled			C	Y		1020(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	PF

## CONFIRMED AND PRESUMED HAZARDOUS MATERIALS REPORT

**Client:** Collingwood General and Marine Hospital

**Site:** 459 Hume Street, Collingwood, ON

**Building Name:** Collingwood General and Marine Hospital

**Location:** #157 : Ambulance Bay

**Floor:** 1

**Room #:**

**Area (sqft):** 1023

**Survey Date:** 2025-04-03

**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Wall		Paint			A	Y		1572(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF

**Client:** Collingwood General and Marine Hospital

**Site:** 459 Hume Street, Collingwood, ON

**Building Name:** Collingwood General and Marine Hospital

**Location:** #158 : Ambulance Entry Vestibule

**Floor:** 1

**Room #:**

**Area (sqft):** 93

**Survey Date:** 2025-04-03

**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Wall		Paint			A	Y		90(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF

## CONFIRMED AND PRESUMED HAZARDOUS MATERIALS REPORT

**Client:** Collingwood General and Marine Hospital    **Site:** 459 Hume Street, Collingwood, ON  
**Location:** #162 : Emergency Room Staff Area    **Floor:** 1  
**Survey Date:** 2025-04-03

**Building Name:** Collingwood General and Marine Hospital  
**Room #:**    **Area (sqft):** 417  
**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Floor		Vinyl Sheet Flooring, Grey			A	Y		417(7)			SF	V0024	Chrysotile	0.5-5%	Confirmed Asbestos	PF

**Client:** Collingwood General and Marine Hospital    **Site:** 459 Hume Street, Collingwood, ON  
**Location:** #237 : X Ray Control Room    **Floor:** 1  
**Survey Date:** 2025-04-03

**Building Name:** Collingwood General and Marine Hospital  
**Room #:**    **Area (sqft):** 102  
**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Floor		Vinyl Sheet Flooring, Grey			A	Y		102(7)			SF	S0024ABC	Chrysotile	0.5-5%	Confirmed Asbestos	PF



## CONFIRMED AND PRESUMED HAZARDOUS MATERIALS REPORT

**Client:** Collingwood General and Marine Hospital    **Site:** 459 Hume Street, Collingwood, ON  
**Location:** #247 : Universal Washroom    **Floor:** 1  
**Survey Date:** 2025-04-03

**Building Name:** Collingwood General and Marine Hospital  
**Room #:**    **Area (sqft):** 29  
**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Floor		Vinyl Floor Tile, 12x12 teal mottled			A	Y		29(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF

**Client:** Collingwood General and Marine Hospital    **Site:** 459 Hume Street, Collingwood, ON  
**Location:** #265 : Wheelchair Storage Room    **Floor:** 1  
**Survey Date:** 2025-04-03

**Building Name:** Collingwood General and Marine Hospital  
**Room #:**    **Area (sqft):** 125  
**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling		Ceiling Tiles (lay-in), 24x48 beige random pinhole			C	Y		16(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	PF

## CONFIRMED AND PRESUMED HAZARDOUS MATERIALS REPORT

**Client:** Collingwood General and Marine Hospital    **Site:** 459 Hume Street, Collingwood, ON  
**Location:** #266 : Inpatient Manager Office    **Floor:** 1  
**Survey Date:** 2025-04-03

**Building Name:** Collingwood General and Marine Hospital  
**Room #:**    **Area (sqft):** 128  
**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling		Ceiling Tiles (lay-in), 24x48 beige random pinhole			C	Y		16(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	PF

**Client:** Collingwood General and Marine Hospital    **Site:** 459 Hume Street, Collingwood, ON  
**Location:** #291 : Server Room    **Floor:** 1  
**Survey Date:** 2025-04-04

**Building Name:** Collingwood General and Marine Hospital  
**Room #:**    **Area (sqft):** 134  
**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Floor <sup>1</sup>		Vinyl Floor Tile, 12"x12" green mottled			A	Y		40(7)			SF	V0008	Chrysotile	0.5-5%	Confirmed Asbestos	NF

1 - 16 sf of tiles removed, mastic exposed but in good condition

## CONFIRMED AND PRESUMED HAZARDOUS MATERIALS REPORT

**Client:** Collingwood General and Marine Hospital    **Site:** 459 Hume Street, Collingwood, ON  
**Location:** #292 : Supply Room    **Floor:** 1  
**Survey Date:** 2025-04-04

**Building Name:** Collingwood General and Marine Hospital  
**Room #:**    **Area (sqft):** 141  
**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Floor <sup>1</sup>		Mastic			A	Y		8(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF

1 - Presumed mastic from ACM mastic under floor tiles in adjoining server room

**Client:** Collingwood General and Marine Hospital    **Site:** 459 Hume Street, Collingwood, ON  
**Location:** #293 : ICU Washroom    **Floor:** 1  
**Survey Date:** 2025-04-04

**Building Name:** Collingwood General and Marine Hospital  
**Room #:**    **Area (sqft):** 26  
**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Wall		Paint			A	Y		150(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF

## CONFIRMED AND PRESUMED HAZARDOUS MATERIALS REPORT

**Client:** Collingwood General and Marine Hospital    **Site:** 459 Hume Street, Collingwood, ON  
**Location:** #302 : Stairwell    **Floor:**  
**Survey Date:** 2025-04-04

**Building Name:** Collingwood General and Marine Hospital  
**Room #:**    **Area (sqft):** 212  
**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling		Ceiling tiles (glue-on), 12x12 random pinhole			C	Y		212(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	PF
Wall		Paint			A	Y		95(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF

**Client:** Collingwood General and Marine Hospital    **Site:** 459 Hume Street, Collingwood, ON  
**Location:** #303 : Second Floor Elevator Lobby    **Floor:** 2  
**Survey Date:** 2025-04-04

**Building Name:** Collingwood General and Marine Hospital  
**Room #:**    **Area (sqft):** 665  
**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling		Ceiling Tiles (lay-in), 24x24 white mottled			C	Y		662(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	PF

## CONFIRMED AND PRESUMED HAZARDOUS MATERIALS REPORT

**Client:** Collingwood General and Marine Hospital    **Site:** 459 Hume Street, Collingwood, ON  
**Location:** #317 : Stairwell    **Floor:**  
**Survey Date:** 2025-04-04

**Building Name:** Collingwood General and Marine Hospital  
**Room #:**    **Area (sqft):** 229  
**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Wall		Paint			A	Y		152(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF

**Client:** Collingwood General and Marine Hospital    **Site:** 459 Hume Street, Collingwood, ON  
**Location:** #326 : OB Room 225    **Floor:** 2  
**Survey Date:** 2025-04-04

**Building Name:** Collingwood General and Marine Hospital  
**Room #:**    **Area (sqft):** 419  
**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling		Ceiling Tiles (lay-in), 24x24 white mottled			C	Y		250(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	PF

## CONFIRMED AND PRESUMED HAZARDOUS MATERIALS REPORT

**Client:** Collingwood General and Marine Hospital

**Site:** 459 Hume Street, Collingwood, ON

**Building Name:** Collingwood General and Marine Hospital

**Location:** #358 : Janitor's Closet

**Floor:** 2

**Room #:**

**Area (sqft):** 15

**Survey Date:** 2025-04-04

**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Wall		Paint			A	Y		40(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF

**Client:** Collingwood General and Marine Hospital

**Site:** 459 Hume Street, Collingwood, ON

**Building Name:** Collingwood General and Marine Hospital

**Location:** #359 : Stairwell

**Floor:** 2

**Room #:**

**Area (sqft):** 191

**Survey Date:** 2025-04-04

**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Wall		Paint			A	Y		570(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF

## CONFIRMED AND PRESUMED HAZARDOUS MATERIALS REPORT

**Client:** Collingwood General and Marine Hospital    **Site:** 459 Hume Street, Collingwood, ON  
**Location:** #360 : Wheelchair Storage Room    **Floor:** 2  
**Survey Date:** 2025-04-04

**Building Name:** Collingwood General and Marine Hospital  
**Room #:**    **Area (sqft):** 110  
**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling		Ceiling Tiles (lay-in), 24x48 beige random pinhole			C	Y		16(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	PF

**Client:** Collingwood General and Marine Hospital    **Site:** 459 Hume Street, Collingwood, ON  
**Location:** #361 : Surgical Managers Office    **Floor:** 2  
**Survey Date:** 2025-04-04

**Building Name:** Collingwood General and Marine Hospital  
**Room #:**    **Area (sqft):** 124  
**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Ceiling		Ceiling Tiles (lay-in), 24x48 beige random pinhole			C	Y		16(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	PF

## CONFIRMED AND PRESUMED HAZARDOUS MATERIALS REPORT

**Client:** Collingwood General and Marine Hospital

**Site:** 459 Hume Street, Collingwood, ON

**Building Name:** Collingwood General and Marine Hospital

**Location:** #388 : EVS supply Room

**Floor:** 2

**Room #:**

**Area (sqft):** 31

**Survey Date:** 2025-04-04

**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Wall		Paint			A	Y		2450(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF

**Client:** Collingwood General and Marine Hospital

**Site:** 459 Hume Street, Collingwood, ON

**Building Name:** Collingwood General and Marine Hospital

**Location:** #398 : Mechanical Room

**Floor:** 2

**Room #:**

**Area (sqft):** 426

**Survey Date:** 2025-04-04

**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Wall		Paint, Paint on brick wall			A	Y		300(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF



## CONFIRMED AND PRESUMED HAZARDOUS MATERIALS REPORT

**Client:** Collingwood General and Marine Hospital

**Site:** 459 Hume Street, Collingwood, ON

**Building Name:** Collingwood General and Marine Hospital

**Location:** #399 : Corridor

**Floor:** 2

**Room #:**

**Area (sqft):** 607

**Survey Date:** 2025-04-04

**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Wall		Paint, Paint on block wall			A	Y		200(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF

**Client:** Collingwood General and Marine Hospital

**Site:** 459 Hume Street, Collingwood, ON

**Building Name:** Collingwood General and Marine Hospital

**Location:** #400 : Stairwell

**Floor:**

**Room #:**

**Area (sqft):** 190

**Survey Date:** NaN-NaN-NaN

**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Wall		Paint			A	Y		570(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF

## CONFIRMED AND PRESUMED HAZARDOUS MATERIALS REPORT

**Client:** Collingwood General and Marine Hospital

**Site:** 459 Hume Street, Collingwood, ON

**Building Name:** Collingwood General and Marine Hospital

**Location:** #401 : Stairwell

**Floor:**

**Room #:**

**Area (sqft):** 190

**Survey Date:** NaN-NaN-NaN

**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Wall		Paint			A	Y		570(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	NF

**Client:** Collingwood General and Marine Hospital

**Site:** 459 Hume Street, Collingwood, ON

**Building Name:** Collingwood General and Marine Hospital

**Location:** #403 : Exterior

**Floor:**

**Room #:**

**Area (sqft):** 0

**Survey Date:** 2025-04-04

**Last Re-Assessment:** 2025-04-01

ASBESTOS																
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard	Friable
Structure	Canopy	Texture Coat			C	Y		22(7)			SF	V9500	Presumed Asbestos		Presumed Asbestos	F

## Legend:

Sample number	Units	Other
S#### Asbestos sample collected	SF Square feet	A Access
V#### Material visually similar to numbered sample collected	LF Linear feet	V Visible
V0000 Known non-asbestos material	EA Each	AP Air Plenum
V9000 Visually identified as an asbestos material	% Percentage	F Friable material
V9500 Material is presumed to be an asbestos material		NF Non Friable material
		PF Potentially Friable material

Access	Condition
A Accessible to all building occupants	Good No visible damage or deterioration
B Accessible to maintenance and operations staff without a ladder	Fair Minor, repairable damage, cracking, delamination or deterioration
C Accessible to maintenance and operations staff with a ladder. Also rarely entered, locked areas	Poor Irreparable damage or deterioration with exposed and missing material
D Not normally accessible	

Visible	Air Plenum
Y The material is visible when standing on the floor of the room, without the removal or opening of other building components (e.g. ceiling tiles or access panels).	Yes or No The material is in a return air plenum or in a direct airstream or there is evidence of air erosion (e.g. duct for heating or cooling blowing directly on or across an ACM). This field is only completed where Air Plenum consideration is required by regulation.
N The material is not visible to view when standing on the floor of the room and requires the removal of a building component (e.g. ceilings tiles or access panels) to view and access. Includes rarely entered crawlspaces, attic spaces, etc. Observations will be limited to the extent visible from the access points.	
L The material is partially visible to view when standing on the floor of the room and requires the removal of a building component (e.g. ceiling system or access panels) to view completely and access. Includes partially viewed access points to crawlspaces, attic spaces, etc. without entering. Observations are limited to the extent visible from the access points.	

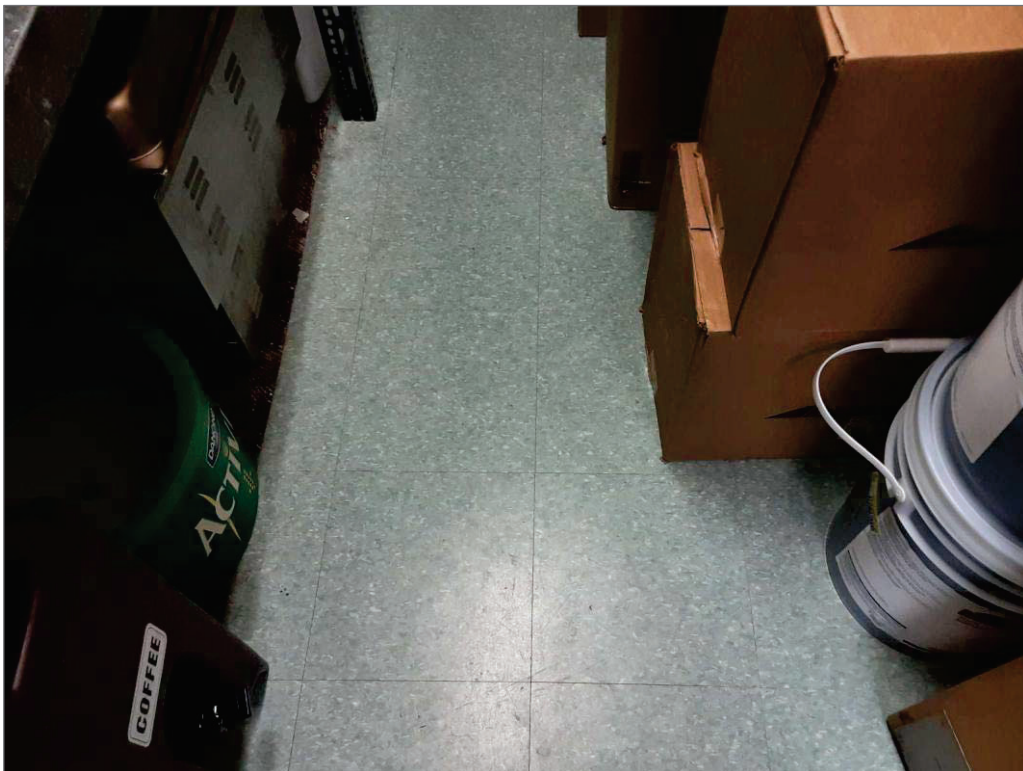
Colour Coding
The material is a hazardous material, either by analytical results or by visible identification.
The material is presumed to be a hazardous material, based on visual appearance, and was not sampled due to limited access or the non-destructive nature of sampling.

Action
(1) Clean up of ACM Debris (2) Precautions for Access Which may Disturb ACM Debris (3) ACM removal
(4) Precautions for Work Which may Disturb ACM in Poor Condition (5) Proactive ACM removal (Minimum repair required for fair condition) (6) ACM repair
(7) Management program and surveillance

**APPENDIX VI**  
**Photographs**

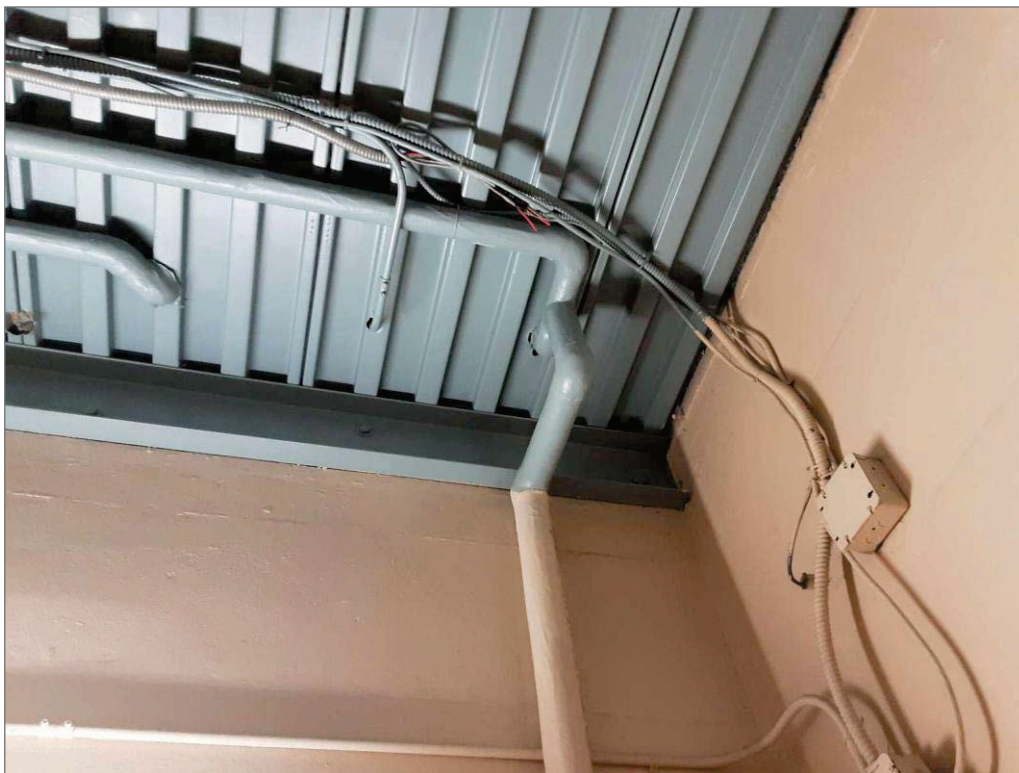


S0001 (Confirmed Asbestos), Parging cement-LPS pipe fitting insulation, Piping, Parging Cement, Boiler Room Mezzanine (Location #: 8)



S0008A (Confirmed Asbestos), 12"x12" green mottled, Floor, Vinyl Floor Tile, Supply Storage Room (Location #: 85)  
16 sf of tiles removed, mastic exposed but in good condition



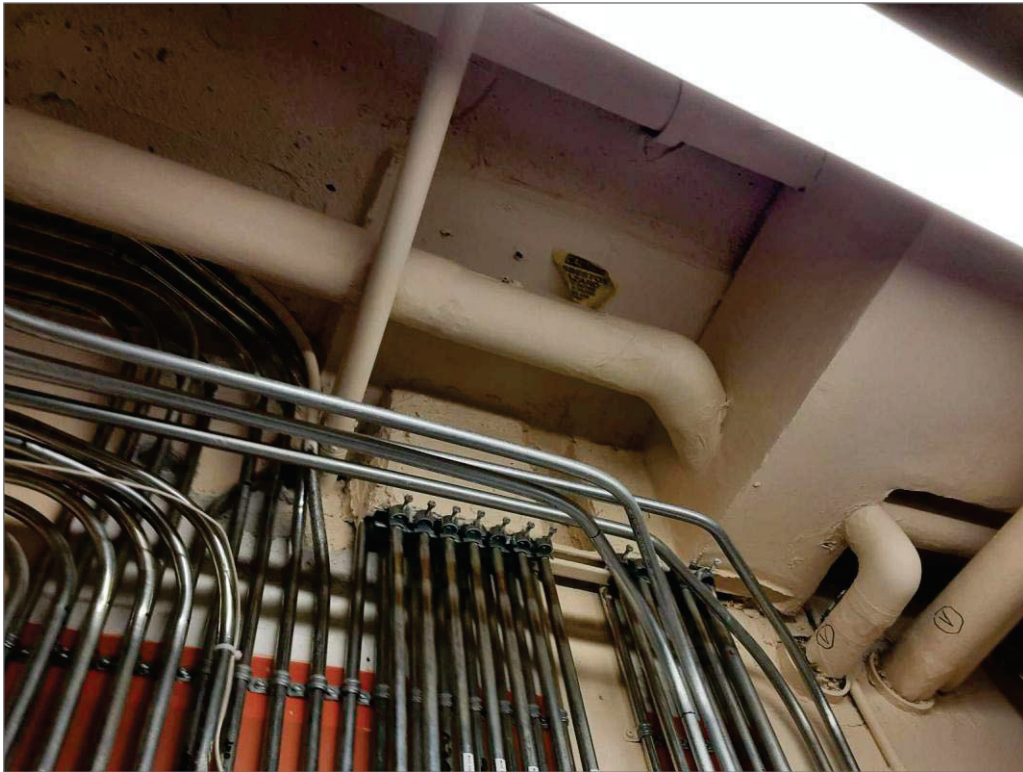


S0009A (Confirmed Asbestos), Hot water heating pipe system, Piping, Hot Water Heating, Parging Cement, Stairwell  
(Location #: 131)

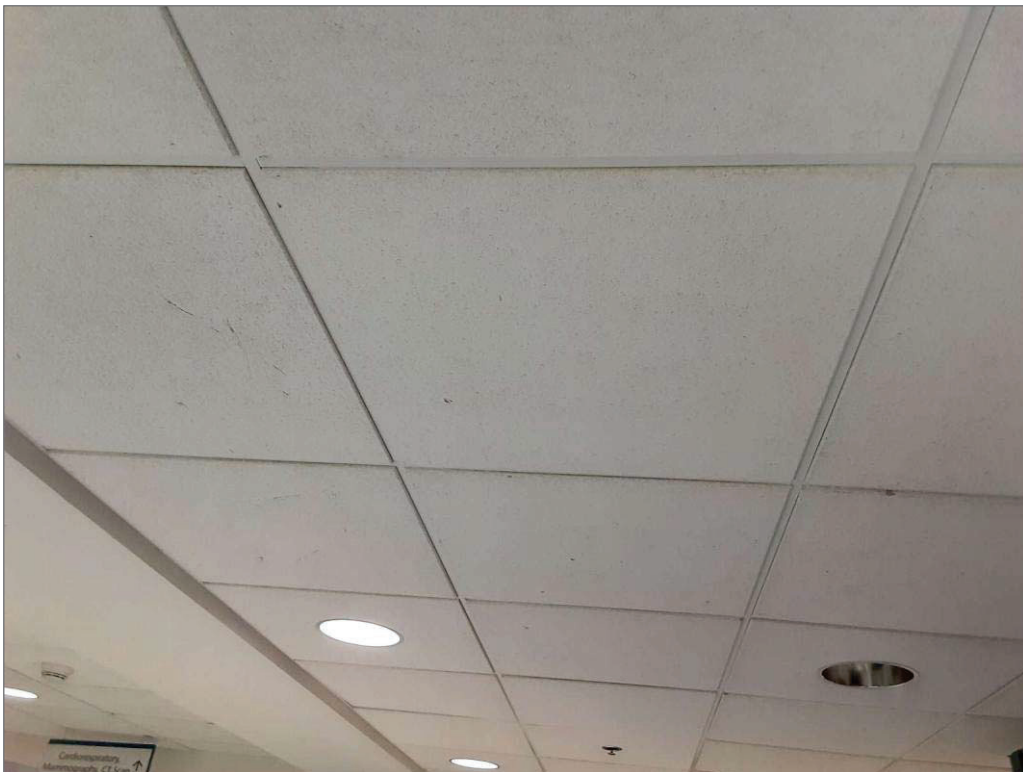


S0024A (Confirmed Asbestos), Grey, Floor, Levelling compound concealed by Vinyl Sheet Flooring, X Ray Control Room  
(Location #: 237)





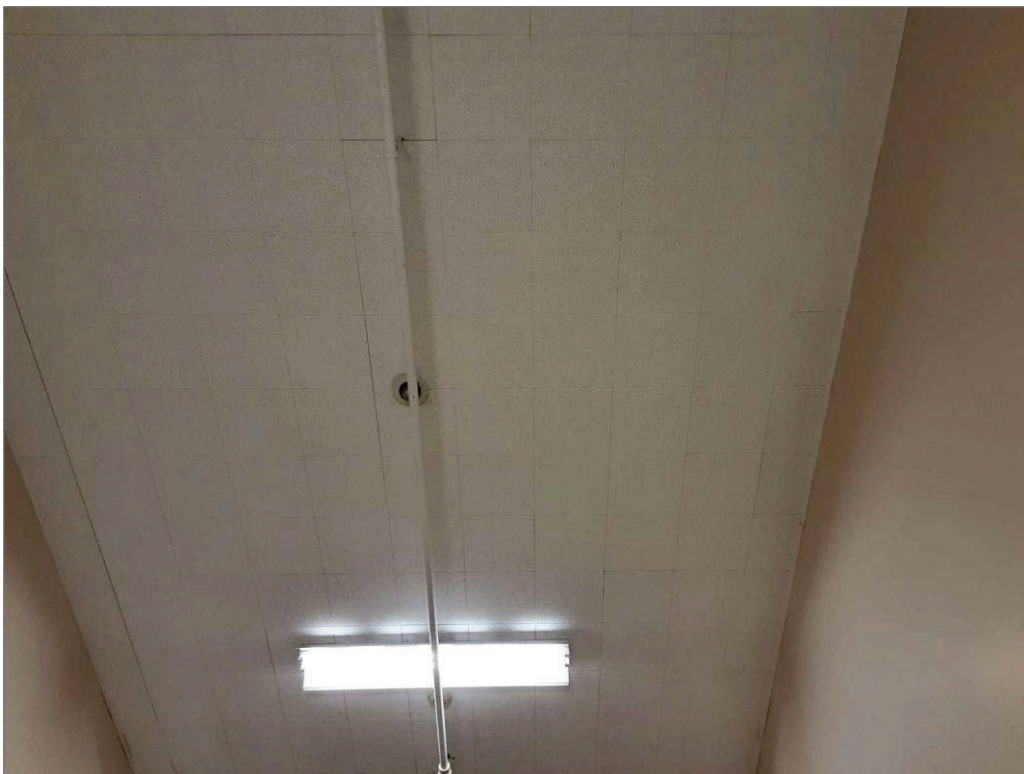
V9000 (Confirmed Asbestos), Fittings above plaster ceiling, as identified by the client. Not accessible, Piping, Parging Cement, Fire Alarm Control Centre (Location #: 39)



V9500 (Presumed Asbestos), 24x24 white mottled, Ceiling, Ceiling Tiles (lay-in), First Floor Elevator Lobby (Location #: 135)



V9500 (Presumed Asbestos), 12x12 teal mottled, Floor, Vinyl Floor Tile, Universal Washroom (Location #: 247)



V9500 (Presumed Asbestos), 12x12 random pinhole, Ceiling, Ceiling tiles (glue-on), Stairwell (Location #: 302)





V9500 (Presumed Asbestos), Structure, Canopy, Texture Coat, Exterior (Location #: 403)



V9500 (Presumed Asbestos), 24x24 white rough textured, Ceiling, Ceiling Tiles (lay-in), Corridor 3 (Location #: 76)



V9500 (Presumed Asbestos), 24x48 beige random pinhole, Ceiling, Ceiling Tiles (lay-in), Food Receiving Area (Location #: 80)



Status **Active** PolicyStat ID **16290785**



Origination 08/2024  
Last Approved 08/2024  
Effective 08/2024  
Last Revised 08/2024  
Next Review 08/2027

Owner Shannan Saunders:  
Director,  
Emergency  
Preparedness  
and Support  
Servi  
Area Administration

## Contractor- Policies

### Purpose:

Collingwood General and Marine Hospital (CGMH) duty under the OHSA as an employer, owner or constructor cannot be delegated or evaded by contracting out the performance of work to independent contractors (i.e. work can be contracted out but responsibility for health and safety cannot). CGMH has established and will maintain a program of safety prequalification for contractors undertaking large capital projects (greater than \$50,000) or any ongoing maintenance contracts. No contractor shall provide any services to CGMH prior to receiving a contract or purchase order for the services. The contractor recognizes that adherence to CGMH safety policies and legislated safety requirements are a contractual condition. Non-compliance with requirements will result in corrective actions including dismissal from the site and up to termination of the contract.

### Policy Statement:

As an employer CGMH is committed to mitigating the occurrence of any unsafe situations which may present a risk to employees, professional staff, patients, visitors or other contractors from unsafe practices.

### Guiding Principles:

A person or company that is hired by Collingwood General and Marine Hospital (CGMH) to perform temporary work is a contractor.

The work is specific and carried out for a defined period of time. Contractors will often be hired at CGMH to perform work for which the skills or experience to work in a certain area are not present in house.

CGMH recognizes the responsibility to take reasonable precautions for the protection of persons within its premises. As such, this document will provide information and direction regarding the responsibilities

both for CGMH and its contractors under the Occupational Health and Safety Act.

## **Definitions:**

### **Contractor:**

An individual or company that is hired to conduct work, whether construction or nonconstruction, under the direction of an employer or constructor

### **Competent:**

Means qualified because of knowledge, training and experience; is familiar with Ontario's Occupational Health and Safety Act and the regulations that apply to the work; and has knowledge of any potential and actual dangers to health or safety in the workplace.

### **Construction:**

Defined as anything "new" being constructed or installed, including the installation of any new equipment or machinery.

### **Constructor:**

A person who undertakes a construction project for an owner and includes an owner who undertakes all or part of a project by himself or by more than one employer

### **Delivery Persons:**

Employer means a person who employs one or more workers or contracts for the services of one or more workers and includes a contractor or subcontractor who performs work or supplies services or undertakes with an owner, constructor, contractor, or subcontractor to perform work or supply services.

### **Employer**

An employer is defined as a person who employs or contracts for the service of one or more workers.

### **Service Contractor:**

Those contractors performing services which are periodic but short in duration. Work is performed inside or outside the hospital where risks are relatively low i.e. snow removal companies

### **Maintenance Contractor:**

Those contractors working on machines/equipment/tools, which may pose a high degree of hazard; however, those contractors are generally technically competent and their stay at the location is generally short i.e. telephone repairmen

### **Project Contractor:**

Those contracted on-site for a lengthy period of time. Workers may be exposed to a fairly large number of hazards ie. Construction companies, asbestos abatement firms, cable installers



## **Maintenance:**

Non-construction work, or more commonly referred to as maintenance, repair or service type work, is anything that is NOT considered construction.

## **CGMH Project Lead:**

A Hospital employee who is currently, within their job function, recognized as being responsible for supervision of Contractors and responsible for ensuring that Contractor's work meets CGMH expectations in terms of safety and quality

## **Safety Officer**

A CGMH employee may be assigned as appropriate, considering the project scope.

# **Policy and Procedure:**

## **Prequalifying**

Prequalifying contractors helps to arrange in advance, competent qualified contractors for the job at hand.

Where appropriate, the prequalification process is as follows

- Include all contractors that are used regularly in the workplace, as well as those who may only work one time during the year, or on an ad hoc basis (ie photocopier tech, snow removal, courier, HVAC tech, etc)
- Classify the contractors into one for the three following categories:
  - Group 1 – Service Contractor;
  - Group 2 – Maintenance Contractor; or
  - Group 3 – Project Contractor
- Develop pre-qualification documents for each group of contractors. For example, A list of criteria for contractors to meet might include training certificates, licenses, WSIB clearance certificates and so on;
- Ensure that the prequalification process is documented for due diligence purposes.

## **Pre-Bid Document Requirements:**

- Contractors internal safety policy;
- CAD-7 or NEER Experience Rating profile;
- Prior job performance evaluations (references); and
- Contractors Health & Safety booklet for its staff (outlining programs and training)

The prequalifying process shall be used to review whether the contractor has written policies, practices and procedures for the hazards in the workplace offered for bid.

All Contractors which bid on a project will be entered into the Contractor database and identified as

either:

- Acceptable, in that all necessary requirements have been met and provided to the CGMH;
- Not Acceptable, in that the contractor has failed to complete the prequalification process or to respond to any assistance in order to become a candidate in the bidding; or
- Pending, in that the contractor has submitted their Project Safety Management Contractor Safety Prequalification document and is reviewing/updating to meet the needs of the Hospital.

No bid will be evaluated unless a prequalifying process has been completed first. If the prequalifying process has been completed within the previous twelve months, and is acceptable to the Safety Officer, the Contractor may not be required to resubmit. They will be included as one of the “Authorized Contractors”.

**Delivery companies/persons are not required to complete the prequalifying process. However, they shall not perform any services, other than delivery, while on CGMH premises**

A “Bidding Package” will be sent to qualified and potential contractors that meet the above requirements.

## Contractor Selection

Once a task has been identified to be carried out by one or more prequalified contractors, CGMH will complete a hazard assessment of the task identifying all potential hazards that could be encountered during the project.

The above hazard assessment will be presented to each prequalified contractor for their input to how each hazard will be controlled.

In addition to the above, all potential contractors who have met the Pre-Bid requirements will be supplied with the following:

- a list of any designated substances within the proposed project area;
- the CGMH Contractor policy;
- the site specific safety requirements; and
- Specific guidelines for the contractor.

The contractor will be selected through a two part process. First and foremost, the contractor who best addresses the hazards identified should be selected. However, In the event that more than one contractor successfully completes the hazard assessment, a second process, or envelop that includes pricing should then be considered to determine who the contract will be awarded to. **Pricing should never be the initial deciding factor.**

### **Pre-Contract requirements provided by potential contractor:**

- WSIB “Certificate of Clearance”, other proof of insurance
- Training records for any job requiring qualifications (i.e., WHMIS, confined space, asbestos, first aid).
- copies of trades person licenses

- WHMIS binder with MDS for every product that will be used on site.
- Contractors Health & Safety booklet for its staff (outlining programs and training)
- Specific guidelines for hazardous work (elevated work)
- Name of competent supervisor
- Name of health and safety representative
- Name of all members on skill trades committee(s),

## Contractor Bids

All costs and expenses necessary for complying with the safety requirements are to be included in the proposal or bid submitted by the contractor.

## Orientation

Once the contract has been awarded and before the commencement of any work, the CGMH Project Lead will

- Provide initial orientation of all site policies, procedures, emergency responses plans and requirements.
- Schedule a pre-job meeting to clarify procedures and regulations, and to introduce the Safety Officer and Infection Control Practitioner as appropriate, to discuss and ensure that work is planned and carried out in a manner that does not expose any worker(s), volunteer(s), visitor(s), patient(s) or other persons at the hospital to any undue risk by:
  - Completing a hazard assessment of the work requirements of the project;
  - Ensuring that appropriate hazard assessment strategies with the CGMH Project Lead to ensure that appropriate hazard management strategies have been developed and implemented.

## Monitoring

Before any work is allowed to begin the following will be completed by the Contractor and validated by the project lead:

- The contractor must obtain and post at applicable work sites, any required notices of project, forms, Acts and Regulations as per legislative requirements.
- Post copy of the Contractors Health and Safety Policy and program
- First Aid requirements (O.Reg 1101) are met
- An employer of five or more workers on a project shall appoint a supervisor for the workers [O.Reg213 sec 15(1)]
- The supervisor will provide initial orientation of all site policies, procedures and requirements and continually thereafter for any new/reassigned workers
- Completion of "Safe Work Permit" for level of risk

During the course of the project work the Contractor shall:

- Appoint a Supervisor to supervise the work at all times either personally or by having an assistant, who is a competent person, to do so personally. [O.Reg 213 sec14(2) or 15(2)]
- Assign the Supervisor or a competent person appointed by the supervisor to:
  - ensure all workers work in compliance with OHSA and its regulations, the contract, the contractor and employer policies, procedures and guidelines.
  - inspect all machinery and equipment, including fire extinguishing equipment, electrical installations, communication systems, sanitation and medical facilities, building and other structures, temporary supports and means of access and egress at the project to ensure that they do not endanger any worker. The inspection shall be documented and made at least once a week or more frequently as the supervisor determines.
  - perform tests and observations necessary for the detection of hazardous conditions on a project
  - advise all workers of any potential or actual dangers
  - provide workers with written instructions as required
  - ensure all applicable workers utilize and wear equipment and/or personal protective equipment required
  - ensure daily housekeeping assignments are completed
  - hold weekly project progress report meeting, where applicable
  - track accident incident status reports monthly

Monitoring contractors helps to ensure that the contractor is fulfilling their contractual obligations to meet health and safety compliance. In addition, monitoring also allows for ongoing communication with the contractor about any new hazards or changes within the job being performed.

The frequency of monitoring is dependent on the length and the risk level of the job. Jobs that are over a long period of time may require more monitoring activities, with longer time frames in between than those jobs that are shorter. The risk level must also be considered when determining monitoring frequency. The higher the risk, the more monitoring is likely to be required. As with any health and safety practice, monitoring contractors should be a process that is documented thoroughly. Not only will monitoring serve to meet legal compliance, but will also review contractor performance, which ultimately may have an impact on future contracts.

Monitoring on an CGMH level by the Safety Officer or Infection Control Practitioner may be arranged through the CGMH Project Lead so as to ensure that entry to the work area can be done so safely.

CGMH reserves the right to suspend and/or terminate any work which has been deemed to be a Health and Safety or Infection Control Risk to its staff, patients or the general public. These situations will be taken seriously and will be addressed immediately with the Contractor.

## **Enforcement**

When contractors are working on CGMH property, they will be obligated and expected to work within the



established health and safety and infection control rules of the Hospital plus all applicable OSHA regulations at all times. It is important that all contractors are treated equally, and that no double standards are applied among them.

Penalties for non compliance must also be clearly indicated and enforced. Discipline results in due diligence as well as demonstrative commitment to health and safety.

## **Evaluation**

Prior to closure of the project the CGMH project lead must conduct an:

- Evaluation of safety compliance, accident statistics and work quality
- Evaluation of general housekeeping, final cleanup and job completion

Based on the above the CGMH Project Lead will ascertain whether the contractor has fully completed their contractual obligations and whether they would be hired for future jobs.

If a record is required to be kept available for inspection at a project, the constructor or employer shall keep the record for a least one year after the project is finished.

## **Communication**

This procedure will be communicated by the CGMH Project Lead to the Contractor and appropriate CGMH staff.

The Contractor will notify the hospital:

- Immediately of any unplanned damage to property not owned by the contractor;
- Immediately of any critical injury or fatality to a person from any cause at the workplace that occurs at CGMH; or
- Within 48 hours of any other injury or illness sustained by a contract worker that occurs as a result of work performed at or for CGMH.

## **Documentation**

CGMH will maintain a record or:

- All contractors who have received CGMH orientation training; and
- All contractors injuries/illnesses which occurred as a result of work performed for or on behalf of CGMH

# **Roles and Responsibilities**

## **Employer**

- Hires competent contractors to perform work at or for the hospital;
- Appoints a competent Project Lead for every project where contract work is performed at or

- for the hospital;
- Provides identification for all contract workers working at the hospital;
- Maintains a sign-in sheet for all contract workers performing work at the hospital
- Retains a contractor as the constructor for construction purposes
- Where a contractor is hired as the constructor for construction no hospital employee other than the MHA Project Lead shall perform work of any kind associated with the construction project.

## **CGMH Project Lead**

- Responsible for ensuring that the contractor meets and maintains the minimum requirements established by the terms of the contract including but not limited to minimum liability insurance, WSIB Clearance Certificates, skills competency including trades licensing, safety qualifications (e.g. WHMIS) and on-site compliance to CGMH's infection control and health/safety programs;
- Monitors the activities of the contractor while the contractor is performing work for the CGMH;
- Stops work where the work presents an immediate danger to any person or presents an unacceptable risk of damage to CGMH property; or
- Immediately notifies their Director when the contractor is in violation of any term of the contract.
- Organizes a stakeholder meeting prior to project commencement regarding any non-obvious risks.
- Provides a copy of any applicable CGMH specific documentation to the selected Contractor which may affect the health and safety of their staff and the facility as a whole i.e. asbestos inventory

## **Contractor**

- Provides goods and services at the CGMH in accordance with the Ontario Occupational Health and Safety Act and associated regulations.
- Distributes necessary personal protective equipment (PPE) to contractor employees in order to ensure their safety during project work i.e. Hard hat, safety shoes, flame resistant clothing, eye, hearing and hand protection, etc.)
- Ensures CGMH is aware of all sub-contractors hired by the contractor and that they have received proper CGMH procedure training.
- Reports all accidents/incidents, near misses or environmental incidents involving the contractor, and immediately stops work until notification of the CGMH Project Lead occurs.

## **Safety Officer**

- Reviews Contractor Safety Prequalification submissions as needed
- Retains a list of all approved contractors as needed

## Joint Health and Safety Advisory Committee (JHSC)

- Will include contractor's adherence to their health and safety roles and responsibilities when conducting monthly inspections.

## Appendices:

### Code of Conduct

<https://collingwoodgmh.policystat.com/policy/13372697/latest>

### Confidentiality and Privacy

<https://collingwoodgmh.policystat.com/policy/13605923/latest>

### Discrimination and Harassment

<https://collingwoodgmh.policystat.com/policy/13372711/latest>

### Workplace Violence Prevention Program

<https://collingwoodgmh.policystat.com/policy/13308452/latest>

### Occupational Health and Safety

<https://collingwoodgmh.policystat.com/policy/14264713/latest>

### WHIMIS

<https://collingwoodgmh.policystat.com/policy/15189480/latest>

### Infection, Prevention and Control

<https://collingwoodgmh.policystat.com/policy/12171489/latest>

## Approval Pathway:

Reviewing Committee	Date	Status (Pending/Approved)

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## Attachments

## Approval Signatures

Step Description	Approver	Date
Kris Baird, VP People & Safety, CHRE provides Final Approval	Kris Baird: Vice President, People Services and Safety	08/2024
Policy Owner approves changes & completes Data Chart	Shannan Saunders: Director, Emergency Preparedness and Support Servi	08/2024

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Status **Active** PolicyStat ID **14486779**



Origination 04/2022  
Last Approved 08/2024  
Effective 08/2024  
Last Revised 08/2024  
Next Review 08/2027

Owner Tiffany Gordon:  
Infection  
Prevention and  
Control  
Practitioner  
  
Area Infection  
Prevention and  
Control

## Construction, Renovation, Maintenance, Repair Projects: Infection Prevention and Control Measures

### Purpose:

Construction, renovation and maintenance or repair projects in the hospital can pose infection control challenges. Spreading of dust or water which can be contaminated with bacteria and/or fungi can occur when wall, ceilings, ventilation systems, water systems or floor spaces are vibrated or disturbed. Disease producing microorganisms can contaminate equipment, air handling or water systems and may be transmitted to susceptible patients, staff or visitors causing illness.

This policy and procedure is written to:

- Maintain patient and staff safety by preventing compromise or contamination of air and water with biological contaminants during repair, maintenance, renovation or construction projects at Collingwood General and Marine Hospital
- Ensure that good communication and a multidisciplinary, proactive approach is undertaken for any construction/renovation/maintenance/repair project at Collingwood General and Marine Hospital
- Ensure compliance with construction/building codes, standards and regulations that impact on occupational health and safety and infection prevention and control.

### Policy Statement:

1. All repair, maintenance, renovation, and construction projects at Collingwood General and Marine Hospital will be planned and performed to reduce infection and health and safety risks, thus ensuring a safe environment for patients, employees, and visitors.
2. Compliance with local, provincial, and federal rules, regulations, codes, and guidelines will minimize risks associated with facility systems.

3. For any repair, maintenance, renovation and/or construction project, a Risk Assessment and Preventative Measures Analysis will be carried out during the planning phase.
4. The Project Manager will ensure that during the planning stage, all involved management personnel and staff have reviewed information about the proposed project and are provided with the opportunity to make recommendations according to the population risk group, the construction activity type (Appendix A) and the type of preventative measures (Appendix B) that are required to be followed.
5. Cleaning both within the project area and in the area external to the project site will be included in the budget of each construction project. For all Class III and IV activities, the contractor will be responsible for cleaning the project site, and CGMH Hospital's EVS staff will be responsible for cleaning the exterior adjacent areas
6. The IPAC Practitioner will educate hospital and contracted staff working on or affected by Class III and IV projects regarding activities and risks associated with the project and required infection prevention and control measures. The IPAC Practitioner and the Project Manager are responsible for identifying the individuals who require training. The Contractor and Hospital Managers are responsible for ensuring that designated staff attend as required.
7. Areas undergoing repair, maintenance, renovation, and/or construction will be monitored daily or at an agreed-upon frequency by selected individuals (refer to Procedure) to evaluate whether appropriate health and safety and infection prevention measures are followed.
8. If preventive measures and safety standards are not meeting the criteria laid out and/or the amount of dust/debris being generated is felt to be unacceptable and unsafe for patient care and staff working conditions, the individual in charge of the project will be notified, and the project may require cessation until the situation is rectified. Work will only resume when conditions are improved and patients and staff are safe.
9. For any breach of infection prevention and control and safety standards, as required by constructors and outlined in this policy and procedure, and consequent stoppage and/or corrective actions, the constructor will pay for all associated costs incurred by CGMH as well as for correction for the work.

## Definitions:

Contractor - a person who undertakes a repair, renovation or construction project for the hospital, e.g. a contractor, subcontractor, construction manager, construction worker, or tradesperson. It also includes hospital employees who personally undertake all or part of a repair, maintenance, renovation or construction project.

## Policy and Procedure:

### Responsibilities:

1. **Project Manager (Manager of Facilities Operation and Maintenance or designate):**
  - Provide a copy of this Policy and Procedure (including Appendices A – G) to all Constructors bidding on requests for proposals.
  - Ensure project bid documents and contracts include specifications for infection prevention and control measures and continued communication with IPAC

Practitioner before and during the construction.

- As a minimum, the contract language will indicate that the Constructor will meet CSA standard Z317.13-07.
- Prior to all construction/renovation/maintenance or repair projects, coordinate the completion of a "Risk Assessment for Hospital Construction, Renovation, Maintenance or Repair Projects" form (Appendix A) identifying the nature of the project, type of construction activity, population risk group and preventive measures level required.
- For all projects involving preventive measures I and II, obtain a signature of agreement from the Constructor, EVS and any involved Unit/Departmental Managers. Determine if consultation with IPAC Practitioner and/or Occupational Health and Safety Officer (OH) is required.
- For all projects involving preventive measures III and IV, consult with and obtain additional signatures of agreement from IPAC Practitioner and OH Officer.
- Copies of the completed form will be kept in the office of the Manager of Facilities Operation and Maintenance.
- Once the form has been completed, ensure the constructors are aware of and implement the Preventive Measures that correspond to the Risk Assessment (Preventive Measures -I, II, III or IV- are outlined in Appendix A – F).
- Decide who will be represented at planning, design, construction and commissioning meetings and organize such multidisciplinary meetings, as required.
- Oversee and coordinate the activities of and manage information flow amongst constructors and other hospital employees involved in the project.
- Ensure signs are posted as necessary to indicate to patients/employees/visitors that repairs/maintenance/renovations or construction is taking place in designated areas.
- Monitor the constructors to ensure they are adhering to the interventions listed in the appropriate "Preventive Measure Recommendations for Hospital Construction/ Renovation/ Repair Activity"
- Identify essential services (e.g. water supply, electricity and ventilation systems) that could be disrupted and provide alternative sources as required.
- Notify affected Departmental Managers and IPAC Practitioner of pending disruptions to patient care areas, providing sufficient time for the implementation of alternative arrangements.
- Ensure contingency plans for emergency response to power failures, water supply disruptions, and fires are in place.
- Notify the Security Supervisor of any special provisions/requirements that they should be aware of for general patrol purposes and to assist in the event of an emergency situation.
- Inform appropriate departments regarding when the project(s) is to start, any required updates and when the project is complete.
- Stop construction if the presence of mould is possible, suspected or identified. Immediately notify IPAC Practitioner, OH Officer, Maintenance staff, contractors and

EVS. Follow “Mould Remediation: wheel developed by the Construction Safety Association of Ontario (Appendix 6).

- Complete a physical walk through the completed project area(s) with the EVS Supervisor and IPAC Practitioner to ensure it is safe and ready to use before patients or staff are readmitted.

## **2. Contractor:**

- Ensure all contracted work is carried out in a manner that meets with all local and provincial standards and codes to ensure patient and staff safety.
- Assess each project undertaken to identify Population Risk Group, Construction Activity Type and the Infection Prevention and Control Measures required (See Appendix A).
- Review the “Risk Assessment for Hospital Construction, Renovation, Maintenance or Repair Projects” form and if in agreement, sign, date and return the form to the Project Manager (consult with Project Manager to resolve any areas of disagreement, if required).
- Notify and obtain input from Infection Prevention and Control and other impacted department Managers during planning stages of any Preventive Measures Analysis Level III or IV project or when the population risk group is Group 4 and the Construction Activity is Type A (Appendix I).
- Ensure that the CSA standards Z317.13-07 and required Infection Prevention and Control Precautions based on Risk Class (see Appendix B).
- Plan to assign extra worker time to these projects, when required, as dictated by required infection prevention measures that meet CSA standards Z317.13-07.
- Plan and implement traffic control and restrictions to construction/renovation site.
- Ensure that materials are kept clean and dry during delivery and installation
- Be responsible for the physical security of the project zone.
- Ensure that the building systems at the project site are isolated from those in the hospital's occupied part to prevent contamination of air, water, medical gas, and other systems.
- Supply, erect, and maintain the integrity of all barriers between the project area and adjacent areas of the hospital.
- Ensure that all gaps, holes leading to adjacent areas and floors above or below the project site are securely sealed.
- Ensure contaminant and dust generation at the project site is within acceptable limits.
- Ensure that proper ventilation, air exchange rates and pressure relationships are monitored and maintained in project activity and patient care areas, and that air is not circulated from construction areas into patient care and other hospital areas.
- Discuss with Project Manager any potential for altering the temperature, airflow or negative/positive pressure status of high-risk areas (e.g. operating rooms, isolation rooms, MDRD etc.) to ensure that appropriate ventilation in these areas is maintained.
- When repair, maintenance, renovation or construction projects occur near air intakes,



ensure that filters are checked and evaluated once the project is completed.

- Notify the Infection Prevention and Control Service and impacted department Managers of any pending disruption to the air or water supply to patient care areas through repair, maintenance, renovation, or construction, providing sufficient time for the implementation of alternative arrangements.
- Ensure thorough cleaning of grilles and the changing of filters at end of the project, prior to connection to hospital.
- Ensure project site is tidy and appropriate environmental cleaning is performed as required.
- Ensure project area is left tidy, clean and safe daily.
- Consider air sampling (under the direction of IPAC) to monitor the effectiveness of physical barriers that separate construction areas from patient areas and/or to evaluate the condition of patient rooms closed due to construction before readmitting patients.
- Be responsible for the actions of their employees (as applicable) and sub-traders.
- Provide a daily report regarding project activities to the Project Manager.

### **3. Infection Prevention and Control:**

- Review the "Risk Assessment for Hospital Construction, Renovation, Maintenance or Repair Projects" and, if in agreement, sign, date, and return the form to the Project Manager (consult with the Project Manager to resolve any areas of disagreement if required).
- In collaboration with Departmental Manager(s), identify high-risk patients who will need to be temporarily moved away from the project area.
- Provide recommendations pertaining to infection prevention and control measures to the Project Manager.
- Communicate and collaborate with the Project Manager on an ongoing basis.
- Assist in the planning for potential disruption of air or water, when required.
- Be an active member of a formed multidisciplinary team throughout the life of the project, from the planning stage to the final evaluation after completion of the work.
- In collaboration with the Project Manager, ensure plans that include measures needed to protect patients, visitors and staff from contaminated air and water during construction are discussed and arranged with maintenance or the contractor and signed off before the start of any project. Designate a traffic pattern for constructors that avoids patient care areas and a traffic pattern for clean or sterile supplies and equipment that avoids the construction area.
- In collaboration with EVS, make recommendations on cleaning procedures that should be used in areas adjacent to the project area.
- In collaboration with the Project and Departmental Managers, identify individuals who require training and develop tailored education sessions to meet learning needs regarding preventive measures required to decrease construction-related infections.
- Provide and document attendance and completion of any Project-related Infection

#### Prevention and Control Training.

- Monitor project areas and compliance with the Preventive Measures outlined and agreed upon (as per Appendix B-F - CSA standards Z317.13-07) during project activities and report problems or non-compliance to the Project Manager.
- Stop construction if there is a failure to adhere to the required preventive measures outlined and agreed upon.
- Visit Population Risk Group 4 areas (see Appendix I) daily.
- Work with lab and patient care staff to ensure that an effective surveillance system is in place to identify patients at risk of acquiring construction-related infections and monitor patients for Legionella during soil excavation on or in proximity to hospital grounds or when the water supply has been disrupted and then depressurized.
- Act as a role model by wearing the appropriate PPE or safety equipment when visiting the project area.
- Help hospital employees ensure that patients, visitors and staff do not go near the project area.
- In collaboration with EVS staff, ensure that the construction area is thoroughly cleaned when work is complete.
- Inspect project area before hoarding removal if patients or staff will be admitted to finished areas.
- Complete a physical walk through the completed project area(s) with the Project Manager and EVS Manager to ensure it is safe and ready for use before admitting patients and staff.

#### **4. EVS Manager:**

- Review the "Risk Assessment for Hospital Construction, Renovation, Maintenance or Repair Projects" and, if in agreement, sign, date, and return the form to the Project Manager (consult with the Project Manager to resolve any areas of disagreement, if required).
- Determine who will be responsible for cleaning the areas adjacent to the project area(s) before the project starts.
- Plan to assign extra worker time to these projects, when required, as dictated by individual projects at the preliminary meeting.
- Complete a physical walkthrough to inspect the area(s) after project completion and clean with the project manager and/or IPAC to ensure it is safe and ready for use before admitting patients and staff.

#### **5. Unit/Department Manager, Nursing and other Employees Working in the Project Area:**

- Review the "Risk Assessment for Hospital Construction, Renovation, Maintenance or Repair Projects" and, if in agreement, sign, date, and return the form to the Project Manager (consult with the Project Manager to resolve any areas of disagreement, if required). Managers Only.
- Attend preliminary meetings to provide input into the project plan when work is in or adjacent to patient care areas.

- In the proposal stage of planning, consider patient safety and the impact of the project on workflow.
- Identify all Group 3 and 4 (see Appendix A) patients and relocate as appropriate. If air quality cannot be ensured during project activity, immunosuppressed patients will be moved to an area away from the project area.
- Ensure that patient care equipment and supplies are protected from dust exposure.
- Ensure that no high-risk patient is in the area during the time of project activity.
- Ensure patients, visitors, or staff do not visit or go near the project area until the work activity is over and the final cleaning has been completed.
- Collaborate with Stores and SPD to ensure the protection of sterile supplies. Ensure items/supplies are removed from the area before construction begins.
- Report discoloured water and water leaks to the Project Manager and Infection Prevention and Control.
- Notify the Project Manager and Infection Prevention and Control if dust is created from the project area and is uncontrolled or found in any patient care area.
- Notify EVS to thoroughly clean repaired/ renovated/ construction areas before readmitting patients or staff.

## References:

Association for Professionals in Infection Control and Epidemiology (APIC) (2007), Infection Control Tool Kit Series: Construction & Renovation. 3<sup>rd</sup> Ed. Available at: [https://apic.org/Resource\\_/store/books/preview/SLS9808\\_Preview.pdf](https://apic.org/Resource_/store/books/preview/SLS9808_Preview.pdf)

Bartley JM. APIC Text of Infection Control & Epidemiology. Volume II. Section 108: Construction and Renovation. 108-16. 2005. Available at: <https://text.apic.org/the-apic-text>

Canadian Standards Association (CSA) (2015) Infection Control during Construction or Renovation of Health Care Facilities, Standard CAN/CSA-Z317.13-07

Ontario Safety Association (2007) Occupational Health and Safety Act & Regulations, O.Reg 213/91, Construction Projects.

The New York City Department of Health and Mental Hygiene (2000), Guidelines on assessment and remediation of fungi in indoor environments accessed Mar 01/08 from web site: <http://www.health.state.ny.us/environmental/indoors/air/mold.htm>

Wayne Hansen. Infection Control during Construction Manual: Policies, Procedures and Strategies for Compliance. HCPPro, 2<sup>nd</sup> Ed. 2004. Available at: [https://hcmarketplace.com/media/browse/9613\\_browse.pdf](https://hcmarketplace.com/media/browse/9613_browse.pdf)

HPSC (2017). National Guidelines for the Prevention of Nosocomial Aspergillosis. Available at: <https://www.hpsc.ie/a-z/respiratory/aspergillosis/guidance/Aspergillus%20Appendix%20D%202018.pdf>

## Appendices:

Appendix A: Risk Assessment for Hospital Construction, Renovation, Maintenance or Repair Projects

Appendix B: Preventive Measure I: Recommendations for Hospital Construction/ Renovation/Repair Project Activity

Appendix C: Preventive Measure II: Recommendations for Hospital Construction/ Renovation/Repair Project Activity

Appendix D: Preventive Measure III: Recommendations for Hospital Construction/ Renovation/Repair Project Activity

Appendix E: Preventive Measure IV: Recommendations for Hospital Construction/ Renovation/Repair Project Activity

Appendix F: Mould Remediation Wheel

## Archived Approval Pathway:

PATH	COMMITTEE	DATE	PURPOSE	STATUS
<b>Originated</b>	Infection Prevention and Control Practitioner	23 Mar 2022	<b>DRAFT Agreement</b>	• completed
<b>Stakeholder Engagement</b>	Facilities Maintenance EVS Manager	29 Mar 2022	<b>Review &amp; Agreement</b>	• completed • completed
<b>Approving Committee</b>	Infection Prevention and Control Committee	4/Apr/2022	<b>FINAL Approval</b>	• completed
<b>Historical Dates:</b>				
<b>Original Policy Date:</b>			June 12, 2008	
<b>List of Dates Reviewed and Revised:</b>			Sept 2016 Mar 2017 Mar 2022	
<b>Policies This Document Replaces</b>			N/A	

Policy Archive Date:	N/A
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# Approval Pathway

Reviewing Committee	Date	Status (Pending/Approved)
EVS Manager	July 2024	Stakeholder Feedback Complete
IPAC Committee	July 2024	Approved

## Attachments

-  [Appendix A: Risk Assessment for Hospital Construction, Renovation, Maintenance or Repair Projects](#)
-  [Appendix B: Preventive Measure I: Recommendations for Hospital Construction/Renovation/Repair Project Activity](#)
-  [Appendix C: Preventive Measure II: Recommendations for Hospital Construction/Renovation/Repair Project Activity](#)
-  [Appendix D: Preventive Measure III: Recommendations for Hospital Construction/Renovation/Repair Project Activity](#)
-  [Appendix E: Preventive Measure IV: Recommendations for Hospital Construction/Renovation/Repair Project Activity](#)
-  [Appendix F: Mould Remediation Wheel.docx](#)

## Approval Signatures

Step Description	Approver	Date
Kris Baird, VP People & Safety, CHRE provides Final Approval	Kris Baird: Vice President, People Services and Safety	08/2024

Policy Owner approves  
changes & completes Data  
Chart

Tiffany Gordon: Infection  
Prevention and Control  
Practitioner

08/2024

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## Appendix A

### Collingwood General and Marine Hospital RISK ASSESSMENT FOR HOSPITAL CONSTRUCTION, RENOVATION, MAINTENANCE OR REPAIR PROJECTS

<b>Location of Project Activity:</b> Unit/Area/Room # SPECT/CT	<b>Project Start Date:</b> Feb/Mar 2026	<b>Estimated Duration/End Date:</b> Sept/Oct 2026
<b>Project Manager (PM):</b> TBD	<b>Project Number:</b>	<b>External Constructor(s):</b> <input type="checkbox"/> TBD

**Brief description of the project and additional considerations/precautions:**

Renovation of old CGMH Foundation office into new SPECT/CT and bone mineral density suites

**RECOMMENDED: Preventative measure IV**

#### PREVENTIVE MEASURES ANALYSIS

(v)	<u>Patient/Area Risk Group</u>	(v)	<u>Construction Activity</u>	(v)	<u>Preventive Measure</u>
	<b>Group 1:</b> Lowest Risk		<b>Type A:</b> Non-invasive activities		<b>I</b>
√	<b>Group 2:</b> Medium Risk		<b>Type B:</b> Small scale, short duration, minimal dust-generating activities		<b>II</b>
	<b>Group 3:</b> Med– High Risk		<b>Type C:</b> Activities that generate mod – high levels of dust require > one work shift to complete		<b>III</b>
	<b>Group 4:</b> High Risk	√	<b>Type D:</b> Activities that generate high levels of dust, major demolition and construction activities requiring consecutive work shifts to complete	√	<b>IV</b>

Area/Unit Below	Area/ Unit Above	Lateral	Lateral	Behind	Front
n/a	3	1	1	1	1
Risk Group	Risk Group	Risk Group	Risk Group	Risk Group	Risk Group

Reference: Canadian Standards Association (2015). Infection control during Construction or Renovation of Health Care Facilities, Standard Z317.13-07.

## CONSTRUCTION ACTIVITY TYPES

### **STEP ONE: Identify the Construction/Renovation/Repair Project Activity type.**

Construction activity types are defined by the amount of dust generated, the activity's duration, and the amount of shared HVAC systems. The following chart describes the 4 levels of construction activity that may occur within the hospital

<b>Type A</b>	<p><b>Inspection and Non-Invasive Activities.</b> These include but are not limited to activities that require:</p> <ul style="list-style-type: none"><li><input type="checkbox"/> Removal of ceiling tiles for visual inspection (limited to 1 tile per 50 square feet)</li><li><input type="checkbox"/> Opening of wall or ceiling panels</li><li><input type="checkbox"/> Painting (but not sanding)</li><li><input type="checkbox"/> Wall covering</li><li><input type="checkbox"/> Electrical trim work</li><li><input type="checkbox"/> Minor plumbing (disrupts water supply to a localized patient care area (ie. one room) <b>for less than 15 minutes</b>)</li><li><input type="checkbox"/> Other <b>maintenance activities that do not generate dust or require cutting of walls or access to ceilings other than for visual inspection</b></li></ul>
<b>Type B</b>	<p><b>Small scale, short duration activities that create minimal dust.</b></p> <p>These include but are not limited to activities that require:</p> <ul style="list-style-type: none"><li><input type="checkbox"/> access to chase spaces</li><li><input type="checkbox"/> cutting of walls or ceilings where dust can be controlled for the installation/repairs of minor electrical work, ventilation components, telephone wires or computer cables</li><li><input type="checkbox"/> sanding of walls for painting or wall covering to <i>only repair</i> small patches</li><li><input type="checkbox"/> plumbing work that disrupts water supply of more than one patient care area (ie. two or more rooms) <b>for less than 30 minutes</b></li></ul>
<b>Type C</b>	<p><b>Any work which generates a moderate to high level of dust or requires demolition or removal of any fixed building components or assemblies (e.g. sinks, countertops, cupboards)</b> These include but are not limited to activities that require:</p> <ul style="list-style-type: none"><li><input type="checkbox"/> sanding of a wall in preparation for painting or wall covering</li><li><input type="checkbox"/> removal of floor coverings or ceiling tiles and casework</li><li><input type="checkbox"/> new wall construction</li><li><input type="checkbox"/> minor duct work or electrical work above ceilings</li><li><input type="checkbox"/> major cabling activities</li></ul>



	<ul style="list-style-type: none"> <li>□ plumbing work that disrupts water supply of more than one patient care area (i.e. two or more rooms) for <b>more than 30 min. but less than 1 hour</b></li> <li>□ <b>any activity which cannot be completed within a single work shift.</b></li> </ul>
<b>Type D</b>	<p><b>Major demolition and construction and renovation projects that generate high levels of dust.</b></p> <p>These include, but are not limited to, activities that involve:</p> <ul style="list-style-type: none"> <li>□ heavy demolition</li> <li>□ removal of a complete cabling system</li> <li>□ new construction that <b>requires consecutive work shifts to complete.</b></li> <li>□ plumbing work that disrupts water supply of more than one patient care area (i.e. two or more rooms) <b>for one hour or more</b></li> </ul>

### PATIENT/GEOGRAPHICAL AREA RISK GROUPS

#### **STEP TWO: Identify the Patient/Geographical Area Risk Group.**

The chart below shows the risk (ranging from lowest to highest) that a particular hospital area may have if exposed to the construction zone. If more than one risk group will be affected, select the higher risk group.

<b>GROUP 1</b> <b>Lowest Risk</b>	<ul style="list-style-type: none"><li>• Office Areas</li><li>• Unoccupied rooms/wards</li><li>• Public areas/hallways</li><li>• Laundry and soiled linen cleaning areas</li><li>• Physical plant workshops</li><li>• Housekeeping areas</li></ul> (areas where generally no patients are seen and there is no patient through traffic)
<b>GROUP 2</b> <b>Medium Risk</b>	<ul style="list-style-type: none"><li>• Other Patient Care Areas not listed in Group 3 or Group 4</li><li>• Outpatient Clinics (except Oncology or Surgery)</li><li>• Waiting rooms</li><li>• Autopsy and morgue</li><li>• Physiotherapy &amp; Occupational therapy areas remote from patient care areas</li></ul>
<b>GROUP 3</b> <b>Medium To High Risk</b>	<ul style="list-style-type: none"><li>• Emergency (except trauma rooms)</li><li>• General Medical and Surgical Units</li><li>• Labor and birthing rooms (non-operating)</li><li>• Diagnostic imaging (DI)</li><li>• Radiology</li><li>• Nuclear medicine * including elevators used to transport patients</li><li>• Hydrotherapy</li><li>• Cardio/Respiratory areas</li><li>• Laboratory</li><li>• Admission/Discharge area</li><li>• Food preparation, serving and dining areas</li><li>• Clean linen handling and storage areas</li></ul>

<p><b>GROUP 4</b></p> <p><b>Highest Risk</b></p>	<ul style="list-style-type: none"> <li>• Trauma Rooms</li> <li>• Protective Precautions (Isolation) Rooms</li> <li>• Recovery Room</li> <li>• Surgical Day Care</li> <li>• Operating Suites, Labour &amp; Delivery (operating room)</li> <li>• Dental procedures room</li> <li>• Medical Reprocessing Department (MDRD)</li> <li>• Sterile supplies storage rooms</li> <li>• Oncology Units and outpatient clinics for cancer patients</li> <li>• Cardiovascular and cardiology patient areas</li> <li>• Endoscopy/Bronchoscopy rooms</li> <li>• Dialysis Unit</li> <li>• Intensive Care Unit (ICU)</li> <li>• Pharmacy (admixture room)</li> </ul>
--------------------------------------------------	-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

**All corridors/hallways adjacent to these areas without a physical barrier should be considered.**

## PREVENTATIVE MEASURES ANALYSIS

**STEP THREE: Match the**

► **Patient Area Risk Group (1 - Low, 2 - Medium, 3- - High, 4 - Highest)**

with the planned

► **Construction Activity Type (A, B, C or D)** on the following chart to determine the

► **Class of Precautions (I, II, III, or IV)** or level of infection control activities required.

The Preventative Measures Analysis chart below assists the Project Coordinator or Hospital team members **to identify the type of infection control activities required** by matching the construction activity and the patient/area risk group.

Patient/Area Risk Group	Construction Activity Type A	Construction Activity Type B	Construction Activity Type C	Construction Activity Type D
Group 1:	1	II	II	III/I V
Group 2	I	II	III	IV
Group 3	I	III	III/I V	IV
Group 4	I- III	III/I V	III/I V	IV

**Shaded Class Areas indicate that IPAC Practitioner and Occupational Health and Safety Officer must be consulted to assist in determining the appropriate preventive and control measures required.**

GENERAL NOTES:

NOTE: This room is minimal in size. The equipment in this room will function properly. However, the space around the system must be considered (i.e. space for additional equipment such as millwork, storage cabinets, stretchers, utility carts, injector cart, anesthesia cart, and etc.). The customer must review the layout and determine if enough space is available for their needs.

NOTE: The purpose of this layout drawing is primarily/specifically to illustrate the location(s) of the Siemens-supplied equipment. All non-Siemens and/or future and/or existing equipment (e.g. millwork, furniture, carts, etc.) is shown for representational purposes and may not accurately represent the actual on-site configurations. It is the responsibility of the customer/contractor that all related codes, policies (e.g. hospital requirements, building codes) and clearances to the Siemens equipment are followed when locating these ancillary items.

NOTE: All construction room upgrades (such as: new walls, doors, windows, millwork, plumbing, furniture, medical equip, and etc.) are shown for proposal purposes only. The customer is to provide these room upgrades. In the case of a turnkey, these room upgrades will be detailed in the contractor's quote. The contractor's quote takes precedence over the room layout drawings.

NOTE: This layout is preliminary only. Siemens reserves the right to make changes as dictated by new technical developments.

NOTE: The customer is responsible to have the transport route for Siemens equipment verified by the Structural Engineer (from point of delivery to final location).

NOTE: Additional anchoring may be required if the site is deemed as 'Seismic Zone' by local codes. the customer must verify the local code requirements and advise the Siemens Project Manager.

NOTE: Siemens is not an Architectural or Engineering firm. Drawings supplied by Siemens are not construction drawings. Therefore, these drawings are to be used only for information to complement actual construction drawings available from a customer-appointed Architectural representative or a Customer's Engineering design group. The Customer's Architect and General Contractor shall be ultimately responsible for compliance with all applicable codes and professional design requirements.

NOTE: Additional accessories that typically accompany the system will require storage space.

WALL and DOOR LEGEND:

Existing walls

New walls (by others).

Existing doors

New doors (by others)

NOTE: Contractor to site verify locations of all existing walls. The locations of existing walls may be different than as shown in this layout proposal.

PROPOSED LAYOUT

1 : 50

EXISTING LAYOUT

1 : 50

EQUIPMENT LEGEND - Symbia Pro.specta X3

No	DESIGNATION	HEAT (kW)	WEIGHT (kg)
1	SPECT Gantry (with HE Collimators and CT Gantry)		3710
2	CT Gantry - X3	1.00 (idle)	
3a	Front Patient Bed (PHS)		1061
3b	Rear Patient Bed (PHS) (with covers and SNAC)	6.20 (operation)	183
4	ICC + ACC + AQC (part of front PHS)		125
5	Patient Positioning Monitor (PPM) (above gantry)		7
6	Integrated Electronics Cabinet	0.15	194
7	UPS Cabinet (below IEC)	--	36
8	UPS (in UPS Cabinet)	0.40	48
9	----	--	--
10	----	--	--
11	Workplace (keyboard & control box)		9
12	Workplace (18" flat panel monitor)	0.08	14
13	Workplace (18" flat panel monitor)		14

SOME EQUIPMENT SHOWN ON THIS DRAWING MAY BE IDENTIFIED AS OPTIONAL. PLEASE REFER TO QUOTATIONS FOR ACTUAL EQUIPMENT TO BE DELIVERED

NOTE: These drawings reflect the installation requirements for all equipment provided by Siemens. Installation information from the manufacturer, and all resulting design requirements, are the responsibility of the customer/contractor should the customer purchase non-Siemens products or equipment by other means

NOTE: This set of final installation drawings reflects the latest sales configuration (OCF). Any changes to the sales configuration may require a revision to these project drawings. Siemens will produce a revised set of drawings to reflect the change(s), but Siemens will not be responsible for any construction costs associated with the change(s) that occur from the plan modification.

Symbia Recommended Room Height  
- Minimum room height for system = 2440 mm  
- Minimum room height for system with ceiling mounted injector = 2900 mm.

MAGNETIC FIELD PRECAUTIONS

The presence of magnetic fields in the vicinity of equipment may have an adverse effect. It is the Customer's responsibility to verify that the following values are not exceeded.	
Maximum Allowable Magnetic Field	Devices
1.0mT (10 Gauss)	Computers, magnetic disk drives, oscilloscopes, processors
0.5mT (5 Gauss)	X-Ray tubes, b/w monitors, magnetic data carriers, data storage devices
0.2mT (2 Gauss)	Siemens CT Scanners
0.15mT (1.5 Gauss)	Colour monitors, Siemens Linear Accelerators
0.05mT (0.5 Gauss)	X-Ray image intensifiers, gamma cameras, PET/Cyclotron, other linear accelerators
Magnetic fields should be measured prior to delivery of Siemens equipment.	

ENVIRONMENTAL REQUIREMENTS

GANTRY COOLING

No external hardware connections are required for air gantry cooling. A general overview of the air cooling function is shown.

ROOM CLIMATE

ITEM	DESCRIPTION
Air temperature	18°C to 30°C
Temperature gradient	4.4°C/hour
Humidity	20% to 75% non-condensing
Air flow rate (through the gantry)	Pro.specta Q3 & X3 1300 m³ per hour 1600 m³ per hour Pro.specta X7 1800 m³ per hour

TRANSPORT INFORMATION - SPECT (NARROW CONFIGURATION)

TRANSPORT INFORMATION - CT (NARROW CONFIGURATION)

TRANSPORT INFORMATION - PHS

TRANSPORT INFORMATION - CT (WIDE CONFIGURATION)

SCHEMATIC - EXAM ROOM (N.T.S.)

This Schematic Diagram represents the ideal finished Ceiling Height for this system and equipment configuration. If the on-site, final finished Ceiling Height will differ from what is currently shown, contact the Siemens PM to update this drawing and discuss any/all potential movement/functional restrictions of the equipment. A final Schematic Diagram with the final finished Ceiling Height is required before this drawing can be approved.

SCHEMATIC - EXAM ROOM (N.T.S.)

No

REVISIONS

CHKD

A

B

KISHAN B. 17 OCT 25  
- Updated drawing with new CAD file.  
KISHAN B. 29 OCT 25  
- General updates for installation drawing.

SUBMITTED FOR:

☐ Approval  
☐ Your use  
☐ Your records  
☒ Installation

APPROVED: \_\_\_\_\_

SIEMENS

Healthineers

Siemens Healthcare Limited

Planning Department

NOTE: ALL DIMENSIONS SHOWN MUST BE VERIFIED ON THE SITE. THIS DRAWING IS NOT TO BE REPRODUCED WITHOUT WRITTEN AUTHORIZATION.

CUSTOMER

COLLINGWOOD GENERAL & MARINE HOSPITAL

COLLINGWOOD, ONTARIO

GENERAL LAYOUT

EQUIPMENT

SYMBIA PRO.SPECTA X3

PO#

M105-000.891.01.06.02

DRAWN BY:

KISHAN B.

SCALE:

AS NOTED

CHKD BY:

---

DATE:

28 MAY 2025

HOSPITAL #

744

PROJECT #

015

DRAWINGSKETCH #

01

REVISION #

B



Recommended minimum floor area to be leveled and flattened (3000 x 6400 mm). See DETAIL A, Note 7.

Absolute minimum floor area to be leveled and flattened (2369 x 5720 mm). See DETAIL A, Note 7.

Front PHS floor plates. See DETAIL A.

SYMBIA Base Frame. See DETAIL A.

NOTE: All dimensions are referenced from the NM center field of view.

Dimensions shown in the drawing include: 3750, 2500, 20°, 1080, 1500, 1400, 2689, 3200, 3091, and 3200.

Technical drawing of a door assembly showing a vertical section with a handle and a dimension line indicating a height of 2500.

### INTEGRATED ELECTRONICS CABINET (IEC)

**NOTE:**

- No service space required on sides of cabinet.
- Mounting hardware for Integrated Electronics Cabinet and UPS are not provided. Please have local site structural engineer approve mounting and ensure compliance per local regulations.

### UPS CABINET

**NOTE:**

UPS weighs 48 kg (106 lbs) and fits inside UPS cabinet. UPS is D130 x H439 x W721 (D5.1" x H17.3" x W28.4").

Front door hinge on the right. UPS cabinet may be rotated and installed 180° from above.

UPS cabinet may need to be off the floor for connection to system.

UPS cabinet is designed to reside under the SIEMENS Integrated Electronics Cabinet.

**NOTE:**

- Cable entry / exit to / from integrated Electronics Cabinet
- Door hinge side 90° open MAX.

### BASE FRAME (IEC/UPS CABINET)

DESIGN PROPOSAL ONLY

**NOTE:**

- No service space required on sides of cabinet.
- IEC cabinet will be delivered to site prior to main system delivery. This will be the responsibility of the contractor to install the IEC cabinet and connect the power supply to it.
- For the location on the electrical Connection Point UPS, behind the UPS cabinet, see DWG 433-016-03.

**NOTE:**

- No service space required on sides of cabinet.
- IEC cabinet will be delivered to site prior to main system delivery. This will be the responsibility of the contractor to install the IEC cabinet and connect the power supply to it.
- For the location on the electrical Connection Point UPS, behind the UPS cabinet, see DWG 433-016-03.

### TOP VIEW

May be used for conduit out to X-ray light on, EPO or door switch

Pilot hole for main power coming in

Cutout under ground plate for cables to system and UPS

### TOP VIEW (RTS)

Fastening points under SIEMENS UPS cabinet

**SECTION A-A (RTS)**

C channel (8" tall). Frame to be bolted to floor, by others.

Opening complete with cover and screws (all 4 sides of base).

**NOTES:**

- Frame to be designed by Structural Engineer in order to be a solid and vibration-free mounting for SIEMENS equipment Cabinet.
- Mounting Frame and Floor Fasteners to be supplied by others/customer.

**RECOMMENDED EXAM ROOM ENVIRONMENT:**

- See CLIMATOGRAM below.
- The optimal environment for the operating personnel and the system is 24°C with a relative humidity of 40-60%.

**SPECIFICATIONS:**

- Temperature: 18° - 30° C. If the necessary temperature ranges cannot be guaranteed in all seasons of the year, an appropriate air-conditioning system must be installed on-site.
- Temperature Gradient: 4.4°C/hour max.
- Relative Humidity: 20% - 75% non-condensing.

- Minimum recommended ceiling height in the exam room and control areas is 2440 mm.

A psychrometric chart with Temperature in °C on the vertical axis (0 to 40) and % Relative Humidity on the horizontal axis (0 to 100). A horizontal dashed line is drawn at 16°C. Two shaded rectangular regions are shown: Region 1\* is a smaller rectangle with a solid border, and Region 2\* is a larger rectangle with a dashed border that encompasses Region 1\*. Both regions are located between 20% and 80% relative humidity and between 16°C and 30°C temperature. To the right of the chart, the text '\*1 RECOMMENDED OPERATION CONDITIONS' is aligned with Region 1\*, and '\*2 REQUIRED OPERATING CONDITIONS' is aligned with Region 2\*.

The following general conditions are necessary to have the status of "ready site":

- 1) Proper power available at SIEMENS equipment power cabinet location and all power outlets functioning.
- 2) Air conditioning/humidification systems complete, tested, and functioning properly according to SIEMENS specifications.
- 3) Proper lighting installed and functioning.
- 4) Plumbing complete except for any final connections to SIEMENS equipment.
- 5) All cable trays/dutys/conduits correctly sized, located, and installed according to the SIEMENS drawings.
- 6) All reinforcement plates/unistrut installed as required.
- 7) Room for equipment installation and immediate vicinity is dust-free and is to remain so for the duration of the installation.
- 8) A secure area (approximately 10' x 10') is available at equipment delivery for parts and installation tools.
- 9) Customer supplied cameras and processors installed.
- 10) Customer approval for SIEMENS remote services (SRS) connection, and customer's IT contact information and IP addresses established.
- 11) All surfaces to be primed and painted, floors to be tiled except in areas of the equipment base plates.

If these conditions are not met, the SIEMENS project manager and the designated SIEMENS installation supervisor shall reschedule the installation start date.

**NOTE:** additional cost may be incurred by the customer/customer and delivery dates may need to be rescheduled, when the SIEMENS site readiness guidelines are not met.

- 1 - All slab coring and drilling for field equipment mounting are provided by the Contractor/ Customer. These areas shall be scanned using acceptable industry methods.
- 2 - When installation does not conform with drawing submitted, the SIEMENS Project Manager must be contacted immediately. Changes may be made.
- 3 - All dimensions shown are from finished surfaces.
- 4 - All pre-installed base plates are to be mounted by the Contractor/Customer. Installation must be coordinated with, and under the supervision of, the SIEMENS Project Manager.
- 5 - All structural support details shown are sample details based upon typical and standard building practices and are not intended to be used as a basis for construction. Detailed design and support calculations shall be prepared by a professional Structural Engineer at the Customer's expense. In the event an existing support system is to be used, it will be the Customer's responsibility to verify the integrity of that system.

NOTE: Floor rails for CT gantry in service position (used during service only).

NOTE: All dimensions are referenced from the NM center field of view.

The front PHS floor plates are installed after the gantry is in position and aligned. (Detail shows left pivoting PHS plates configuration).

Dimensions and labels include:

- Overall width: 1361, 1480, 1620
- Internal width segments: 740, 740
- Overall height: 1320, 1924, 965, 330
- Internal height segments: 714, 462, 966, 49, 20
- Labels: A, B, C, D, E, F, G

- 1 - Maximum Gantry weight with heaviest collimators (HE) at SPECT "Home" position. Depending on SPECT Head Reconfiguration and rotation angle, the gantry loads can shift up to 20% (example Footing B and C can see 20% more load with A and C 20% less load. Total load remains the same).
- 2 - There can be additional transient impulse load of 1335 N (300 lbf) on each gantry foot (A, B, C & D) due to SPECT rotation (a slip-and-stop). Residual load is 1335 N (300 lbf). In addition, the transient impulse load per foot will be in compression on one side while in tension on opposite side.
- 3 - Load Includes rear PHIS and maximum patient weight. Rear bed reconfigures along with patient motion along top of bed, creates different worst case load conditions. There is a second worst case conditions where the patient load is at the opposite end of the bed, and here the following applies:  $F = (246 \text{ N}) (55 \text{ lbf})$ ,  $0.034 \text{ MPa}$  ( $0.5 \text{ psi}$ ), and  $F' = 3.343 \text{ N}$  ( $0.75 \text{ lbf}$ ),  $0.019 \text{ MPa}$  ( $2.7 \text{ psi}$ ).

- 1 - The base frame foot pads are mounted to the floor using 19 mm x 203 mm (3/4" x 8") long anchors (4 places). Then the leveling screws are used to level the gantry front to back and side to side. Once the gantry is level, the locking screws are tightened on all four pads.
- 2 - The minimum compressive strength for the floor cover (based on the worst-case loading of the collimator cart: 2 High Energy and 2 Medium Energy collimators) must be 2586 kPa (375 psi).
- 3 - Floor plate supplied and installed by SIEMENS.
- 4 - Prior to the start of installation, it is the customer's responsibility to ensure that the floor has sufficient load-bearing capacity for the Pro Spectra system. Please include finished floor surfaces (tile, wood, carpeting, etc.).

**6 - Both conduit openings to project 76 mm above the finished floor. Conduit opening (Ø25 mm) to be 1/2-NPT male thread.**

floor of the entire room be leveled and flattened according to specification; if this is not possible, it is imperative that the system installation area is leveled and flattened (2369 x 5720 mm).  
**Slope:** within  $\pm 25$  mm over 5720 mm.  
**Flatness:** surface must be smooth and have no more than 2 mm deviation in any 1220 mm throughout the room.

- Upon completion of the installation floor area, verify the surface flatness using a straight edge of 1220 mm (4') in length (or longer). Any measurement outside of acceptable limits must be leveled with leveling compound.

NOTE: Flow rate for CT capacity in service position (used during service only).

load calculations in this area (rear of system).

Front PHS Floor Load Information		
ID	Max. Load (Patient Home Position)	Max. Load <sup>1</sup> (Patient extended for brain imaging)
A	5,323 N (1,197 lbf) (10.3 MPa) (1,494 psi)	7,668 N (1,724 lbf) (14.84 MPa) (2,153 psi)
B <sup>2</sup>	1,149 N (258 lbf) (0.11 MPa) (16 psi)	~2,080 N (~468 lbf) tension 0 MPa (0 psi)
C <sup>3</sup>	1,462 N (329 lbf) (2.83 MPa) (410.5 psi)	0 N (0 lbf) tension 0 MPa (0 psi)

1 - The system must be installed in a vibration-free location. The minimum allowable concrete thickness of the scanner room floor, for non-seismic regions, is 152 mm (6"). The floor must be of concrete class C20/25 to C50/60.

2 - Floor plate supplied and installed by SIEMENS. For maximum floor level variation over the area of the system, see Detail above.

**PHS** = Patient Handling System  
**ICC** = Intergrated Collimator Changer (option)  
**AQC** = Automatic Quality Control (option)

THIS PLANNING PROPOSAL, TOGETHER WITH ANY ENCLOSED DOCUMENTATION AND SPECIFICATIONS, IS BASED ON THE MOST CURRENT TECHNICAL INFORMATION AVAILABLE AT THE TIME OF ISSUE. WE RESERVE THE RIGHT TO MAKE CHANGES AS DICTATED BY TECHNICAL DEVELOPMENTS.

SEISMIC REQUIREMENTS:  
ADDITIONAL ANCHORING MAY BE REQUIRED IF SITE IS DEEMED  
AS 'SEISMIC ZONE' BY LOCAL CODES. THE CUSTOMER MUST  
VERIFY THE LOCAL CODES REQUIREMENTS AND ADVISE THE  
SIEMENS PROJECT MANAGER.

IN ORDER TO AVOID DELAY IN INSTALLATION, SIEMENS CANADA LTD. PLANNING DEPT. SHOULD BE CONSULTED PRIOR TO INSTALLATION. FINAL ARCHITECTURAL DWGS SHOULD BE MADE AVAILABLE TO SIEMENS AT THIS TIME TO VERIFY THAT ALL REQUIREMENTS HAVE BEEN ADHERED TO.

THIS DRAWING DOES NOT PROVIDE RADIATION PROTECTION SPECIFICATIONS. IT IS SUGGESTED THAT A LICENSED RADIATION PHYSICIST BE CONSULTED.

SOME EQUIPMENT SHOWN ON THIS DRAWING IS OPTIONAL.  
PLEASE REFER TO QUOTATIONS FOR ACTUAL EQUIPMENT TO BE  
DELIVERED ALL ITEMS NOT SPECIFIED IN THE EQUIPMENT LEGEND  
(eg. COUNTERS) ARE TO BE SUPPLIED AND INSTALLED BY THE  
CUSTOMER/CONTRACTOR, ON APPROVAL BY THE CUSTOMER.

METRIC to IMPERIAL CONVERSIONS:  
1000mm = 39.37" 1'-0" = 304.8mm 1kg = 2.205lbs.

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS, UNLESS OTHERWISE SPECIFIED.

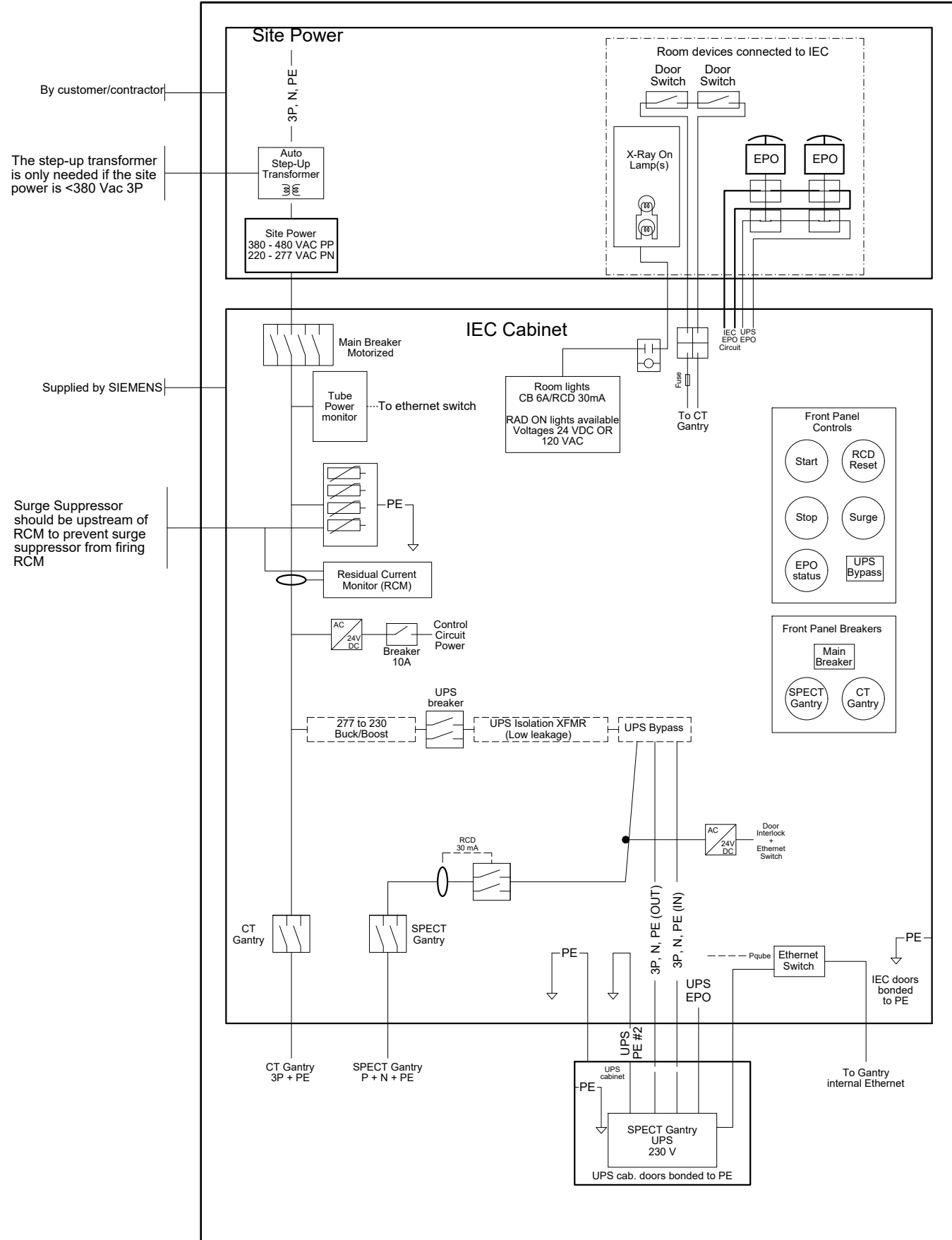
ALL DIMENSIONS SHOWN ARE FROM FINISHED SURFACES.

SEISMIC REQUIREMENTS:  
ADDITIONAL ANCHORING MAY BE REQUIRED IF SITE IS DEEMED  
AS 'SEISMIC ZONE' BY LOCAL CODES. THE CUSTOMER MUST  
VERIFY THE LOCAL CODES REQUIREMENTS AND ADVISE THE  
SIEMENS PROJECT MANAGER.

02



POWER DISTRIBUTOR LOCALLY SOURCED  
FOR SYMBIA Pro.specta Systems



POWER SUPPLY SCHEDULE (SYMBIA Pro.specta X3)

POWER REQUIREMENTS - SYMBIA Pro.specta X3  
LINE CONNECTION: ..... 3/N ~ 480V ±10%, 47 - 63 Hz  
LINE IMPEDANCE: ..... ≤400 mΩ  
POWER CONSUMPTION: ..... Please refer to Power Consumption Chart

POWER CONSUMPTION  
PRO. SPECTA Q3 AND X3

The following table shows system power consumption values for exemplary periods (sec.):

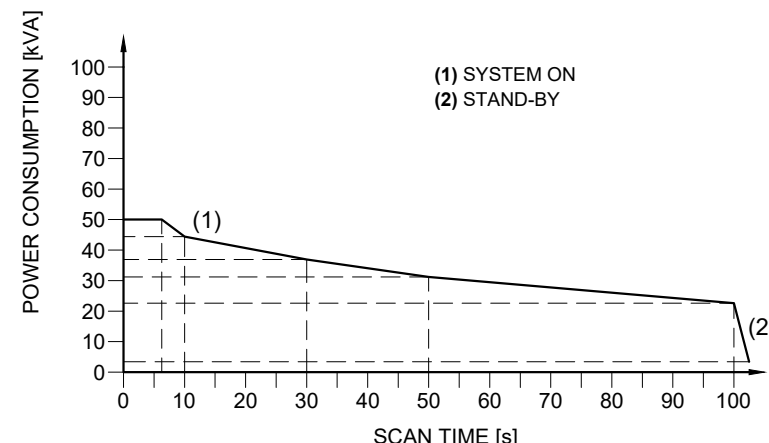
Time	System Power Consumption (kVA)	Operating Mode
6 sec.	50	System ON (Operation)
10 sec.	44	
30 sec.	37	
50 sec.	31	
100 sec.	22	System ON (Standby)
> 100 sec.	3	
> 100 sec.	0.15	
> 100 sec.	0	
		System OFF (SPECT. Det. Powered)
		System Completely OFF (Not recommended)

CONNECTION VALUE = Nominal line voltage (V) x External line fuse (A) x 1.73

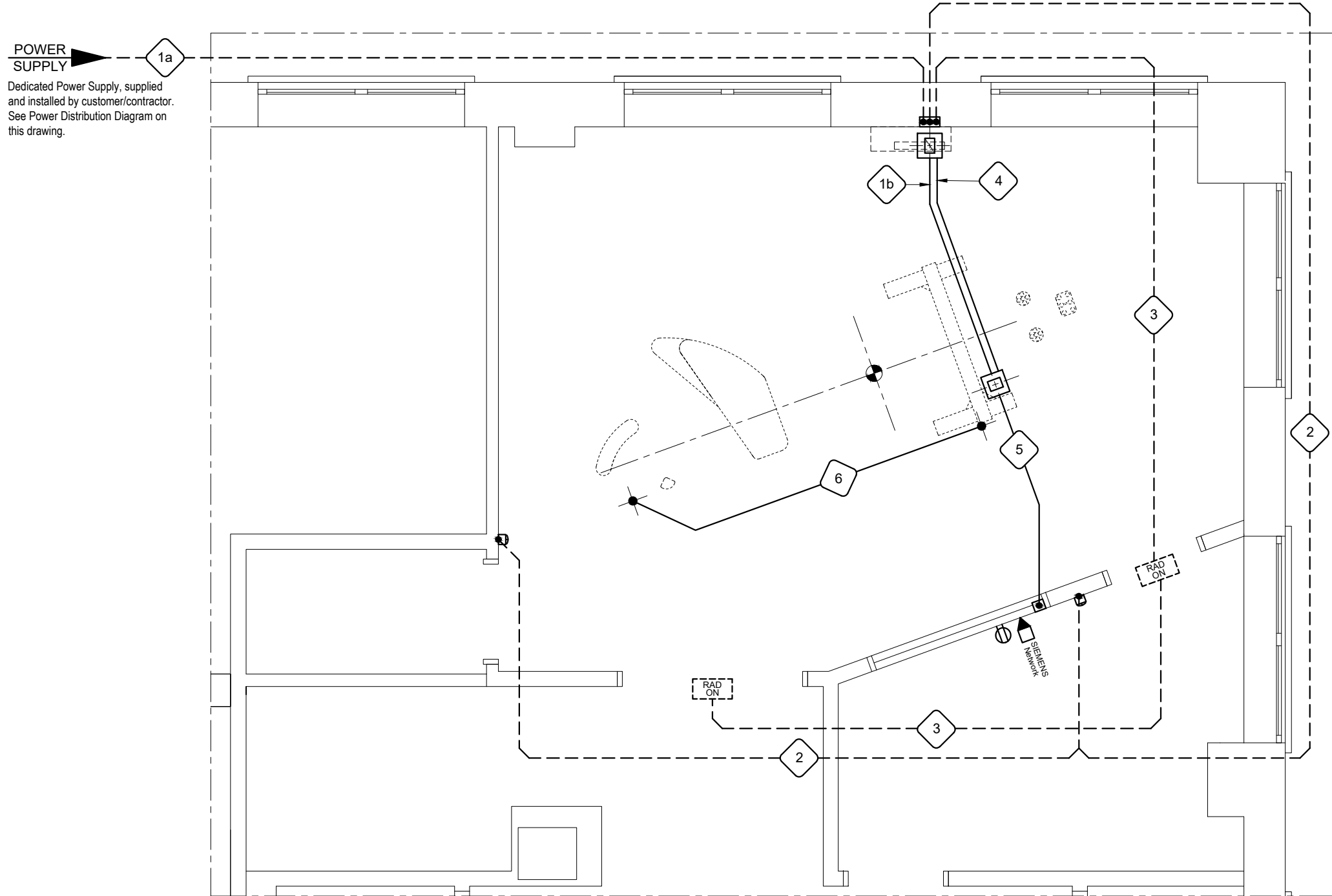
UPS FOR OVERALL SYSTEM: There is no UPS manufacturer recommendation. If a UPS is being for the overall system, please ensure proper power calculation.

MIN. 50 kVA output power

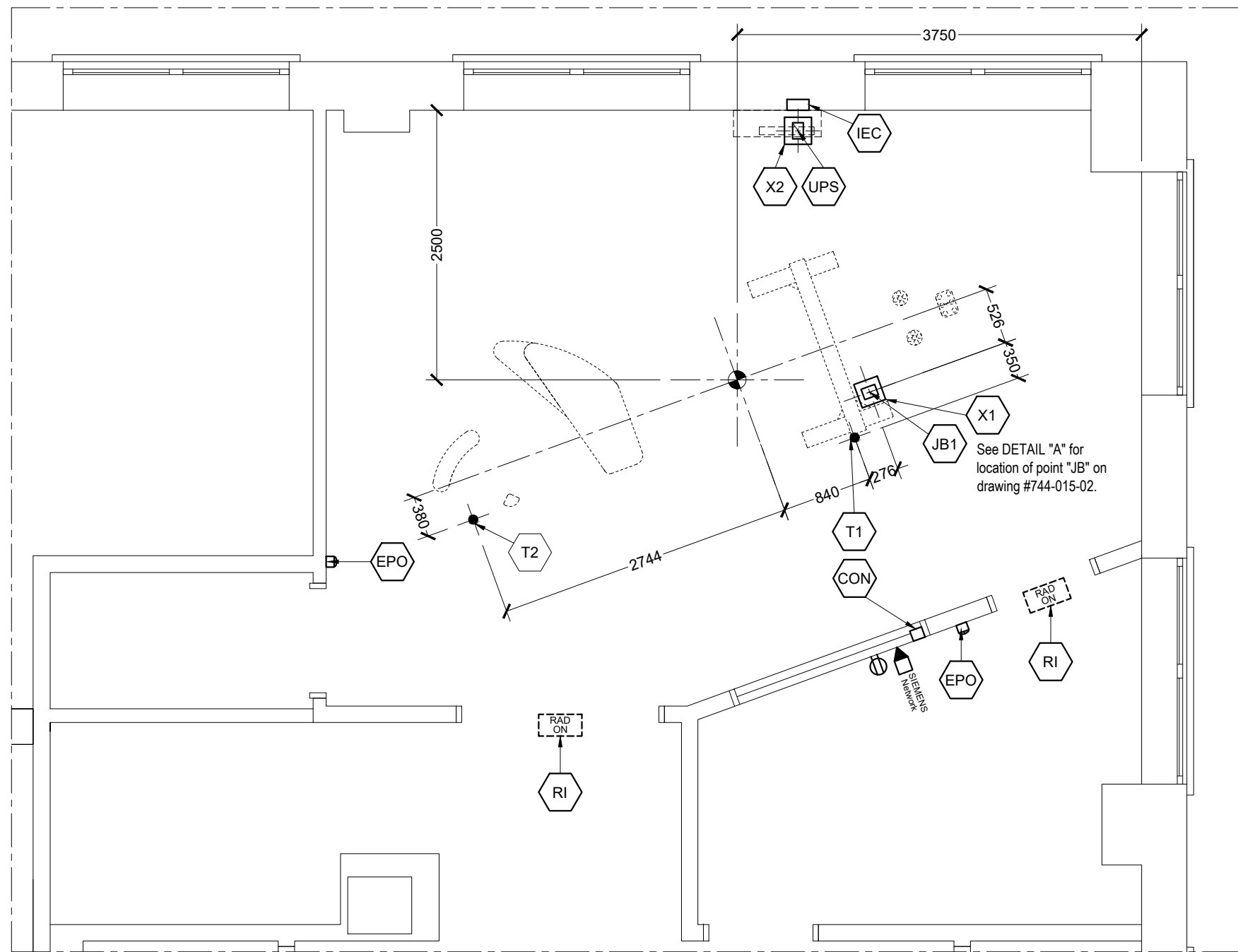
POWER CONSUMPTION OF OVERALL SYSTEM



RACEWAY LAYOUT



CONNECTION POINT LAYOUT



SYMBOL LEGEND

CONNECTION POINT	RACEWAY	MISCELLANEOUS
Raceway termination	Raceway duct in ceiling space below/floor space	Network connection point
Access floor opening	Raceway duct in ceiling space above	POWER SUPPLY
Conduit termination	Vertical raceway	1-Ph 110V ±10% Duplex oil 12" above finished floor
Underfloor duct and junction box/pull box	Conduit in ceiling space below/floor space	1-Ph 220V ±10% 20A, 3-Wire Twistlock (hubbles #L6-20)
Ceiling space above junction box/pull box	Conduit in ceiling space above	On/Off disconnect
On/Off disconnect	Vertical conduit	

GENERAL NOTES

NOTE: The information contained in this drawing is based on the most current technical information available at the time this drawing was issued. We reserve the right to make changes as dictated by technical product developments.

Connection points that are not dimensioned may be located at the Customer's discretion. The location of these items as shown on this drawing indicate the preferred SIEMENS location only.

RACEWAY SCHEDULE

RUN	DESIGNATION	MOUNTING	SIZE
	FROM POINT (RUN/R) TO POINT (RUN/R)		
	DUCT (CABLE WIREWAY)		
	CONDUIT (RIGID CONDUIT ONLY)		
	TRENCH DUCT (FLOOR FLUSH)		
	CABLE TRAY		
	VERTICAL DUCT/W		
	CONTAINS POWER SUPPLY CABLES		
	REMOVABLE ACCESSIBLE COVER		
	# OF EQUAL COMPARTMENTS		
	FLUSH FLOOR/ ACCESS FL(A)		
	FLUSH WALL(W) CEILING(C)		
	CEILING SPACE BELOW		
	ACCESS FLOOR SPACE		
	ABOVE FINISHED FLOOR &		
	SURFACE FL(F) ACCESS FL(A)		
	SURFACE CEILING(C) WALL(W)		
	EXISTING		
	AS SHOWN		
	WALL SPACE		
	TO SUIT (BY CONTRACTOR)		
	SIZE REQUIRED (INTERNAL DIMENSION)		

CONNECTION POINT SCHEDULE

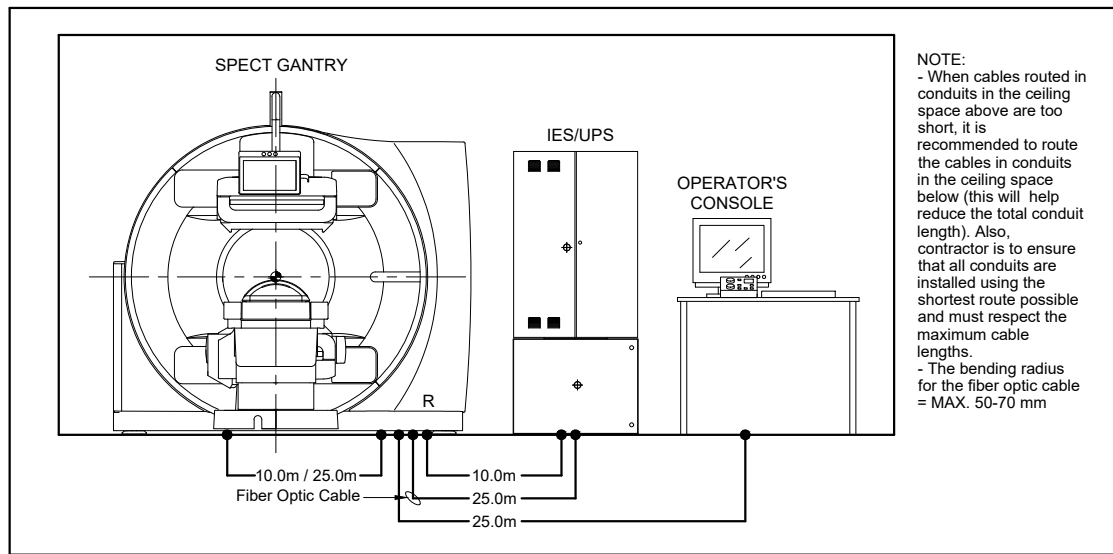
POINT	DESIGNATION	MOUNTING	SIZE
	ON/OFF DISCONNECT		
	CONTRACTOR		
	EMERGENCY SHUNT TRIP		
	PULL BOX		
	ACCESS FLOOR OPENING		
	DUCT TERMINATION		
	CONDUIT TERMINATION		
	REMOVABLE COVER		
	SPLIT REMOVABLE COVER		
	DUCT COVER PLATE OPENING		
	GROMMETED HOLE DIAMETER		
	FLUSH FLOOR/ ACCESS FL(A)		
	FLUSH WALL(W) CEILING(C)		
	CEILING SPACE ABOVE		
	ACCESS FLOOR SPACE		
	ABOVE FINISHED FLOOR &		
	SURFACE FL(F) ACCESS FL(A)		
	SURFACE CEILING(C) WALL(W)		
	BELOW FINISHED CEILING &		
	x THRU COVER WIDTH		
	TO SUIT (BY CONTRACTOR)		
	SIZE REQUIRED (INTERNAL DIMENSION)		

\*1 Emergency Shunt Trip (EST) is at the customer's discretion (optional), unless required by local electrical code. All EST devices to be equipped with a hinged plastic clear cover to protect against accidental activations (by others).

\*2 SIEMENS provides a floating ground contact: 24V/10A-DC.

\*3 For additional information on the IEC/UPS cabinet, see EQUIPMENT DETAILS on DWG 744-015-02.

CABLE SPECIFICATIONS (n.t.s.)



ELECTRICAL NOTES

- All wires and multi-conductor cables installed by contractor shall be standard, flexible and flame seal type, and are to be left with minimum 6'-0" tail at each termination unless otherwise specified.
- The electrical contractors shall provide all necessary pull boxes, conduits, raceways, fittings, bushings, cables and other items as per the electrical plan unless otherwise specified.
- All cable outlets, pull boxes and raceways described in this drawing as being set flush with finished floor are to be of the waterproof type with gasketed metal covers.
- All conduits which are left empty for the cables supplied by SIEMENS shall be provided with Greenlee Conduit Measuring tape (Cat.# N435 or equivalent).
- All conduit bends are to have large sweeping radius. Only standard conduit elbows are to be used. Only rigid conduits can be used for the entire conduit run.
- All cable ducts shown are to be supplied with a removable cover.
- Each conduit termination indicated on the drawing shall be finished with plastic bushing.
- Conduits and raceways shown are indicated schematically and are not to be used for actual runs. Contractor is to determine the SHORTEST RUN available prior to installation. Refer to the CABLE SPECIFICATION detail on this sheet.
- The electrical work in this installation shall be performed in strict compliance with Canadian Electrical Code, or local Codes, whichever is more stringent.
- When installation does not conform with drawing submitted, the SIEMENS Project Manager must be contacted before any design changes may be made.
- All slab coring and drilling for raceway installations and final equipment mounting are provided by the Contractor/Customer. These areas shall be scanned using acceptable industry methods.
- All dimensions shown are from finished surfaces.
- If the Line Impedance specification is not met, the maximum generator output (kW) will not be possible.
- The conduit/duct layout as shown considers the mandatory separation of power and signal cables. Any changes to, or consolidation of, conduits/ducts must be approved by the SIEMENS Project Manager.

- ALL WIRES/CONDUCTORS of the POWER SUPPLY MUST be of EQUAL SIZE, regardless of local codes, and supplied BY CONTRACTOR. The safety GROUND MUST be ISOLATED, to protect the system from interference. All materials and equipment not by SIEMENS MUST be GROUNDED SEPARATELY. The SIEMENS equipment ground must be continuous, with no breaks or use of conduit, chassis or earth as the sole grounding path.
- All power supply requirements are to be designed and/or approved by a Electrical Engineer. SIEMENS recommends the incoming power lines be analyzed for transient surges and impulses, sags and overvoltages.
- Cable trays shown in the access floor space are to be supplied only if required by local Electric Code.

METRIC TO IMPERIAL CONVERSIONS:  
1000mm = 39.37" 1'-0" = 304.8mm 1kg = 2.205lbs.

Scale 1:50  
0' 1' 2' 3' 4' 5' 6' 7' 8' 9' 10'

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS, UNLESS OTHERWISE SPECIFIED.  
ALL DIMENSIONS SHOWN ARE FROM FINISHED SURFACES.

THIS PLANNING PROPOSAL, TOGETHER WITH ANY ENCLOSED DOCUMENTATION AND SPECIFICATIONS, IS BASED ON THE MOST CURRENT TECHNICAL INFORMATION AVAILABLE AT THE TIME OF ISSUE. WE RESERVE THE RIGHT TO MAKE CHANGES AS DICTATED BY TECHNICAL DEVELOPMENTS.

SEISMIC REQUIREMENTS:  
ADDITIONAL ANCHORING MAY BE REQUIRED IF SITE IS DEEMED AS 'SEISMIC ZONE' BY LOCAL CODES. THE CUSTOMER MUST VERIFY THE LOCAL CODES REQUIREMENTS AND ADVISE THE SIEMENS PROJECT MANAGER.

No	REVISIONS	CHK'D
<div>Submitted for:</div> <div><input type="checkbox"/> Approval</div> <div><input type="checkbox"/> Your use</div> <div><input type="checkbox"/> Your records</div> <div><input checked="" type="checkbox"/> Installation</div> <div>APPROVED: _____</div>		
<div>Siemens Healthcare Limited</div> <div>Planning Department</div>		
<div>NOTE: ALL DIMENSIONS SHOWN MUST BE VERIFIED ON THE SITE. THIS DRAWING IS NOT TO BE REPRODUCED WITHOUT WRITTEN AUTHORIZATION.</div>		
CUSTOMER		
COLLINGWOOD GENERAL & MARINE HOSPITAL		
COLLINGWOOD, ONTARIO		
ELECTRICAL REQUIREMENTS		
EQUIPMENT		
SYMBIA PRO.SPECTA X3		
PG#:		
MI05-000.891.01.06.02		
DRAWN BY	SCALE	AS NOTED
KISHAN B.	DATE	29 OCT 2025
CHK'D BY	PROJECT #	744 015
HOSPITAL #	REVISION #	03
DRAWING/SKETCH #		

Client Approval  
Signature:

Date:

The above approval confirms that the client has reviewed the information contained in the design and that the layout and dimensions are accurate and approves them to be installed as indicated.

Typical of: 1

Room #s:  
CT SUITE

Designer:  
D. GAUVAIN  
Sales Rep:  
J. SPEIRAN

Int Approval:  
J. DYER  
PM Approval:  
U. AMAD

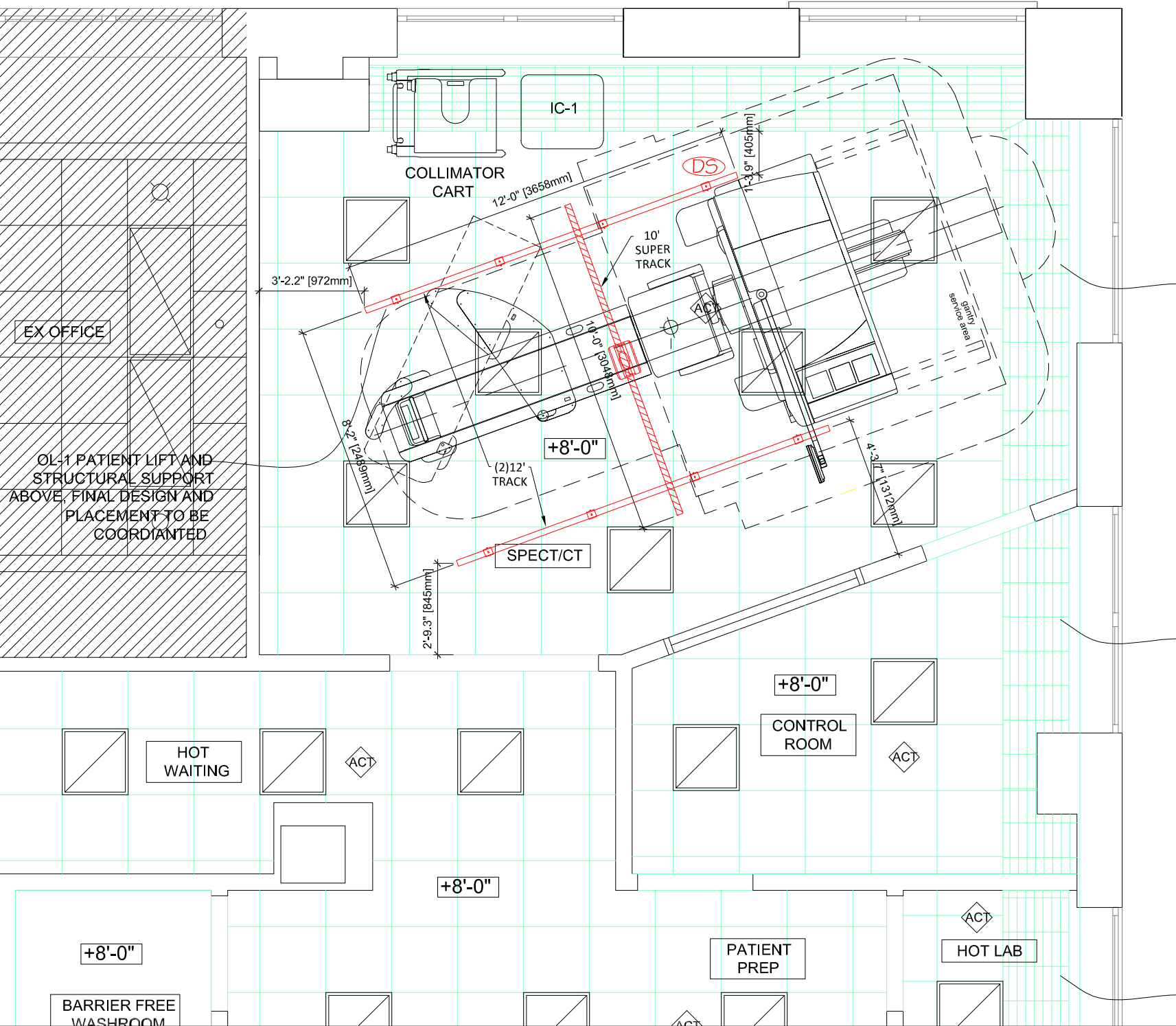
Project Name:  
COLLINGWOOD GENERAL  
HOSPITAL  
24 200 SPECT

Sheet Description:

XY GANTRY SYSTEM

Motor/Lifting Capacity/Type/SWL:  
A-625 MANUAL TRAVERSE  
@625lb SWL

Scale: 1/4" = 1'-0"	Project #: 4587458500
Date: 2025-08-05	Sheet #: 1 OF 1

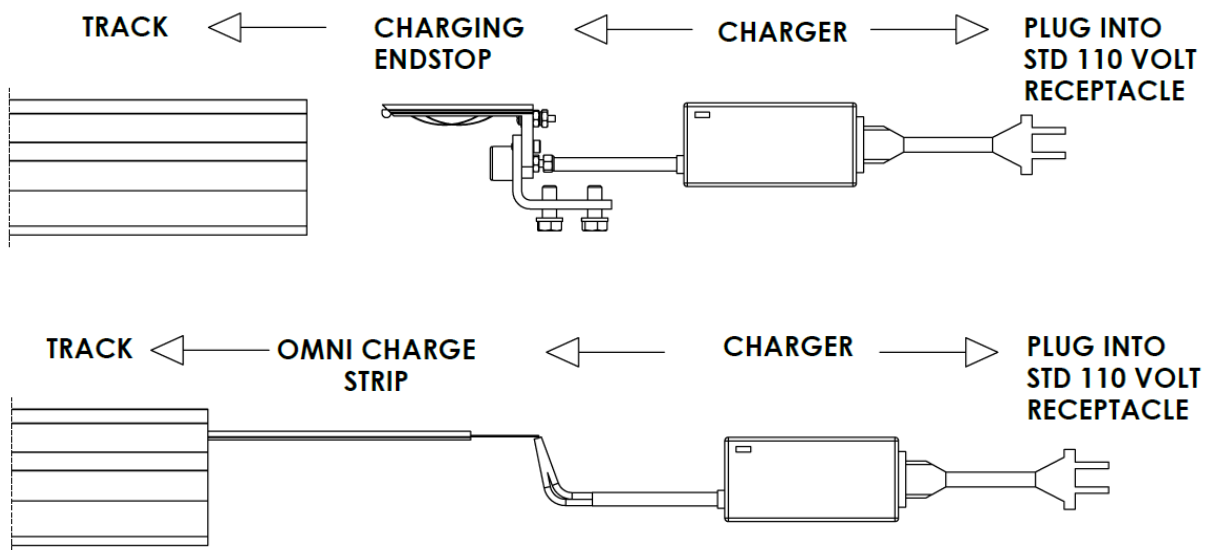


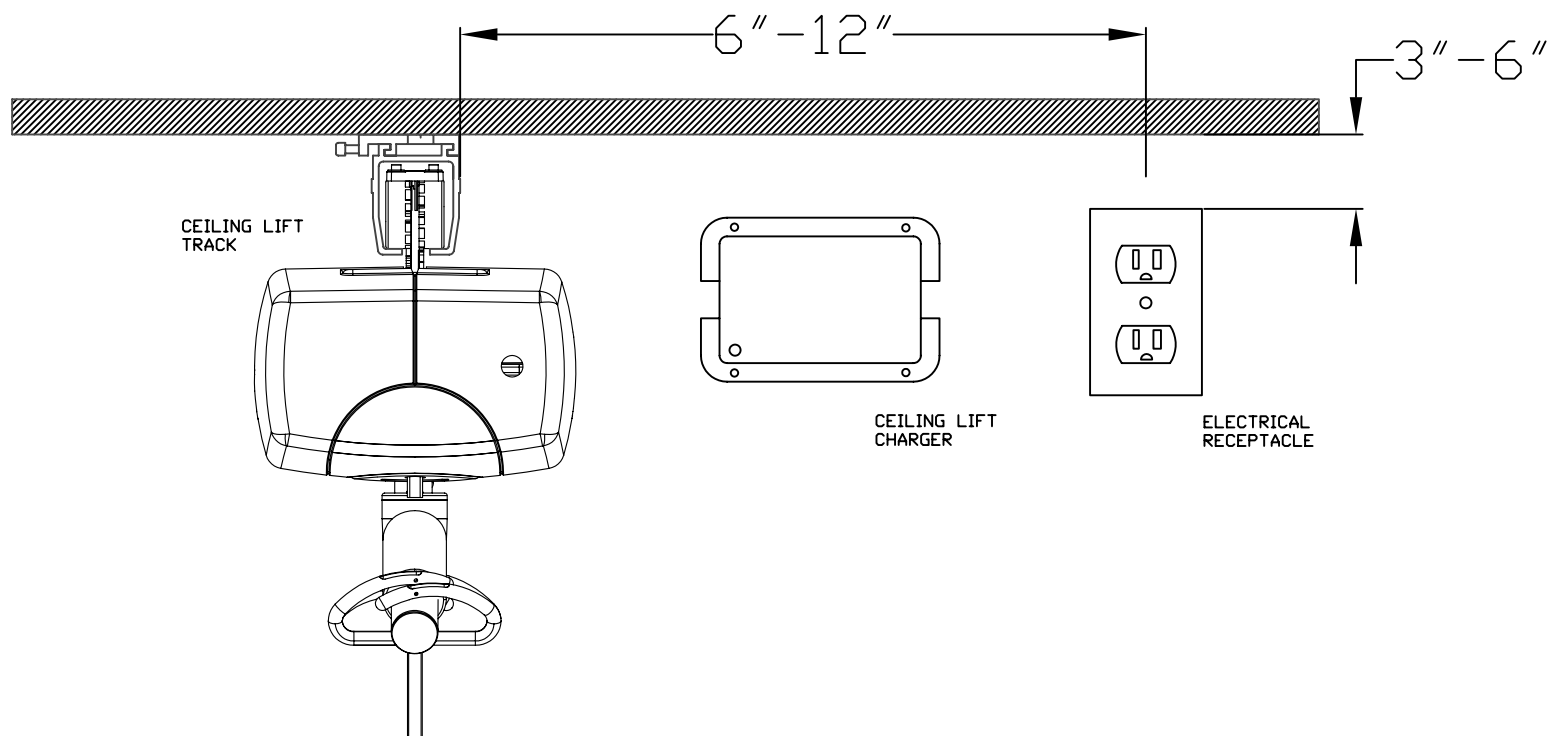


## A-Series Charger Power Requirements

Input Characteristics	
Input Voltage Range	100-240 VAC
AC Voltage Frequency	50/60 HZ
Max. Current	0.8A
Output Characteristics	
Output Voltage	24V
Max. Voltage	25.2V
Constant Current	1.3A
Max. Power	38W
Power Efficiency	85%

- Certified UL, CSA, CE, FCC
- Protections Features:
  - o Short circuit
  - o Reverse polarity
  - o Over voltage
  - o Over current
- Dimensions: 3.8in X 1.84in (97mm X 47mm)
- Endstop and Constant (Omni) Charging
- Charger compatible with all A-450 and A-625 Ceiling Lifts







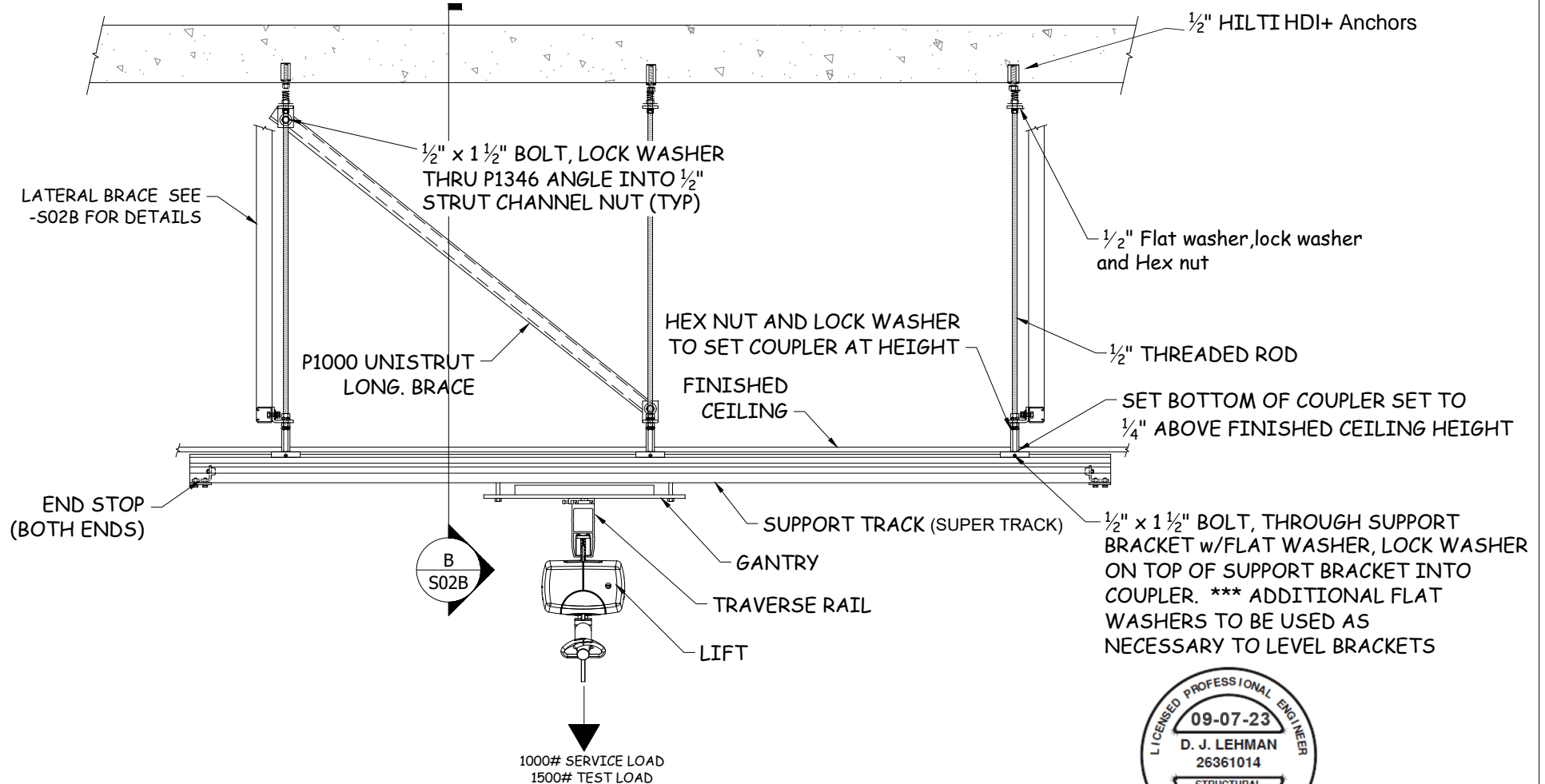
# handicare

Tel.: (416) 260-2145 · Fax: (416) 260-0256

Website: [www.handicare.com](http://www.handicare.com)

# PROJECT DRAWING

## Concrete Slab

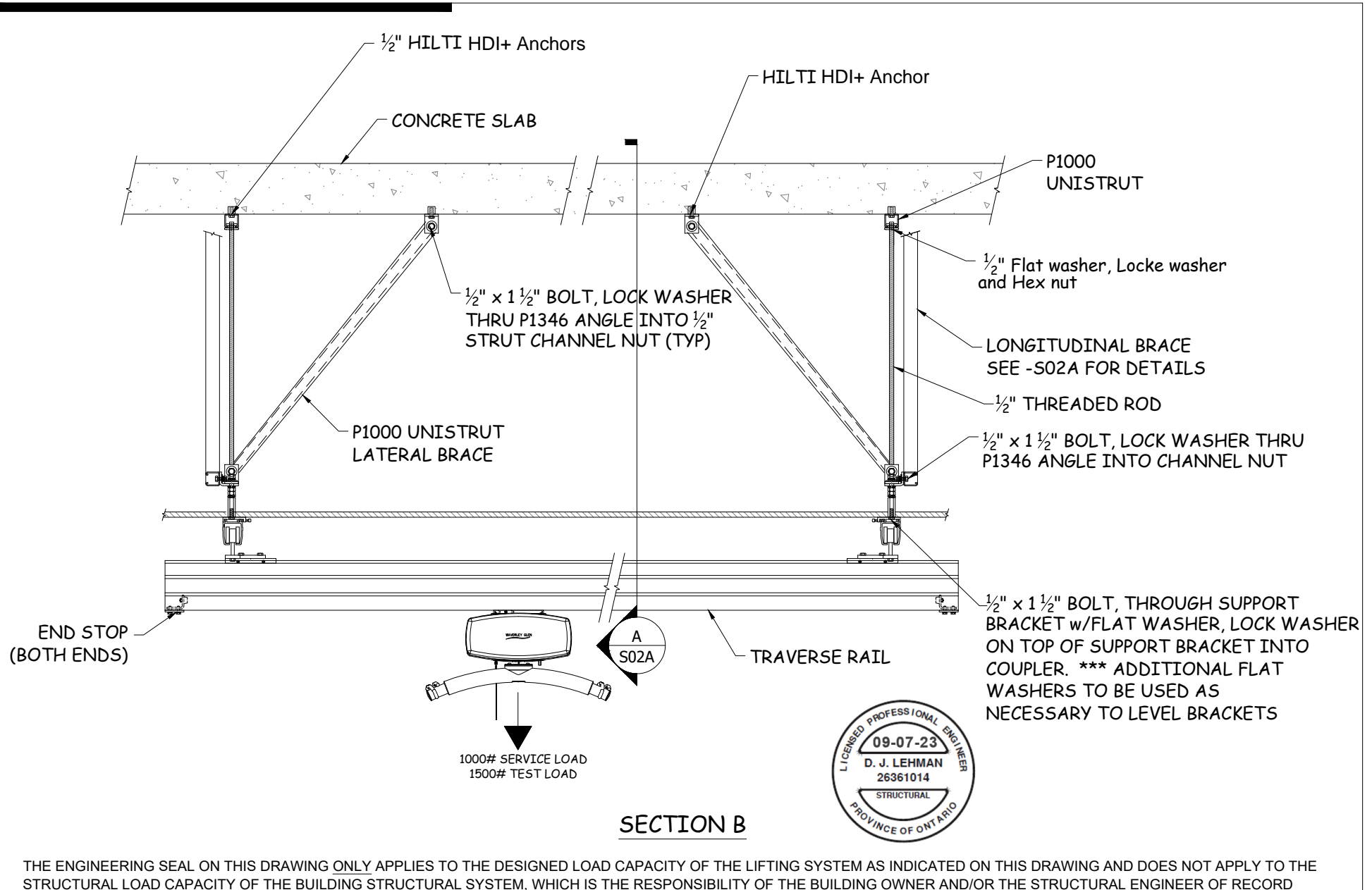


## SECTION A

THE ENGINEERING SEAL ON THIS DRAWING ONLY APPLIES TO THE DESIGNED LOAD CAPACITY OF THE LIFTING SYSTEM AS INDICATED ON THIS DRAWING AND DOES NOT APPLY TO THE STRUCTURAL LOAD CAPACITY OF THE BUILDING STRUCTURAL SYSTEM, WHICH IS THE RESPONSIBILITY OF THE BUILDING OWNER AND/OR THE STRUCTURAL ENGINEER OF RECORD

Tel.: (416) 260-2145 · Fax: (416) 260-0256

Website: [www.handicare.com](http://www.handicare.com)



Jeffrey Martin  
 David Carter Architects Inc.  
 699 Richmond St. W, Suite 303  
 Toronto, ON M6J 1C5

08-12-2025

## Quotation

Jeffrey,

Please find pricing below for the Patient Lift Ceiling System required in the CGMH Nuclear Medicine Spect/CT Suite.

### 1) Patient Lift Ceiling System

Item #	Qty #	Description	Unit Price	Total
12X10A625	1 ea.	Fully installed extended XY Ceiling Lift System with 625 lb capacity. Price includes fully installed tracking system and A625 Manual Traverse Lift.	\$9,575.00 ea.	\$9,575.00
SHIPPING	1 ea.	Shipping	\$600.00 ea.	\$600.00
			<b>TOTAL PRICE</b>	<b>\$10,175.00</b>

**NOTE: HST is charged on shipping only. Lift systems (including installation) are HST exempt**

### Other Requirements

Unless otherwise noted, our prices do not include the following items, which are to be completed prior to installation of the lift system:

- Relocation of ceiling fixtures, such as lights, fans, smoke detectors, and alarms, which are located on or near the path of the track.
- Modification of any curtain fabric, track and fittings, doors, door headers, walls or other barriers through which the lift track will pass.
- Removal of light fixtures to allow ceiling access.
- A standard 3-prong 110-volt electrical outlet placed in reasonable proximity to desired charging location
- If contaminated material, including asbestos, is to be removed or remediated prior to equipment installation, it is the responsibility of the owner to remove, remediate, discard, and perform any clean-up operations at the owner's expense prior to the installation.
- Customer to provide structural drawings of facility.
- Any costs associated with BIM services or coordination.
- Structural engineer stamped drawings and schedules.

- Payment performance bond.
- Concrete scanning, if applicable.
- Facility to notify Handicare if there are any services embedded in concrete, if applicable. Handicare does not assume liability for any costs associated with remediation of any damage to services (ie electrical conduit, water lines) embedded in concrete or any other items which may be damaged as a result of such. This condition applies in all instances regardless of whether concrete scanning was completed or not prior to damage occurring.
- Pricing includes typical above ceiling support for the patient lift systems, attaching to concrete slab with minimum 6" of thickness. Should any lead shielding be present on the slab (impacting anchor installation), pricing will be affected.

#### **Installation Scheduling**

This proposal is based on our experience with similar construction. Unless there are extraordinary circumstances, the costs we have developed for installation are accurate. Note that after hours or weekend work are not included unless otherwise noted.

#### **General Terms and Conditions**

**The delivery and installation of the equipment described in this quotation are subject to the Terms and Conditions as set forth:**

- Installation and delivery will be scheduled upon acceptance of this quotation.
- Applicable sales tax not included.
- Price does not include union labour, as patient lift installs are a specialized trade. If union labour is required, price increases will apply.
- Prices valid for 90 days from date of this quotation.

By purchasing the products and services quoted, customer agrees to above terms.

If you have any questions, please feel free to call me at any time at 416-432-1575 or send me an email to [josh.maltin@handicare.com](mailto:josh.maltin@handicare.com)

Sincerely,



Josh Maltin  
Handicare Canada

## **1 GENERAL**

### **1.01 RELATED REQUIREMENTS**

- .1 Refer to all applicable Division 0 and 1 specifications.
- .2 Refer to Owner's tender and bid documents.

### **1.02 WORK COVERED BY CONTRACT DOCUMENTS**

- .1 Work of this Contract comprises renovation for architectural, structural, mechanical, and electrical. components within the following building address:

Building Address: 459 Hume Street, Collingwood ON.

### **1.03 CONTRACT METHOD**

- .1 Refer to Section 00 21 00 List of Contract Documents.
- .2 Employ suppliers and subcontractors as required by Owner. Refer to Owner's tender and bid documents.
- .3 Relations and responsibilities between Contractor and Subcontractors assigned by Owner are as defined in General Conditions of the Contract. Assigned Subcontractors shall, in addition:
  - .1 Furnish to Contractor, bonds covering faithful performance of subcontracted work and payment of obligations thereunder when Contractor is required to furnish such bonds to Consultant. Such bonds shall be provided by major Mechanical and Electrical Subcontractors.
  - .2 Purchase and maintain liability insurance to protect Contractor from claims for not less than limits of liability which Contractor is required to provide to Consultant.

### **1.04 SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit Project construction progress schedule in accordance with Section 01 32 16.16 - Construction Progress Schedule - Critical Path Method (CPM).
- .3 Sustainable Design Submittals:
  - .1 Reserved.
- .4 Submit site-specific and Work Plan Health and Safety Plan in accordance with Section 01 35 29.06 - Health and Safety Requirements.

### **1.05 WORK BY OTHERS**

- .1 Co-operate with other Contractors in carrying out their respective works and carry out instructions from Owner.
- .2 Co-ordinate work with other contractors. If any part of work under this Contract depends for its proper execution or result upon work of another contractor, report promptly to Owner, in writing, any defects which may interfere with proper execution of Work.

### **1.06 FUTURE WORK**

- .1 Reserved.



#### **1.07 WORK SEQUENCE**

- .1 Construct Work in stages to accommodate Owner's continued use of areas adjacent to the area of work premises during construction.
- .2 Co-ordinate Progress Schedule and co-ordinate with Owner Occupancy during construction.
  - .3 Required stages: Refer to phasing plan/notes and/or Owner's project milestones where applicable.
- .3 Maintain continuous emergency exit path for egress and fire access/control.
- .4 Protect workers and public safety.

#### **1.08 CONTRACTOR USE OF PREMISES**

- .1 Co-ordinate use of premises under direction of Owner and provide appropriate hoarding and barrier protection to occupations, equipment, and stored items.
- .2 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.
- .3 Refer to Section 01 51 00 - Temporary Utilities, Section 01 52 00 - Construction Facilities and Section 01 56 00 - Temporary Barriers and Enclosures, for temporary facilities, access roads and parking areas, traffic regulations, and utilities.
- .4 Remove or alter existing work to prevent injury or damage to portions of existing work which remain.
- .5 Repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work.
- .6 Ensure that operations conditions of existing work at completion are still the same, equal to or better than that which existed before new work started.

#### **1.09 OWNER OCCUPANCY**

- .1 Owner will occupy areas adjacent to area of work premises during entire construction period for execution of normal operations.
- .2 Co-operate with Owner in scheduling operations to minimize conflict and to facilitate Owner usage.

#### **1.10 PARTIAL OWNER OCCUPANCY**

- .1 Schedule and substantially complete designated portions of Work for Owner's occupancy prior to Substantial Performance of entire Work.
- .2 Refer to phasing plan/notes where provided for project.

#### **1.11 PRE-ORDERED PRODUCTS OR PRE-BID WORK**

- .1 Reserved.

#### **1.12 PRE-PURCHASED EQUIPMENT**

- .1 Reserved.

### **1.13 OWNER FURNISHED ITEMS**

- .1 Owner Responsibilities:
  - .1 Arrange and pay for delivery to site in accordance with Progress Schedule.
  - .2 Inspect deliveries jointly with Contractor.
  - .3 Submit claims for transportation damage.
  - .4 Arrange for replacement of damaged, defective or missing items.
- .2 Contractor Responsibilities:
  - .1 Receive and unload products on Site.
  - .2 Inspect deliveries jointly with Owner; record shortages, and damaged or defective items.
  - .3 Handle products on Site, including uncrating and storage.
  - .4 Protect products from damage, and from exposure to elements.
  - .5 Assemble, install, connect, adjust, and finish products.
  - .6 Provide installation inspections required by public authorities.
  - .7 Repair or replace items damaged by Contractor or Subcontractor on site (under his control).
  - .8 Schedule of Owner furnished items: Refer to Fixtures, Fittings & Equipment Schedule where applicable.

### **1.14 ALTERATIONS, ADDITIONS OR BUILDING**

- .1 Execute work with least possible interference or disturbance to building operations, occupants, public and normal use of premises. Arrange with Owner to facilitate execution of work. Conduct work in accordance with Owner's work requirements and restrictions.
- .2 Use only Owner designated routes, stairs, elevators, existing in building for moving workers and material.
  - .1 Investigate the status of existing elevators, dumbwaiters, conveyors and or escalators in building(s), if they are functional and safe for moving workers and materials before the Work starts.
  - .2 Provide the required protection for passenger elevators walls, obtain Owner approval before using these elevators.
  - .3 Accept liability for damage, safety of equipment and overloading of existing equipment and pay for costs associated with repairs required to restore damaged areas to original condition.

### **1.15 EXISTING SERVICES**

- .1 Notify, Owner and utility companies of intended interruption of services and obtain required permission.
- .2 Where Work involves breaking into or connecting to existing services, give Owner five (5) working days notice for necessary interruption of mechanical or electrical service throughout course of work. Minimize duration of interruptions. Where applicable, carry out work at times as directed by governing authorities with minimum disturbance to pedestrian, vehicular traffic and tenant operations.
- .3 Provide alternative routes for personnel, pedestrian and vehicular traffic.
- .4 Establish location and extent of service lines in area of work before starting Work. Notify Owner and Consultant of findings.
- .5 Submit schedule for approval by Owner for any shut-down or closure of active service or facility including power and communications services. Adhere to approved schedule and provide notice to affected parties.
- .6 Provide temporary services required by Work to maintain critical building and tenant services.

- Review and coordinate with Mechanical and Electrical requirements to determine necessary temporary services and include for all associated costs.
- .7 Provide adequate bridging over trenches which cross sidewalks or roads to permit normal traffic.
  - .8 Where unknown services are encountered, immediately advise Owner and Consultant and confirm findings in writing.
  - .9 Protect, relocate or maintain existing active services. When inactive services are encountered, cap off in manner approved by authorities having jurisdiction.
  - .10 Record locations of maintained, re-routed and abandoned service lines.
  - .11 Construct barriers, as required, in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

## **1.16 DOCUMENTS REQUIRED**

- .1 Maintain at job site, one copy of each document as follows:
  - .1 Contract Drawings.
  - .2 Specifications.
  - .3 Addenda.
  - .4 Reviewed Shop Drawings.
  - .5 List of Outstanding Shop Drawings.
  - .6 Change Orders.
  - .7 Other Modifications to Contract.
  - .8 Field Test Reports.
  - .9 Copy of Approved Work Schedule.
  - .10 Health and Safety Plan and Other Safety Related Documents.
  - .11 Other documents as specified.

## **2 PRODUCTS**

### **2.01 NOT USED**

- .1 Not used.

## **3 EXECUTION**

### **3.01 NOT USED**

- .1 Not used.

**END OF SECTION**

## **1 GENERAL**

### **1.01 RELATED REQUIREMENTS**

- .1 Refer to Owner's tender and bid documents.
- .2 Refer to phasing plan(s) where provided for project.

### **1.02 ACCESS AND EGRESS**

- .1 Design, construct and maintain temporary "access to" and "egress from" work areas, including stairs, runways, ramps or ladders and scaffolding, independent of finished surfaces and in accordance with relevant municipal, provincial and other regulations.

### **1.03 USE OF SITE AND FACILITIES**

- .1 Execute work with least possible interference or disturbance to normal use of premises. Make arrangements with Owner to facilitate work as stated.
- .2 Maintain existing services to building and provide for personnel and vehicle access.
- .3 Where security is reduced by work provide temporary means to maintain security.
- .4 Use of Owner's sanitary facilities by Contractor's personnel is at the discretion of Owner. Unless otherwise stated by Owner, include for temporary sanitary facilities for all Contractor's personnel.
- .5 Use only Owner designated routes, doors, elevators, dumbwaiters, conveyors or escalators existing in building for moving workers and material.
  - .1 Protect all surfaces to approval of Owner prior to use.
  - .2 Accept liability for damage, safety of equipment and overloading of existing equipment. Pay for all costs associated with repair of damages.
- .6 Closures: protect work temporarily until permanent enclosures are completed.
- .7 After-hours Work: Work required to be performed outside of Owner's hours of operation shall be defined as "After-hours Work". At start of project, confirm hours of operation with Owner. See below for types of work required to be performed after-hours. Include for all costs associated with after-hours work and an appropriate number of trade visits and mobilizations to suit the Work to be performed.

### **1.04 ALTERATIONS, ADDITIONS OR REPAIRS TO EXISTING BUILDING**

- .1 Execute work with least possible interference or disturbance to building operations, occupants, public and normal use of premises. Arrange with Owner to facilitate execution of work.

### **1.05 EXISTING SERVICES**

- .1 Notify, Owner and utility companies of intended interruption of services and obtain required permission.
- .2 Where Work involves breaking into or connecting to existing services, give Owner five (5) working days notice for necessary interruption of mechanical or electrical service throughout course of work. Keep duration of interruptions minimum. Carry out interruptions during after-hours and preferably on weekends or as directed by Owner.
- .3 Provide for personnel, pedestrian and vehicular traffic where applicable.
- .4 Construct barriers in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

## **1.06 SPECIAL REQUIREMENTS**

- .1 Paint, flooring and ceiling installation work at public or Owner occupied areas must be performed after-hours.
- .2 Work generating excessive noise and vibration impacting occupants including but not limited to concrete slab cutting, riveting, grinding etc. must be performed after-hours.
- .3 Work that must take place outside of construction hoarding or area, including but not limited to Work that is near occupied spaces, construction of hoarding etc. must be performed after-hours.
- .4 Work that requires interruption and or shutdown of building mechanical and electrical utilities and services must be performed after-hours.
- .5 Reserved.
- .6 Work that may generate excessive fumes, smoke or other environmental hazards to nearby occupants must be performed after-hours.
- .7 Indicate Work being performed after-works on construction schedule.
- .8 Ensure Contractor's personnel employed on site become familiar with and obey regulations including safety, fire, traffic and security regulations.
- .9 Keep within limits of work and avenues of ingress and egress.
- .10 Ingress and egress of Contractor vehicles must comply with Owner's designated routes unless otherwise stated by Owner.
- .11 Notify and coordinate with Owner for delivery of materials and where use of Owner's loading dock and/or doors are required.

## **1.07 SECURITY**

- .1 Where security has been reduced by Work of Contract, provide temporary means to maintain security.
- .2 Security clearances:
  - .1 Refer to Owner's tender and bid requirements for personnel security checks, if applicable.
- .3 Security escort:
  - .1 Reserved.

## **1.08 BUILDING SMOKING ENVIRONMENT**

- .1 Comply with smoking restrictions. Smoking is not permitted.

## **2 PRODUCTS**

### **2.01 NOT USED**

- .1 Not Used.

**3 EXECUTION**

**3.01 NOT USED**

.1 Not Used.

**END OF SECTION**

## **1 GENERAL**

### **1.01 REFERENCE STANDARDS**

- .1 Canadian Construction Documents Committee (CCDC):
  - .1 CCDC 2, Stipulated Price Contract.
- .2 Project Supplementary Conditions:
  - .1 Refer to Tender Documents and/or Contract where applicable.

### **1.02 CASH ALLOWANCES**

- .1 Refer to Contract.
- .2 Include in Contract Price specified cash allowances.
- .3 Cash allowances, unless otherwise specified, cover net cost to Contractor of services, products, construction machinery and equipment, freight, handling, unloading, storage installation and other authorized expenses incurred in performing Work.
- .4 Contract Price, and not cash allowance, includes Contractor's overhead and profit in connection with such cash allowance.
- .5 Contract Price will be adjusted by written order to provide for excess or deficit to each cash allowance.
- .6 Where costs under a cash allowance exceed amount of allowance, Contractor will be compensated for excess incurred and substantiated plus allowance for overhead and profit as set out in Contract Documents.
- .7 Include progress payments on accounts of work authorized under cash allowances in Consultant's monthly certificate for payment.
- .8 Prepare schedule jointly with Consultant to show when items called for under cash allowances must be authorized by Consultant for ordering purposes so that progress of Work will not be delayed.
- .9 List the amount of each allowance, for each work specified in each respective specification Section as follows:
  - .1 Refer to Owner's Tender Documents, Bid Forms, and/or Pricing Tables where requested for required Cash Allowances.

### **1.03 CONTINGENCY ALLOWANCE**

- .1 Refer to CCDC 2, GC 4.2.
- .2 Include in Contract Price contingency allowance of \$ N/A.
- .3 Do not include in Contract Price, additional contingency allowances for products, installation, overhead or profit.
- .4 Expenditures under contingency allowance will be authorized in accordance with procedures provided in CCDC 2, GC 6.1 - Changes CCDC 2, 6.2 Change Order and CCDC 2, 6.3 Change Directive.



**2        PRODUCTS**

**2.01    NOT USED**

.1        Not Used.

**3        EXECUTION**

**3.01    NOT USED**

.1        Not Used.

**END OF SECTION**

## **1 GENERAL**

### **1.01 REFERENCE STANDARDS**

- .1 General Conditions of the Contract.

### **1.02 APPLICATIONS FOR PROGRESS PAYMENT**

- .1 Refer to Contract.
- .2 Reserved.
- .3 Make applications for payment on account as indicated in Contract as Work progresses.
- .4 Date applications for payment last day of agreed monthly payment period and ensure amount claimed is for value, proportionate to amount of Contract, of Work performed and Products delivered to Place of Work at that date.
- .5 Submit to Consultant and Owner, at least 14 days before first application for payment. Schedule of values for parts of Work, aggregating total amount of Contract Price, to facilitate evaluation of applications for payment. Include sufficient itemized breakdown to allow for Consultant review. Include separate breakdown schedules for major subtrades.

### **1.03 SCHEDULE OF VALUES**

- .1 Refer to Contract.
- .2 Reserved.
- .3 Provide schedule of values supported by evidence as Consultant may reasonably direct and when accepted by Consultant, be used as basis for applications for payment.
- .4 Include statement based on schedule of values with each application for payment.
- .5 Support claims for products delivered to Place of Work but not yet incorporated into Work by such evidence as Consultant may reasonably require to establish value and delivery of products in accordance with the Contract.

### **1.04 PREPARING SCHEDULE OF UNIT PRICES**

- .1 Submit separate schedule of unit prices requested in Bid form where required by Tender documents.
- .2 Make form of submittal parallel to Schedule of Values, with each line item identified same as line item in Schedule of Values. Include in unit prices only:
  - .1 Cost of material.
  - .2 Delivery and unloading at site.
  - .3 Sales taxes.
  - .4 Installation, overhead and profit.
- .3 Ensure unit prices multiplied by quantities given equal material cost of that item in Schedule of Values.

### **1.05 PROGRESS PAYMENT**

- .1 Refer to Contract.
- .2 Reserved.

- .3 Consultant will issue to Owner, no later than 10 days after receipt of an application for payment, certificate for payment in amount applied for or in such other amount as Consultant determines to be due. If Consultant amends application, Consultant will give notification in writing giving reasons for amendment.

#### **1.06 SUBSTANTIAL PERFORMANCE OF WORK**

- .1 Refer to Contract.
- .2 Reserved.
- .3 Prepare and submit to Consultant a comprehensive list of items to be completed or corrected and apply for a review by Consultant to establish Substantial Performance of Work, or substantial performance of designated portion of Work, when Work is substantially performed if permitted by lien legislation applicable to Place of Work designated portion which Owner agrees to accept separately is substantially performed. Failure to include items on list does not alter responsibility to complete Contract.
- .4 No later than 10 days after receipt of list and application, Consultant will review Work to verify validity of application, and no later than 7 days after completing review, will notify Contractor if Work or designated portion of Work is substantially performed.
- .5 Consultant: state date of Substantial Performance of Work or designated portion of Work in certificate.
- .6 Immediately following issuance of certificate of Substantial Performance of Work, in consultation with Consultant, establish reasonable date for finishing Work. Refer to Section 01 77 00 - Closeout Procedures.

#### **1.07 PAYMENT OF HOLDBACK UPON SUBSTANTIAL**

- .1 Refer to Contract.
- .2 Reserved.
- .3 After issuance of certificate of Substantial Performance of Work:
  - .1 Submit application for payment of holdback amount.
  - .2 Submit sworn statement that accounts for labour, subcontracts, products, construction machinery and equipment, and other indebtedness which may have been incurred in Substantial Performance of Work and for which Owner might be held responsible have been paid in full, except for amounts properly retained as holdback or as identified amount in dispute.
- .4 After receipt of application for payment and sworn statement, Consultant will issue certificate for payment of holdback amount.
- .5 Where holdback amount has not been placed in a separate holdback account, Owner will, 10 days prior to expiry of holdback period stipulated in lien legislation applicable to Place of Work, place holdback amount in bank account in joint names of Owner and Contractor.
- .6 Amount authorized by certificate for payment of holdback amount is due and payable on day following expiration of holdback period stipulated in lien legislation applicable to Place of Work. Where lien legislation does not exist or apply, holdback amount is due and payable in accordance with other legislation, industry practice, or provisions which may be agreed to between parties. Owner may retain out of holdback amount sums required by law to satisfy liens against Work or, if permitted by lien legislation applicable to Place of Work, other third party monetary claims against Contractor which are enforceable against Owner.

**1.08 PROGRESSIVE RELEASE OF HOLDBACK**

- .1 Refer to Contract.
- .2 Reserved.
- .3 Where legislation permits, if Consultant has certified that Work of Subcontractor or supplier has been performed prior to Substantial Performance of Work, Owner will pay holdback amount retained for such subcontract Work, or products supplied by such supplier, on day following expiration of holdback period for such Work stipulated in lien legislation applicable to Place of Work.
- .4 In addition to provisions of preceding paragraph, and certificate wording, ensure that such subcontract Work or products is protected pending issuance of final certificate for payment and be responsible for correction of defects or Work not performed regardless of whether or not such was apparent when such certificates were issued.

**1.09 FINAL PAYMENT**

- .1 Refer to Contract.
- .2 Reserved.
- .3 Submit application for final payment when Work is completed.
- .4 Consultant will, no later than 10 days after receipt of application for final payment, review Work to verify validity of application. Consultant will give notification that application is valid or give reasons why it is not valid, no later than 7 days after reviewing Work.
- .5 Consultant will issue final certificate for payment when application for final payment is found valid.

**2 PRODUCTS**

**2.01 NOT USED**

- .1 Not Used.

**3 EXECUTION**

**3.01 NOT USED**

- .1 Not Used.

**END OF SECTION**

## **1 GENERAL**

### **1.01 RELATED REQUIREMENTS**

- .1 Refer to applicable Division 1 specifications.

### **1.02 ADMINISTRATIVE**

- .1 Schedule and administer project meetings throughout the progress of the work at the call of Owner and Consultant.
- .2 Prepare agenda for meetings.
- .3 Distribute written notice of each meeting four days in advance of meeting date to Owner and Consultants.
- .4 Owner will identify a location on Site for on-site meetings.
- .5 Preside at meetings.
- .6 Record the meeting minutes. Include significant proceedings and decisions. Identify actions by parties.
- .7 Reproduce and distribute copies of minutes within three days after meetings and transmit to meeting participants, Owner, and Consultants.
- .8 Representative of Contractor, Subcontractor and suppliers attending meetings will be qualified and authorized to act on behalf of party each represents.

### **1.03 PRECONSTRUCTION MEETING**

- .1 Within 5 days after award of Contract, request a meeting of parties in Contract to discuss and resolve administrative procedures and responsibilities.
- .2 Owner, Consultants, Contractor, major Subcontractors, field inspectors will be in attendance.
- .3 Establish time and location of meeting and notify parties concerned minimum 4 days before meeting.
- .4 Incorporate mutually agreed variations to Contract Documents into Agreement, prior to signing.
- .5 Agenda to include:
  - .1 Appointment of official representative of participants in the Work.
  - .2 Schedule of Work: in accordance with Section 01 32 16.16 - Construction Progress Schedule.
  - .3 Schedule of submission of shop drawings, samples, colour chips. Submit submittals in accordance with Section 01 33 00 - Submittal Procedures.
  - .4 Requirements for temporary facilities, site sign, offices, storage sheds, utilities, fences in accordance with Section 01 52 00 - Construction Facilities.
  - .5 Delivery schedule of specified equipment.
  - .6 Site security in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.
  - .7 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.
  - .8 Owner provided products.
  - .9 Record drawings in accordance with Section 01 33 00 - Submittal Procedures.
  - .10 Maintenance manuals in accordance with Section 01 78 00 - Closeout Submittals.
  - .11 Take-over procedures, acceptance, warranties in accordance with Section 01 78 00 - Closeout Submittals.
  - .12 Monthly progress claims, administrative procedures, photographs, hold backs.

- .13 Appointment of inspection and testing agencies or firms.
- .14 Insurances, transcript of policies.

#### **1.04 PROGRESS MEETINGS**

- .1 During course of Work and three weeks prior to project completion schedule progress meetings bi-weekly.
- .2 Contractor, major Subcontractors involved in Work, Consultants, and Owner are to be in attendance.
- .3 Notify parties minimum four days prior to meetings.
- .4 Record minutes of meetings and circulate to attending parties and affected parties not in attendance within three days after meeting.
- .5 Agenda to include the following:
  - .1 Review, approval of minutes of previous meeting.
  - .2 Review of Work progress since previous meeting.
  - .3 Field observations, problems, conflicts.
  - .4 Problems which impede construction schedule.
  - .5 Review of off-site fabrication delivery schedules.
  - .6 Corrective measures and procedures to regain projected schedule.
  - .7 Revision to construction schedule.
  - .8 Progress schedule, during succeeding work period.
  - .9 Review submittal schedules: expedite as required.
  - .10 Maintenance of quality standards.
  - .11 Review proposed changes for affect on construction schedule and on completion date.
  - .12 Other business.

### **2 PRODUCTS**

#### **2.01 NOT USED**

- .1 Not Used.

### **3 EXECUTION**

#### **3.01 NOT USED**

- .1 Not Used.

**END OF SECTION**

## **1 GENERAL**

### **1.01 RELATED REQUIREMENTS**

- .1 Refer to Owner's tender and bid documents and General Conditions of the Contract.

### **1.02 DEFINITIONS**

- .1 Activity: Distinct, scheduled portion of work performed during course of a project.
- .2 Activity Duration: time in calendar units between start and finish of a scheduled activity. See also Duration.
- .3 Assumption: factor in planning process that is considered true, real, or certain without proof or demonstration.
- .4 Bar Chart (Gantt Chart): graphic display of schedule-related information.
  - .1 In typical bar chart, schedule activities or work breakdown structure components are listed down left side of chart, dates are shown across the top, and activity durations are shown as date-placed horizontal bars.
- .5 Baseline: approved version of a work product that can be changed only through formal change control procedures and is used as a basis for comparison.
- .6 Budget: approved estimate for a project or work breakdown structure component or schedule activity.
- .7 Cash Flow: projection of progress payment requests based on cash loaded construction schedule.
- .8 Change Control: process whereby modifications to documents, deliverables, or baselines associated with a project are identified, documented, approved, or rejected.
- .9 Completion Milestones: they are firstly Substantial Performance and secondly Final Certificate.
- .10 Constraint: scheduled limiting factor that effects execution of a project, program, portfolio, or process.
- .11 Contract: mutually binding agreement that obligates a seller to provide a specified product or service or result and obligates a buyer to pay for it.
- .12 Control: comparing actual performance with planned performance, analyzing variance, assessing trends, to effect process improvements, evaluating possible alternatives, and recommending appropriate corrective action as needed.
- .13 Corrective Action: intentional activity that realigns performance of project work with project management plan.
- .14 Critical Path: sequence of activities that represents longest path through a project, which determines shortest possible duration.
- .15 Critical Path Activity: activity on critical path in a project schedule.
- .16 Critical Path Method (CPM): method used to estimate minimum project duration and determine amount of scheduling flexibility on logical network of paths within schedule model.
- .17 Data Date: point in time when the status of the project is recorded.
- .18 Decomposition: technique used for dividing and subdividing project scope and project



deliverables into smaller, more manageable parts.

- .19 Deliverable: unique and verifiable product, result, or capability to perform a service that is required to be produced to complete a process, phase, or project.
- .20 Duration: total number of work periods (not including holidays or other non-working periods) required to complete a schedule activity or work breakdown structure component.
  - .1 Usually expressed as workdays or work weeks.
- .21 Early Finish Date (EF): in Critical Path Method, earliest possible point in time when uncompleted portions of schedule activity can finish based on schedule network logic, data date, and schedule constraints.
  - .1 Early finish dates can change as Project progresses and changes are made to Project plan.
- .22 Early Start Date (ES): in Critical Path Method, earliest possible point in time when uncompleted portions of a schedule activity can start based on schedule network logic, data date, and schedule constraints.
  - .1 Early start dates can change as Project progresses and changes are made to Project Plan.
- .23 Execute: directing, managing, performing, and accomplishing project work; providing deliverables, and providing work performance information.
- .24 Finish Date: point in time associated with a schedule activity's completion.
  - .1 Usually qualified by one of following: actual, planned, estimated, scheduled, early, late, baseline, target, or current.
- .25 Float: (also known as slack) amount of time a schedule activity can be delayed without delaying early start date of a successor or violating a schedule constraint.
  - .1 This resource is available to both Owner and Contractor.
- .26 Forecast: estimate or prediction of conditions and events in project future based on information and knowledge available at time of forecast.
  - .1 Information is based on projects past performance and expected future performance, and includes information that could impact project in future, a such as estimate at completion and estimate to complete.
- .27 Gantt Chart: see Bar Chart.
- .28 Impact Analysis: schedule analysis technique that adds a modeled delay to an accepted construction schedule to determined possible outcome of that delay on project completion.
- .29 Imposed Date: a fixed date imposed on a schedule activity or schedule milestone, usually in form of a "start no earlier than" and "finish no later than" date.
- .30 Lag: amount of time whereby a successor activity is required to be delayed with respect to a predecessor activity.
- .31 Late Finish Date (LF): in critical path method, latest possible point in time when uncompleted portions of a schedule activity can finish based on schedule network logic, project completion date, and schedule constraints.
- .32 Late Start Date (LS): in critical path method, latest possible point in time when uncompleted portions of a schedule activity can start based on schedule network logic, project completion date, and schedule constraints.
- .33 Lead: amount of time whereby a successor activity can be advanced with respect to a predecessor activity.

- .34 Logic Diagram: see Project network diagram.
- .35 Logical Relationship: dependency between two activities or between an activity and a milestone.
- .36 Master Schedule: summary-level schedule that identifies major deliverable; work breakdowns structure components, and key schedule milestones.
- .37 Milestone: significant point or event in a project, program, or portfolio.
- .38 Monitor: collect project performance data with respect to a plan, procedure performance measures, and report and disseminate performance.
- .39 Network: see Project Schedule Network Diagram.
- .40 Non-Critical Activities: activities which when delayed, do not affect specified Contract duration.
- .41 Project Control System: fully computerized system utilizing commercially available software packages.
- .42 Project Management: application of knowledge, skills, tools, and techniques, to project activities to meet project requirements.
- .43 Project Management Plan: approved document that describes how project will be executed, monitored, and controlled.
  - .1 Primary uses of Project management plan are to document planning assumptions and decisions, facilitate communication among stakeholders, and document approved scope, cost, and schedule baselines.
  - .2 Project management plan may be summary or detailed.
- .44 Project Management Planning: development and maintenance of Project Management Plan.
- .45 Project Management Planning, Monitoring and Control System: overall system operated to enable monitoring of Project Work in relation to established milestones.
- .46 Project Schedule: planned dates for performing activities and planned dates for meeting milestones.
- .47 Project Schedule Network Diagram: graphical representation of logical relationships among project schedule activities.
  - .1 Always drawn from left to right to reflect Project chronology.
- .48 Project Scope: work performed to deliver a product, service, or result with specified features and functions.
- .49 Quantified days duration: working days based on 5 day work week, discounting statutory holidays.
- .50 Risk: uncertain event or condition that, if it occurs, has positive or negative effect on one or more project objectives.
- .51 Schedule: see Project Schedule.
- .52 Schedule Data: collection of information for describing and controlling schedule.
- .53 Scope: see Project Scope.
- .54 Start Date: point in time associated with activity's start, usually qualified by one of following: actual, planned, estimated, scheduled, early, late, target, baseline, or current.
- .55 Work Breakdown Structure (WBS): hierarchical decomposition of total scope of work to be carried

out by project team to accomplish project objectives and create the required deliverables.

### **1.03 REFERENCE STANDARDS**

- .1 Project Management Institute (PMI Standards)
  - .1 A Guide to the Project Management Body of Knowledge (PMBOK Guide) - Fifth Edition.
  - .2 Practice Standard for Scheduling.

### **1.04 ALLOWANCES**

- .1 Reserved.

### **1.05 ADMINISTRATIVE REQUIREMENTS**

- .1 Project Meeting:
  - .1 Meet with Owner and Consultant within 15 working days of Award of Contract date, to establish Work requirements and approach to project construction operations.
  - .2 Hold and participate in regular project progress meetings with Owner and Consultant specifically intended to discuss update of detailed schedule and Contract changes.
- .2 Scheduling:
  - .1 Ensure that planning process is iterative and results in generally top-down processing with more detail being developed as planning progresses, and decisions concerning options and alternatives are made.
  - .2 Ensure project schedule efficiencies through monitoring of project in detail to ensure integrity of Critical Path, by comparing actual completions of individual activities with their scheduled completions, and review progress of activities that have started but are not yet completed.
  - .3 Monitor sufficiently often so that causes of delays can immediately be identified and mitigated.
- .3 Project monitoring and reporting:
  - .1 Keep team aware of changes to schedule, and potential consequences as project progresses.
  - .2 Use narrative reports to provide advice on seriousness of challenges and measures to overcome them.
  - .3 Begin narrative reporting with statement on general status of project followed by summarization of delays, potential problems, corrective measures and project status criticality.
- .4 Critical Path Method (CPM) Requirements:
  - .1 Ensure Master Plan and Detail Schedule are practical and remain within specified Contract duration.
  - .2 Revise Master Schedule and Detail Schedule deemed impractical by Consultant and resubmit for approval.
  - .3 Change to Contract Duration:
    - .1 Acceptance of Master Schedule and Detail Schedule showing scheduled Contract duration shorter than specified Contract duration does not constitute change to Contract.
    - .2 Duration of Contract may only be changed through bilateral Agreement.
  - .4 Consider Master Schedule and Detail Schedule deemed practical by Consultant, showing Work completed in less than specified Contract duration, to have float.
  - .5 First Milestone on Master Schedule and Detail Schedule will identify start Milestone with an Early Start, "ES", constraint date equal to Award of Contract date.
  - .6 Calculate dates for completion of milestones from Plan and Schedule using specified time periods for Contract.
  - .7 Substantial Performance with Late Finish, "LF", constraint equal to calculated date.

- .8 Calculations on updates such that if early finish of Interim Certificate falls later than specified Contract duration then float calculation to reflect negative float.
- .9 Delays to non-critical activities with float may not be basis for time extension.
- .10 Do not use float suppression techniques such as extended activity times or imposed dates other than required by Contract.
- .11 Allow for adverse weather conditions normally anticipated and show in Master Plan and Detail Schedule.
  - .1 Specified Contract duration has been predicated assuming normal amount of adverse weather conditions.
- .12 Provide necessary crews and manpower to meet schedule requirements for performing Work within specified Contract duration.
  - .1 Simultaneous use of multiple crews on multiple fronts on multiple critical paths may be required.
- .13 Arrange participation on and off site of subcontractors and suppliers, as required for purpose of network planning, scheduling, updating and progress monitoring.
  - .1 Approvals by Consultant of original networks and revisions do not relieve Contractor from duties and responsibilities required by Contract.
- .14 Ensure that it is understood that Award of Contract or time of beginning, rate of progress, Interim Certificate and Final Certificate as defined times of completion are of essence of this Contract.

#### **1.06 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit to Consultant Project Control System for planning, scheduling, monitoring and reporting of project progress. Use of MS Project is required.
- .3 Submit Project Control System to Owner and Consultant for approval.
  - .1 Failure to comply with each required submission, may result in progress payment being withheld in accordance with Contract.
- .4 Include costs for execution, preparation and reproduction of schedule submittals in bid documents.
- .5 Submit letter ensuring that schedule has been prepared in co-ordination with major Subcontractors.
- .6 Refer to article "PROGRESS MONITORING AND REPORTING" of this specification Section for frequency of Project control system submittals.
- .7 Submit impact analysis of schedule for changes that result in extension of Contract Time.
  - .1 Include draft schedule update and report as outlined in article "PROGRESS MONITORING AND REPORTING".
- .8 Submit Project planning, monitoring and control system data as part of initial schedule submission and monthly status reporting and as required by Owner and Consultant in following form.
  - .1 Files in original scheduling software MS PROJECT containing schedule and cash flow information, labelled with data date, specific update, and person responsible for update.
  - .2 Master Schedule Bar Chart.
  - .3 Construction Detail Schedule Bar Chart.
  - .4 Listing of project activities including milestones and logical connectors, networks (sub-networks) from Project start to end. Sort activities by activity identification number and accompany with descriptions. List early and late start and finish dates together with durations, codes and float.
  - .5 Criticality report listing activities and milestones with up to 5 days total float used as first sort for ready identification of critical or near critical paths through entire project. List early

and late starts and finishes dates, together with durations, codes and float for critical activities.

- .6 Progress report in early start sequence, listing for each trade, activities due to start, underway, or finished within 2 months from monthly update date. List activity identification number, description and duration. Provide columns for entry of actual start and finish dates, duration remaining and remarks concerning action required.

#### **1.07 QUALITY ASSURANCE**

- .1 Use experienced personnel, fully qualified in planning and scheduling to provide services from start of construction to Final Certificate, including Commissioning.

#### **1.08 WORK BREAKDOWN STRUCTURE (WBS)**

- .1 Reserved.

#### **1.09 PROJECT MILESTONES**

- .1 Mandatory and recommended project milestones form targets for both Master Schedule and Detail Schedule of CPM construction network system.
  - .1 Refer to project milestones indicated by Owner's tender and bid documents, Contract, and Contract Documents where indicated.

#### **1.10 MASTER SCHEDULE**

- .1 Reserved.
- .2 Prepare comprehensive construction Master Schedule (CPM logic diagram) and dependent Cash Flow Projection within 10 working days of finalizing Agreement to confirm validity or alternates of identified milestones.
  - .1 Master Schedule will be used as baseline.
    - .1 Revise baseline as conditions dictate and as required by Consultant.
    - .2 Consultant as Project progresses will review and return revised baseline within 10 work days.
- .3 Reconcile revisions to Master Schedule and Cash Flow Projections with previous baseline to provide continuous audit trail.
- .4 Initial and subsequent Master Schedule will include:
  - .1 Schedule and cash flow information, clearly labelled with data date, specific update, and person responsible for update.
  - .2 Bar chart identifying coding, activity durations, early/late and start/finish dates, total float, completion as percentile, current status and budget amounts.
  - .3 Network diagram showing coding, activity sequencing (logic), total float, early/late dates, current status and durations.
  - .4 Actual/projected monthly cash flow: expressed monthly and shown in both graphical and numerical form.

#### **1.11 DETAIL SCHEDULE**

- .1 Provide detailed project schedule (CPM logic diagram) within 10 working days of Award of Contract date showing activity sequencing, interdependencies and duration estimates. Include listed activities as follows:
  - .1 Shop drawings.
  - .2 Samples.
  - .3 Approvals.
  - .4 Procurement.
  - .5 Construction.

- .6 Installation.
- .7 Site works.
- .8 Testing.
- .9 Commissioning and acceptance.
- .10 Lead Times and Delivery Dates.
- .2 Detail CPM schedule to cover in detail beginning from Award of Contract date with duration of each activity.
  - .1 Show remaining activities for CPM construction network system up to Final Certificate and develop complete detail as project progresses.
  - .2 Detail activities completely and comprehensively throughout duration of project.
- .3 Relate Detail Schedule activities to basic activities and milestones developed and approved in Master Schedule.
- .4 Clearly show sequence and interdependence of construction activities and indicate:
  - .1 Start and completion of all items of Work, their major components, and interim milestone completion dates.
  - .2 Activities for procurement, delivery, installation and completion of each major piece of equipment, materials and other supplies, including:
    - .1 Time for submittals, resubmittals and review.
    - .2 Time for fabrication and delivery of manufactured products for Work.
    - .3 Interdependence of procurement and construction activities.
  - .3 Include sufficient detail to assure adequate planning and execution of Work.
- .5 Provide level of detail for project activities such that sequence and interdependency of Contract tasks are demonstrated and allow co-ordination and control of project activities. Show continuous flow from left to right.
- .6 Ensure activities with no float are calculated and clearly indicated on logical CPM construction network system as being, whenever possible, continuous series of activities throughout length of Project to form "Critical Path". Increased number of critical activities is seen as indication of increased risk.
- .7 Insert Change Orders in appropriate and logical location of Detail Schedule. After analysis, clearly state and report to Consultant for review effects created by insertion of new Change Order.

#### **1.12 REVIEW OF CONSTRUCTION DETAIL SCHEDULE**

- .1 Allow minimum 5 work days for review by Consultant of proposed construction Detail Schedule unless otherwise specified.
- .2 Upon receipt of reviewed Detail Schedule make necessary revisions and resubmit to Consultant for review within maximum 5 work days unless otherwise specified.
- .3 Promptly provide additional information to validate practicability of Detail Schedule as required by Consultant.
- .4 Submittal of Detail Schedule indicates that it meets Contract requirements and will be executed generally in sequence.

#### **1.13 COMPLIANCE WITH DETAIL SCHEDULE**

- .1 Comply with reviewed Detail Schedule.
- .2 Proceed with significant changes and deviations from scheduled sequence of activities that cause delay, only after written receipt of approval by Consultant.

- .3 Identify activities that are behind schedule and causing delay. Provide measures to regain slippage.
  - .1 Corrective measures may include:
    - .1 Increase of personnel with more experience/qualifications on site for effected activities or work package.
    - .2 Increase in materials and equipment.
    - .3 Overtime work and Additional work shifts.
    - .4 Contractor is financially responsible for corrective measures required to adhere to their schedule.
- .4 Submit to Consultant, justification, project schedule data and supporting evidence for approval of extension to Contract completion date or interim milestone date when required. As part of supporting evidence, include:
  - .1 Written submission of proof of delay based on revised activity logic, duration and costs, showing time impact analysis illustrating influence of each change or delay relative to approved Contract schedule.
  - .2 Prepared schedule indicating how change will be incorporated into overall logic diagram. Demonstrate perceived impact based on date of occurrence of change and include status of construction at that time.
  - .3 Other supporting evidence requested by Consultant.
  - .4 Do not assume approval of Contract extension prior to receipt of written approval from Owner and Consultant.
- .5 In event of Contract extension, display in Detail Schedule that scheduled float time available for work involved has been used in full without jeopardizing earned float.
  - .1 Consultant will determine and advise Contractor number of allowable days for extension of Contract based on project schedule updates for period in question, and other factual information.
  - .2 Construction delays affecting project schedule will not constitute justification for extension of Contract completion date.

#### **1.14 PROGRESS AND REPORTING**

- .1 On an ongoing basis, Detail Schedule on job site to show "Progress to Date". Arrange participation on and off site of Subcontractors and suppliers, as, and when necessary, for purpose of network planning, scheduling, updating and progress monitoring.
- .2 Update and reissue project Work Breakdown Structure and relevant coding structures as project develops and changes.
- .3 Perform Detail Schedule update monthly with status dated (Data Date) on last working day of month. Update to reflect activities completed to date, activities in progress, logic and duration changes.
- .4 Do not automatically update actual start and finish dates by using default mechanisms found in project management software.
- .5 Submit to Owner and Consultant copies of updated Detail Schedule.
- .6 Requirements for monthly progress monitoring and reporting are basis for progress payment request.
- .7 Submit monthly written report based on Detail Schedule, showing Work to date performed, comparing Work progress to planned, and presenting current forecasts. Report summarize progress, defining problem areas and anticipated delays with respect to Work schedule, and critical paths. Explain alternatives for possible schedule recovery to mitigate potential delay. Include in report:
  - .1 Description of progress made.

- .2 Pending items and status of: permits, shop drawings, change orders, possible time extensions.
- .3 Status of Contract completion date and milestones.
- .4 Current and anticipated problem areas, potential delays and corrective measures.
- .5 Review of progress and status of Critical Path activities.

## **2 PRODUCTS**

### **2.01 NOT USED**

- .1 Not used.

## **3 EXECUTION**

### **3.01 NOT USED**

- .1 Not used.

**END OF SECTION**



## **1 GENERAL**

### **1.01 RELATED REQUIREMENTS**

- .1 Refer to all applicable specification sections and drawings and provide submittals as indicated in accordance with the General Conditions of the Contract.
- .2 In addition to submittals specifically requested by the Contract Documents, submit other submittals as may be reasonably requested by the Consultant, or as are required to coordinate the Work and to provide the Owner with choices available, within the scope of the Contract Documents.
- .3 Procedures and requirements for Contract closeout submittals shall be in accordance with the following sections:
  - .1 Section 01 77 00 – Closeout Procedures.
  - .2 Section 01 78 00 – Closeout Submittals.

### **1.02 REFERENCE STANDARDS**

- .1 Reserved.

### **1.03 ADMINISTRATIVE REQUIREMENTS**

- .1 Submit to Consultant submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .2 Do not proceed with Work affected by submittal until review is complete and submittal has been accepted by Consultant.
- .3 Present shop drawings, product data, samples and mock-ups in SI Metric units.
- .4 Where items or information is not produced in SI Metric units converted values are acceptable.
- .5 Review submittals before submission to Consultant. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and coordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.
- .6 Notify Consultant, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .7 Verify site measurements and affected adjacent Work are coordinated and include information on applicable submittals.
- .8 Contractor's responsibility for errors and omissions in submittal is not relieved by Consultant's review of submittals.
- .9 Contractor's responsibility for deviations in submittal from requirements of Contract Documents is not relieved by Consultant's review of submittals.
- .10 Keep one reviewed and accepted copy of each submittal on site.

### **1.04 SHOP DRAWINGS AND PRODUCT DATA**

- .1 Refer to CCDC 2 GC 3.11 where applicable, otherwise refer to terms of Contract.
- .2 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance

- charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.
- .3 Submit drawings stamped and signed by professional engineer registered or licensed in Ontario, Canada.
  - .4 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been coordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to Contract drawings and specifications.
  - .5 Allow 5 working days for Consultant's review of each submittal.
  - .6 Adjustments made on shop drawings by Consultant are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Consultant before to proceeding with Work.
  - .7 Make changes in shop drawings as Consultant may require, consistent with Contract Documents. When resubmitting, notify Consultant in writing of revisions other than those requested.
  - .8 Accompany submissions with transmittal letter, containing:
    - .1 Date.
    - .2 Project title and number.
    - .3 Contractor's name and address.
    - .4 Identification and quantity of each shop drawing, product data, and sample.
    - .5 Other pertinent data.
  - .9 Submissions to include:
    - .1 Date and revision dates.
    - .2 Project title and number.
    - .3 Name and address of:
      - .1 Subcontractor.
      - .2 Supplier.
      - .3 Manufacturer.
    - .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of site measurements and compliance with Contract Documents.
    - .5 Details of appropriate portions of Work as applicable:
      - .1 Fabrication.
      - .2 Layout, showing dimensions, including identified site dimensions and clearances.
      - .3 Setting or erection details.
      - .4 Capacities.
      - .5 Performance characteristics.
      - .6 Standards.
      - .7 Operating weight.
      - .8 Wiring diagrams.
      - .9 Single line and schematic diagrams.
      - .10 Relationship to adjacent work.
  - .10 After Consultant's review, distribute copies.
  - .11 Submit electronic copy of shop drawings for each requirement requested in specification Sections and as Consultant may reasonably request.
  - .12 Submit electronic copies of product data sheets or brochures for requirements requested in specification Sections and as requested by Consultant where shop drawings will not be prepared due to standardized manufacture of product.

- .13 Submit electronic copies of test reports for requirements requested in specification Sections and as requested by Consultant.
  - .1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.
  - .2 Testing must have been within 3 years of date of Contract award for project or applicable to most current standard unless otherwise noted.
- .14 Submit electronic copies of certificates for requirements requested in specification Sections and as requested by Consultant.
  - .1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.
  - .2 Certificates must be dated after award of Contract complete with project name.
- .15 Submit electronic copies of manufacturers instructions for requirements requested in specification Sections and as requested by Consultant.
  - .1 Pre-printed material describing installation of product, system or material, including special notices and Safety Data Sheets concerning impedances, hazards and safety precautions.
- .16 Submit electronic copies of Manufacturer's Site Reports for requirements requested in specification Sections and as requested by Consultant.
- .17 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
- .18 Submit electronic copies of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Consultant.
- .19 Delete information not applicable to project.
- .20 Supplement standard information to provide details applicable to project.
- .21 If upon review by Consultant no errors or omissions are discovered or if only minor corrections are made copies will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.
- .22 Reserved.

#### **1.05 SAMPLES**

- .1 Submit for review samples in duplicate as requested in respective specification Sections. Label samples with origin and intended use.
- .2 Deliver samples prepaid to Consultant's business address unless otherwise directed.
- .3 Notify Consultant in writing, at time of submission of deviations in samples from requirements of Contract Documents.
- .4 Where colour, pattern or texture is criterion, submit full range of samples.
- .5 Adjustments made on samples by Consultant are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Consultant before proceeding with Work.
- .6 Make changes in samples which Consultant may require, consistent with Contract Documents.

- .7 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.

## **1.06 MOCK-UPS**

- .1 Erect mock-ups in accordance with Section 01 43 00 - Quality Assurance.

## **1.07 PHOTOGRAPHIC DOCUMENTATION OF CONSTRUCTION PROGRESS**

- .1 Submit electronic copy of colour digital photography in jpg format, fine resolution monthly with progress statement and as directed by Consultant and or Owner.
- .2 Project identification: name and number of project and date of exposure indicated.
- .3 Number of viewpoints:
  - .1 Select viewpoints suitable to describe work and progress, provide additional photos as request of Consultant and Owner.
- .4 Frequency of photographic documentation: monthly.
  - .1 Upon completion of: excavation, foundation, framing and services before concealment of Work, and as directed by Consultant and Owner.
  - .2 When submitting monthly progress application to establish general progress of the Work.
  - .3 Submit additional photographic documentation as requested by Consultant and Owner.

## **1.08 CERTIFICATES AND TRANSCRIPTS**

- .1 Immediately after award of Contract, submit Workers' Compensation Board status.
- .2 Submit transcription of insurance immediately after award of Contract where applicable.

## **2 PRODUCTS**

### **2.01 NOT USED**

- .1 Not Used.

## **3 EXECUTION**

### **3.01 NOT USED**

- .1 Not Used.

**END OF SECTION**

## **1 GENERAL**

### **1.01 RELATED REQUIREMENTS**

- .1 Refer to Owner's health and safety requirements, designated substances survey reports, project specific Preventive Measures Analysis Form, and other relevant project information where applicable.
- .2 Section 02 81 00 - Hazardous Materials, where applicable.

### **1.02 REFERENCE STANDARDS**

- .1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations.
- .2 Province of Ontario:
  - .1 Occupational Health and Safety Act and Regulations for Construction Projects, R.S.O. 1990, c.0.1, as amended and O. Reg. 213/91 as amended - Updated 2005.
  - .3 Occupational Health and Safety Act, R.S.Y. - Updated 2006.

### **1.03 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit site-specific Health and Safety Plan: Within 10 days after date of Award / Notice to Proceed and prior to commencement of Work. Health and Safety Plan must include:
  - .1 Results of site specific safety hazard assessment.
  - .2 Results of safety and health risk or hazard analysis for site tasks and operation.
- .3 Submit copies of Contractor's authorized representative's work site health and safety inspection reports to Owner, and to authority having jurisdiction where required.
- .4 Submit copies of reports or directions issued by Federal, Provincial and Territorial health and safety inspectors.
- .5 Submit copies of incident and accident reports.
- .6 Submit WHMIS Safety Data Sheets (SDS).
- .7 Owner and/or Consultant will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within 5 days after receipt of plan. Revise plan as appropriate and resubmit plan to Owner and Consultant within 3 days after receipt of comments.
- .8 Owner and Consultant's review of Contractor's final Health and Safety plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.
- .9 Medical Surveillance: where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel prior to commencement of Work, and submit additional certifications for any new site personnel to Owner and Consultant.
- .10 On-site Contingency and Emergency Response Plan: address standard operating procedures to be implemented during emergency situations. Submit to Owner for review and approval.

### **1.04 FILING OF NOTICE**

- .1 File Notice of Project with Provincial authorities prior to beginning of Work.
- .2 Contractor shall be responsible and assume the Principal Contractor role for each work zone

location and not the entire complex. Contractor shall provide a written acknowledgement of this responsibility within 3 weeks of contract award.

- .3 Work zone locations include: Areas of Work indicated on Drawings.
- .4 Contractor shall agree to install proper site separation and identification in order to maintain time and space separation at all times throughout life of project.

#### **1.05 SAFETY ASSESSMENT**

- .1 Perform site specific safety hazard assessment related to project.

#### **1.06 MEETINGS**

- .1 Schedule and administer Health and Safety meeting with Owner and Consultant prior to commencement of Work.

#### **1.07 REGULATORY REQUIREMENTS**

- .1 Do Work in accordance with Section 01 41 00 - Regulatory Requirements.

#### **1.08 PROJECT/SITE CONDITIONS**

- .1 Refer to Owner's provided designated substance survey report where applicable.

#### **1.09 GENERAL REQUIREMENTS**

- .1 Develop written site-specific Health and Safety Plan based on hazard assessment prior to beginning site Work and continue to implement, maintain, and enforce plan until final demobilization from site. Health and Safety Plan must address project specifications.
- .2 Owner and Consultant may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns.

#### **1.10 RESPONSIBILITY**

- .1 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.
- .2 Contractor will be responsible and assume the role Constructor as described in the Ontario Occupational Health and Safety Act and Regulations for Construction Projects.
- .3 Contractor shall be the Principal Contractor as described in the Quebec Act Respecting Health and Safety code for the Construction for only their scope and areas of work as defined and described this project specification.
- .4 Comply with and enforce compliance by employees with safety requirements of Contract Documents, applicable federal, provincial, territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

#### **1.11 COMPLIANCE REQUIREMENTS**

- .1 Comply with Ontario Occupational Health and Safety Act, R.S.O. 1990, c. 0.1 and Ontario Regulations for Construction Projects, O. Reg. 213/91.
- .2 Comply with Occupational Health and Safety Regulations, 1996.

- .3 Comply with Occupational Health and Safety Act, General Safety Regulations.
- .4 Comply with Canada Labour Code, Canada Occupational Safety and Health Regulations.

#### **1.12 UNFORSEEN**

- .1 When unforeseen or peculiar safety-related factors, hazards, or conditions occur during performance of Work, follow procedures in place for Employee's Right to Refuse Work in accordance with Acts and Regulations of Province having jurisdiction and advise Owner verbally and in writing.
- .2 When unforeseen or peculiar safety-related factors, hazards, or conditions occur during performance of Work, advise Health and Safety co-ordinator where available and follow procedures in accordance with Acts and Regulations of Province having jurisdiction and advise Owner verbally and in writing.

#### **1.13 HEALTH AND SAFETY CO-ORDINATOR**

- .1 Employ and assign to Work, competent and authorized representative as Health and Safety Co-ordinator. Health and Safety Co-ordinator must:
  - .1 Have site-related working experience specific to required Work activities.
  - .2 Have working knowledge of occupational safety and health regulations.
  - .3 Be responsible for completing Contractor's Health and Safety Training Sessions and ensuring that personnel not successfully completing required training are not permitted to enter site to perform Work.
  - .4 Be responsible for implementing, enforcing daily and monitoring site-specific Contractor's Health and Safety Plan.
  - .5 Be on site during execution of Work and report directly to and be under direction of site supervisor.

#### **1.14 POSTING OF DOCUMENTS**

- .1 Ensure applicable items, articles, notices and orders are posted in conspicuous location on site in accordance with Acts and Regulations of Province having jurisdiction, and in consultation with Owner.

#### **1.15 CORRECTION OF NON-COMPLIANCE**

- .1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Owner and or Consultant.
- .2 Provide Owner and or Consultant with written report of action taken to correct non-compliance of health and safety issues identified.
- .3 Owner and or Consultant may stop Work if non-compliance of health and safety regulations is not corrected.

#### **1.16 BLASTING**

- .1 Blasting or other use of explosives is not permitted.

#### **1.17 POWDER ACTUATED DEVICES**

- .1 Use powder actuated devices only after receipt of written permission from Owner.

**1.18 WORK STOPPAGE**

- .1 Give precedence to safety and health of public and site personnel and protection of environment over cost and schedule considerations for Work.

**2 PRODUCTS**

**2.01 NOT USED**

- .1 Not used.

**3 EXECUTION**

**3.01 NOT USED**

- .1 Not used.

**END OF SECTION**



## **1 GENERAL**

### **1.01 SUMMARY**

- .1 This Section references laws, bylaws, ordinances, rules, regulations, codes, orders of Authority Having Jurisdiction (AHJ), and other legally enforceable requirements applicable to the Work and that are or become enforced during performance of the Work.

### **1.02 RELATED REQUIREMENTS**

- .1 Refer to Owner's tender and bid documents.

### **1.03 DEFINITIONS**

- .1 Reference Standards: Means consensus standards, trade association standards, guides, and other publications expressly referenced in the Contract Documents.

### **1.04 REFERENCE STANDARDS AND REFERENCE DOCUMENTS**

- .1 If specified referenced standards do not indicate an edition or version, the latest edition or revision issued by the publisher at the time of bid closing shall apply, except as follows:
  - .1 If a particular edition or revision date of a specified standard is referenced in an applicable code or other regulatory requirement, the edition or version in the regulatory reference shall apply.
- .2 The specified reference standards establish minimum requirements. If Contract Documents indicate requirements that conflict with a reference standard, the more stringent requirements shall apply.
- .3 If multiple reference standards are specified and the standards establish different requirements, the most stringent requirement shall apply.
- .4 In case of discrepancy or uncertainties, refer to Owner or Consultant for interpretation or clarification.

### **1.05 CODES**

- .1 Building Code: Perform Work in accordance with the Ontario Building Code (OBC) including amendments up to tender closing time and other code provincial or local application provided that in case of conflict or discrepancy, more stringent requirements apply.
- .2 Fire Code: Perform Work in accordance with the Ontario Fire Code including amendments up to the time of bid closing and other codes of provincial or local application.
- .3 Energy Code: Refer to applicable mechanical and electrical Contract Documents.
- .4 Plumbing Code: Refer to applicable mechanical Contract Documents.
- .5 If there is a conflict or discrepancy between codes, the most stringent requirements shall apply.
- .6 Specific design and performance requirements listed in Specifications and indicated on Drawings may exceed minimum requirements established by referenced Codes; these requirements will govern over the minimum requirements listed in the referenced Codes.

### **1.06 LAWS**

- .1 Reserved.

## **1.07 FEES**

- .1 Regulatory Requirements: Except as otherwise specified, Contractor shall apply for, obtain, and pay fees associated with all necessary permits, licenses, certificates, and approvals required by regulatory requirements and Contract Documents to perform the Work, based on General Conditions of Contract and the following:
  - .1 Regulatory requirements and fees in force at the time of bid closing, and
  - .2 A change in regulatory requirements or fees scheduled to become effective after the time of bid closing and of which public notice has been given before the time of bid closing.

## **1.08 HAZARDOUS MATERIAL DISCOVERY**

- .1 Asbestos: demolition of spray or trowel-applied asbestos is hazardous to health. Refer to Owner's Designed Substance Survey Report where available.
- .2 PCB: Polychlorinated Biphenyl: stop work immediately when material resembling PCB is encountered during demolition work. Notify Owner and Consultant in writing.
- .3 Mould: stop work immediately when material resembling mould is encountered during demolition work. Notify Owner and Consultant in writing.

## **2 PRODUCTS**

### **2.01 EASEMENTS AND NOTICES**

- .1 Reserved.

### **2.02 PERMIT REQUIREMENTS**

- .1 Development Permit: Owner has applied for, obtained, and paid for development permit.
- .2 Building Permit:
  - .1 Owner shall apply for, obtain and pay for building permit.
  - .2 Contractor is responsible for obtaining and coordinating other permits required for Work and its various parts, including but not limited to permits required to injure or remove trees, working on public property, street and road obstruction etc.
  - .3 Contractor will require that specific Subcontractors obtain and pay for some permits required by authorities having jurisdiction (AHJ), where their work is affected by work requiring permits including medical gas installation and asbestos abatement and control permits if required.
  - .4 Contractor shall display building permit and other permits in a conspicuous location at the Place of the Work.
- .3 Occupancy Permits:
  - .1 Contractor shall apply for, obtain, and pay for occupancy permits, including partial occupancy permits where required by authorities having jurisdiction (AHJ).
  - .2 Contractor shall correct deficiencies in accordance with Consultant's instructions. If a deficiency is not corrected, the Owner reserves the right to make correction and charge Contractor for costs incurred.
  - .3 Contractor shall turn occupancy permits over to Owner.

**3 EXECUTION**

**3.01 NOT USED**

.1 Not Used.

**END OF SECTION**

## **1 GENERAL**

### **1.01 RELATED REQUIREMENTS**

- .1 Refer to all technical specification Sections for additional quality assurance requirements specific to each trade.

### **1.02 DEFINITIONS**

- .1 Mock-up: A full-size physical example that demonstrates materials, finishes, interrelationship of materials and assemblies, aesthetic effects, and execution. A mock-up may demonstrate coordination of multiple Subcontractors' work. A mock-up establishes a standard by which the Work will be judged. Mock-ups are not samples.
- .2 Quality Assurance: Procedures for preventing defects and deficiencies before and during execution of the Work.
- .3 Quality Audit: Systematic and independent examination to determine whether quality requirements have been fulfilled as planned. A quality audit will examine processes, products and services to determine if they have been implemented effectively to achieve their specified objective.

### **1.03 REFERENCE STANDARDS**

- .1 ASTM International (ASTM):
  - .1 [ASTM E 329-\[20\]](#) ASTM Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection.
- .2 International Organization for Standardization (ISO):
  - .1 ISO 9001: 2015, Quality Management Systems – Requirements.

### **1.04 SECTION INCLUDES**

- .1 This Section describes administrative and procedural requirements for proactive Contractor activities to assure the quality of construction before and during execution of the Work.

### **1.05 ADMINISTRATIVE REQUIREMENTS**

- .1 Contractor is responsible for self-performed testing and inspections and submission of test reports to Consultants and Owner.
- .2 Where indicated in technical specification Sections, Contractor will employ and pay for quality audit services performed through third-party observation and testing to validate the Contractor's performance of the Work and perform whole building testing at completion of project.
- .3 Contractor to provide a Quality Management System that establishes a standardized approach to managing quality of materials and workmanship during the execution of Work in accordance with ISO 9001. Quality Management System will describe Contractor 's contributions for testing and inspection programs as necessary for successful Work.

### **1.06 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit a detailed testing and inspections schedule to Owner and Consultant in accordance with the Contractor 's Quality Management System.
- .3 Submit certificates for products, process and system for review by Consultant.

- .4 Submit formal testing and inspections reports **as indicated in technical specification Sections** to Owner and Consultants in accordance with contractual agreement.
- .5 Submit quality assurance inspection and test report to Owner and Consultants, except where a technical specification Section indicates otherwise.
- .6 Submit mill test certificates as required in technical specification Sections and as indicated on Drawings.

## **1.07 QUALIFICATIONS**

- .1 Manufacturers' Qualifications:
  - .1 Specializes in manufacturing the products specified in the technical Section of the Project's construction specification.
  - .2 Minimum 3 years documented experience with a record of successful performance, or greater as indicated in technical specification Sections.
- .2 Suppliers' Qualifications:
  - .1 Authorized to distribute manufacturer's products.
  - .2 Has capacity to supply required products without delaying the Project.
- .3 Fabricators' Qualifications:
  - .1 Experienced in producing products required for this Project.
  - .2 Successful record of in-service performance with past project experience of similar complexity and scale.
  - .3 Sufficient production capacity to fabricate required products without delaying the Project.
  - .4 Is a member of local and/or applicable trade organization indicated in technical specification Sections.
- .4 Installer Qualifications:
  - .1 Firm or individual experienced in design and installation, application, and erection of materials to the extent required for this Project.
  - .2 successful record of in-service performance with past project experience of similar complexity and scale.
  - .3 Is a member of local and/or applicable trade organization indicated in technical specification Sections.
- .5 Testing and Inspecting Agency Qualifications:
  - .1 Accredited organizations by the Standards Council of Canada for testing and inspection.
  - .2 Capable of reliably performing testing of building products and inspections of construction activities in accordance with ISO 9001 and [ASTM E 329](#) unless otherwise noted.
  - .3 Obtain Owner and Consultant approval of testing and inspecting agency prior to proceeding with testing and inspections services.
- .6 Licensed Professionals Qualifications:
  - .1 Individual registered or licensed to practice their respective design profession as defined by the statutory requirements of the professional registration laws of the Province or jurisdiction in which the project is to be constructed.

## **1.08 CERTIFICATIONS**

- .1 Ensure that certification of products, processes, and systems includes physical and examination testing as specified in [ASTM E 329](#) and or ISO 9001 to confirm compliance with Specifications requirements where applicable.

## **1.09 COORDINATION**

- .1 Coordinate and schedule tests and inspections with accredited inspection agencies as indicated

in Contract Documents and in accordance with [ASTM E 329](#) requirements.

- .2 Coordinate Contractor's Quality Management System with Owner and Consultant for reporting, scheduling access and incidental labour required by Quality Auditor's reports if required.
- .3 Obtain Consultant approval before proceeding with inspections, and additional tests and inspections as may be reasonably requested by Consultant and Owner.
- .4 Coordinate testing and inspections schedule with subcontractor, testing agencies, and other affected parties.

#### **1.10 SITE SAMPLES**

- .1 Obtain Consultant's acceptance to proceed with the sampling process.
  - .1 Testing agency is responsible for obtaining representative samples of those materials required to be tested and evaluated as directed by Consultant in accordance with the Contract Documents.
- .2 Ensure testing agency performs sampling in accordance with [ASTM E 329](#).
  - .1 When sampling collection is required by testing agency, ensure proper protection, handling and storing of samples.
- .3 Testing agency to document procedures and appropriate techniques to select samples.
- .4 Record details of environmental conditions present during the sampling, such as rain or freezing weather that may affect testing of sample or interpretation of test results.

#### **1.11 MOCK-UPS**

- .1 Mock-ups can be used as a reference for assessing quality of workmanship and site-applied finishes as requested in the project's Contract Documents.
- .2 Obtain Consultant's acceptance of mock-ups installation before beginning to install those portions of the Work represented by the mock-up.
- .3 Assemble mock-ups at the Place of the Work or in locations acceptable to Owner and Consultant, or where location is indicated in the technical specification Section.
- .4 Schedule mock-ups ready for Owner's and Consultant's review and in orderly sequence, to avoid delays in Work.
  - .1 Failure to prepare mock-ups in ample time is not considered sufficient reason to request an extension of Contract Time. Claims for extension of Contract Time by reason of such default will not be considered.
- .5 Reserved.
- .6 Construct mock-ups using materials, finishes, colours, and methods proposed for the completed Work. Mock-ups to demonstrate proposed workmanship and range of aesthetic appearance.
- .7 Where a mock-up represents or affects multiple specification Sections, coordinate activities of these Subcontractors to ensure mock-ups are complete.
- .8 Modify or replace mock-ups when unacceptable to Consultant.
- .9 Maintain acceptable mock-ups in an undisturbed condition as a standard for judging the completed Work.
- .10 Demolish and remove mock-ups after review of mock up(s) are completed unless otherwise stated by Owner and Consultant.

## **2 PRODUCTS**

### **2.01 NOT USED**

.1 Not Used.

## **3 EXECUTION**

### **3.01 NOT USED**

.1 Not Used.

**END OF SECTION**

## **1 GENERAL**

### **1.01 SUMMARY**

- .1 This Section describes administrative and procedural requirements for reactive activities to verify that completed Work conforms to Contract Documents requirements.
- .2 Having inspection and testing agencies by Contractor or Owner does not relieve the Contractor of their responsibility to perform Work in accordance with Contract Documents.

### **1.02 RELATED REQUIREMENTS**

- .1 Refer to Contract.

### **1.03 ADMINISTRATIVE REQUIREMENTS**

- .1 Cash Allowances for independent inspection and testing services to be retained and paid for by the Contractor as described in Section 01 21 00 - Allowances. Cash Allowance(s) exclude any inspection and testing that is for the Contractor's own quality control, and excludes inspection and testing required by authority having jurisdiction (AHJ).
- .2 Allow and coordinate access to Work on site, manufacturing off site, and fabrication off site with inspection and testing agencies.
- .3 Retain and pay for inspection and testing that are designated for Contractor's own quality control plan, and when testing and inspection are required by AHJ.
- .4 Give advanced notice to Consultant and to each inspection/testing agency for inspection and testing required by Contract Documents or by AHJ.
- .5 In advance of each test, notify appropriate agency and Consultant in the order that attendance arrangements can be made.

### **1.04 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit schedule of testing and inspection activities to Consultant, Owner, applicable Subcontractors, testing agencies, and other affected parties. Include the following:
  - .1 List each testing and inspection agency.
  - .2 Identify types of tests and inspections for each agency, and cross reference to applicable specification Section number-title in Contract Documents.
  - .3 Description of test and inspection.
  - .4 Identify applicable reference standard.
  - .5 Identify test and inspection method.
  - .6 Indicate number of each test and inspection required.
- .3 Submit each quality assurance inspection and test report to Owner and Consultant, except where a technical specification Section indicates otherwise.
- .4 Submit reports for inspection and testing required by Contract Documents or by AHJ and performed by Contractor-retained inspection and testing agencies within 10 days after inspection or test is completed, except where a technical specification Section indicates a different time period.
- .5 Submit each quality control inspection and test report to Owner and Consultant, except where a technical specification Section indicates otherwise.



- .6 Deliver copies of quality control reports to Subcontractor of work being inspected or tested.

#### **1.05 SOURCE QUALITY CONTROL PROCEDURES**

- .1 Reserved.

#### **1.06 SITE QUALITY CONTROL PROCEDURES**

- .1 Provide labour, construction equipment, and temporary facilities to obtain and handle test samples and materials on site. Arrange for sufficient space to store and cure test samples.
- .2 Deliver samples and materials required for testing, as requested in technical specification Sections. Submit with reasonable promptness and in an orderly sequence to avoid delays in Work.

#### **1.07 TESTING AND INSPECTION SERVICES**

- .1 Contractor will retain and pay for independent inspection and testing agencies to inspect, test, or perform other quality control reviews of parts of the work, except where indicated otherwise.
- .2 Provide equipment required for executing inspection and testing by appointed agencies.
- .3 Correct defects and deficiencies when they are revealed during inspection or testing as advised by independent inspection agency representative at no change to Contract Price or Contract Time. Pay costs for retesting and re-inspection. Appointed agency will request additional inspections or tests to ensure full degree of defects or deficiencies are revealed and corrected.
- .4 Quality control testing and inspection reports to include the following:
  - .1 Project name and number.
  - .2 Testing/Inspection agency's name, address, telephone number, and website, and engineering seals where applicable.
  - .3 Date of issuing report.
  - .4 Dates and locations of tests, inspections, or samples.
  - .5 Description of the Work and test and inspection method.
  - .6 Numbers and titles of associated specification Sections.
  - .7 Test and inspection data and interpretation of test results (e.g., pass or fail).
  - .8 Ambient conditions at time of test, inspection, or sampling.
  - .9 Recommendations on re-testing and re-inspecting, if applicable.

#### **1.08 MANUFACTURING FACILITY INSPECTION PROCEDURES**

- .1 Reserved.

#### **1.09 CLIMATE RESILIENCY QUALITY CONTROL PROCEDURES**

- .1 Reserved.

#### **1.10 CODE-REQUIRED SPECIAL INSPECTIONS AND PROCEDURES**

- .1 Reserved.

#### **1.11 CONSULTANT REVIEW**

- .1 Allow Consultant access to Work.
- .2 Give minimum 10 working days of advanced notice to Consultant for work requiring Consultant review.

- .3 If Contractor covers or permits covering of Work that is required to be reviewed prior to covering, Contractor shall uncover Work for review, then make good Work at Contractor's expense.
- .4 Consultant may order part of Work to be examined at Contractor's expense if Work is suspected to be not in accordance with Contract Documents.

#### **1.12 REJECTED WORK**

- .1 Refer to Contract.
- .2 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not which has been rejected by Consultant as failing to conform to Contract Documents. Replace or re-execute Work in accordance with Contract Documents at Contractor's expense.
- .3 If Contractor refuses to make good noted defective Work, the Owner reserves the right to have Work completed by own forces at Contractor's expense.

### **2 PRODUCTS**

#### **2.01 NOT USED**

- .1 Not Used.

### **3 EXECUTION**

#### **3.01 NOT USED**

- .1 Not Used.

**END OF SECTION**

## **1 GENERAL**

### **1.01 GENERAL REQUIREMENTS**

- .1 Arrange, obtain and pay for all costs for permits required for temporary works, facilities, controls.
- .2 Provide and maintain temporary facilities and controls for the Work and remove them upon issuance of certificates of substantial performance.
- .3 Arrange and pay for required temporary services, unless otherwise indicated by Consultant.
- .4 Do not use permanent mechanical or electrical systems during the course of the Work unless specific written permission is provided by the Consultant and Owner.
- .5 Provide connection and disconnection of temporary services and facilities required in the Work.
- .6 Where Work is taking place within an occupied building, refer to Section 01 14 00 Work Restrictions for requirements.

### **1.02 RESERVED**

- .1 Reserved.

### **1.03 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

### **1.04 TEMPORARY ELECTRICITY**

- .1 Provide and pay for temporary electricity for all required lighting and operating of power tools during construction.
- .2 Arrange for connection with appropriate utility company. Pay costs for installation, maintenance, and removal.
- .3 Temporary electricity for all electric equipment required to perform the Work is responsibility of Contractor.
- .4 Electrical power systems installed under this Contract may not be used for construction requirements unless provided with prior approval from Owner if warranties are not affected.
  - .1 Contractor to repair damage to electrical system caused by use under this Contract.

### **1.05 TEMPORARY FIRE PROTECTION**

- .1 Provide and maintain temporary fire protection equipment during performance of Work required by insurance companies having jurisdiction and governing codes, regulations and bylaws.
- .2 Provide and maintain temporary fire protection equipment during performance of Work required by insurance companies having jurisdiction and by governing codes, regulations and bylaws.
- .3 Burning rubbish and construction waste materials is not permitted on site.

### **1.06 TEMPORARY FUEL OIL**

- .1 Reserved.

### **1.07 TEMPORARY HEATING COOLING AND VENTILATING**

- .1 Provide temporary heating as required during construction period, including attendance,

- maintenance and fuel.
- .2 Construction heaters used inside building must be vented to outside or be of the flameless (vent free) type. Solid fuel salamanders are not permitted.
- .3 Provide temporary heat and ventilation in enclosed areas as required to:
  - .1 Facilitate progress of Work.
  - .2 Protect Work and Products against dampness and cold.
  - .3 Prevent moisture and condensation on surfaces.
  - .4 Provide ambient temperatures and humidity levels for storage, installation, and curing of materials.
  - .5 Provide adequate ventilation to meet health regulations for safe working environment.
- .4 Maintain minimum temperatures of 10 °C in areas where construction is in progress.
- .5 Ventilating:
  - .1 Prevent accumulations of dust, fumes, mists, vapours, or gases in occupied areas during construction.
  - .2 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.
  - .3 Dispose of exhaust materials in a manner that will not result in harmful exposure to persons.
  - .4 Ventilate storage spaces containing hazardous or volatile materials.
  - .5 Ventilate temporary sanitary facilities.
  - .6 Continue operating ventilation and exhaust system after cessation of work process until complete removal of harmful contaminants is ensured.
- .6 Permanent heating, ventilating, and air conditioning system of building, may be used where approved by Owner. Be responsible for damage to systems if use is permitted.
- .7 On completion of Work for which permanent heating system is used, replace filters and provide thorough cleaning and or decontamination of ductwork.
- .8 Ensure Date of Substantial Performance and Warranties for heating system does not start until entire system is in as near original condition as possible and is certified by Consultant.
- .9 Pay costs for maintaining temporary heat when using permanent heating system.
- .10 Maintain strict supervision of operation of temporary heating and ventilating equipment to:
  - .1 Conform with applicable codes and standards.
  - .2 Enforce safe practices.
  - .3 Prevent abuse of services.
  - .4 Prevent damage to finishes.
  - .5 Vent direct-fired combustion units to outside.
- .11 Be responsible for damage to Work due to failure to provide adequate heat and protection during construction.

## **1.08 TEMPORARY LIGHTING**

- .1 Provide and maintain temporary lighting throughout Project. Ensure level of illumination on all floors and stairs is not less than 162 lx unless otherwise stated in applicable codes and regulations.
- .2 Electrical lighting systems installed under this Contract may be used for construction requirements only with prior approval of Owner and if warranties are not affected.
  - .1 Repair damage to lighting systems caused by use under this Contract.
  - .2 Replace lamps that have been used for more than 3 months.

## **1.09 TEMPORARY NATURAL GAS**

- .1 Reserved.

## **1.10 TEMPORARY TELECOMMUNICATIONS**

- .1 Provide and pay for temporary telephone, fax, and or data hook up and lines and equipment necessary for own use and use of Owner.

## **1.11 TEMPORARY WATER**

- .1 Provide continuous supply of potable water for construction use.
- .2 Arrange for connection with appropriate utility company and pay costs for installation, maintenance, and removal.
- .3 Pay for utility charges at prevailing rates, based on General Conditions of Contract.
- .4 Use of building's washroom facilities by workers is prohibited, unless otherwise indicated in Owner's tender and bid documents. Where washroom facilities are not provided by Owner, Contractor to provide and maintain temporary sanitary water closets and washbasins for use by workers.

## **1.12 TEMPORARY EROSION AND SEDIMENTATION CONTROL**

- .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction, specific to site, that complies with requirements of authorities having jurisdiction.

## **1.13 TEMPORARY STRUCTURAL SUPPORTS**

- .1 Provide shoring as required to suit proposed design indicating modifications to existing construction.

## **1.14 TEMPORARY DRAINAGE AND PUMPING FOR DEWATERING**

- .1 Provide temporary drainage and pumping equipment to keep excavations and site free from standing water.

## **2 PRODUCTS**

### **2.01 NOT USED**

- .1 Not Used.

## **3 EXECUTION**

### **3.01 INSTALLATION AND REMOVAL**

- .1 Provide temporary utilities to execute Work expeditiously.
- .2 Remove all such temporary utilities from site after use.

**END OF SECTION**

## **1 GENERAL**

### **1.01 RELATED REQUIREMENTS**

- .1 Refer to Owner's tender and bid documents.

### **1.02 REFERENCE STANDARDS**

- .1 General Conditions of the Contract.
- .2 Canadian General Standards Board (CGSB):
  - .1 [CAN/CGSB 1.189-\[00\]](#), Exterior Alkyd Primer for Wood.
  - .2 [CGSB 1.59-\[97\]](#), Alkyd Exterior Gloss Enamel.
- .3 CSA Group (CSA):
  - .1 [CSA-A23.1/A23.2-\[04\]](#), Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
  - .2 CSA-0121-[M1978(R2003)], Douglas Fir Plywood.
  - .3 [CSA S269.2-16 \(R2021\)](#), Access Scaffolding for Construction Purposes.
  - .4 [CAN/CSA-Z321-\[96\(R2001\)\]](#), Signs and Symbols for the Occupational Environment.

### **1.03 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Reserved.

### **1.04 INSTALLATION AND REMOVAL**

- .1 Prepare site plan indicating proposed location and dimensions of area to be fenced and used by Contractor, number of trailers to be used, avenues of ingress/egress to fenced area and details of fence installation.
- .2 Identify areas which have to be graveled to prevent tracking of mud.
- .3 Indicate use of supplemental or other staging area.
- .4 Provide construction facilities in order to execute work expeditiously.
- .5 Remove from site all such work after use.

### **1.05 SCAFFOLDING**

- .1 Scaffolding in accordance with [CAN/CSA-S269.2](#).
- .2 Provide and maintain scaffolding, ramps, ladders, swing staging, platforms, temporary stairs and all other required temporary construction required to perform Work.

### **1.06 HOISTING**

- .1 Provide, operate and maintain hoists cranes required for moving of workers, materials and equipment. Make financial arrangements with Subcontractors for their use of hoists.
- .2 Hoists cranes to be operated by qualified operator.
- .3 Review and coordinate any proposed hoist crane locations with Owner and obtain necessary approvals from Authorities Having Jurisdiction.

## **1.07 ELEVATORS**

- .1 Only designated existing elevators are to be used by construction personnel [and transporting of materials]. Co-ordinate use with Owner.
- .2 Provide protective coverings for finish surfaces of cars and entrances.
- .3 Repair any damages to equipment and finishes to restore to original condition and pay for all costs associated.

## **1.08 SITE STORAGE/LOADING**

- .1 Refer to Contract.
- .2 Confine work and operations of employees by Contract Documents. Do not unreasonably encumber premises with products.
- .3 Do not load or permit to load any part of Work with weight or force that will endanger Work.
- .4 Refer to all specification sections applicable to temporary barriers and hoarding requirements.
- .5 Prepare a plan indicating site storage, staging, loading information on a drawing and submit to Owner and Consultants for review and coordination.

## **1.09 CONSTRUCTION PARKING**

- .1 Parking will not be permitted on site, unless otherwise indicated in Owner's tender and bid documents.
- .2 Provide and maintain adequate access to project site.
- .3 Clean runways and taxi areas where used by Contractor's equipment.

## **1.10 SECURITY**

- .1 Provide and pay for responsible security personnel to guard site and contents of site after working hours and during holidays.
- .2 Contractor to secure site from entry of persons, rodents etc. during non-working hours.
- .3 Refer to Contract.

## **1.11 OFFICES**

- .1 Provide office heated to 22 degrees C, lighted 750 lx and ventilated, of sufficient size to accommodate site meetings and furnished with drawing laydown table, unless otherwise indicated in Owner's tender and bid documents.
- .2 Provide marked and fully stocked first-aid case in a readily available location.
- .3 Subcontractors to provide their own offices as necessary, if permitted by Owner. Direct location of these offices once approved by Owner.

## **1.12 EQUIPMENT, TOOL AND MATERIALS STORAGE**

- .1 Provide and maintain, in clean and orderly condition, lockable weatherproof sheds for storage of tools, equipment and materials.
- .2 Locate materials not required to be stored in weatherproof sheds on site in manner to cause least

interference with work activities, and where approved by Owner.

### **1.13 SANITARY FACILITIES**

- .1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances.
- .2 Post notices and take precautions as required by local health authorities. Keep area and premises in sanitary condition.

### **1.14 CONSTRUCTION SIGNAGE**

- .1 Provide and erect project sign, within two weeks of signing Contract, in a location designated by Owner.
- .2 Construction sign 1m x 1m, of wood frame and plywood construction painted with exhibit lettering produced by a professional sign painter.
- .3 Indicate on sign, name of Owner, Consultant and Contractor, of design style established by Owner.
- .4 No other signs or advertisements, other than warning signs, are permitted on site.
- .5 Provide project identification site sign comprising foundation, framing, and one 1200 x 2400 mm signboard as detailed and as described below.
  - .1 Foundations: 15 MPa concrete to [CSA-A23.1](#) minimum 200 mm x 900 mm deep.
  - .2 Framework and battens: SPF, pressure treated minimum 89 x 89 mm.
  - .3 Signboard: 19 mm Medium Density Overlaid Douglas Fir Plywood to [CSA O121](#).
  - .4 Paint: alkyd enamel to [CAN/CGSB-1.59](#) over exterior alkyd primer to [CAN/CGSB 1.189](#).
  - .5 Fasteners: hot-dip galvanized steel nails and carriage bolts.
  - .6 Vinyl sign face: printed project identification, self adhesive, vinyl film overlay.
- .6 Locate project identification sign where directed by Owner and construct as follows:
  - .1 Build concrete foundation, erect framework, and attach signboard to framing.
  - .2 Paint surfaces of signboard and framing with one coat primer and two coats enamel. Colour white on signboard face, black on other surfaces.
  - .3 Apply vinyl sign face overlay to painted signboard face in accordance with installation instruction supplied.
- .7 Direct requests for approval to erect signboard to Owner. For consideration general appearance of Consultant/Contractor signboard must conform to project identification site sign. Wording in both official languages.
- .8 Signs and notices for safety and instruction in both official languages Graphic symbols to [CAN/CSA-Z321](#).
- .9 Maintain approved signs and notices in good condition for duration of project, and dispose of off site on completion of project or earlier if directed by Owner.

### **1.15 PROTECTION AND MAINTENANCE OF TRAFFIC**

- .1 Provide access and temporary relocated roads as necessary to maintain traffic.
- .2 Maintain and protect traffic on affected roads during construction period except as otherwise specifically directed by Owner.
- .3 Provide measures for protection and diversion of traffic, including provision of watch-persons and flag-persons, erection of barricades, placing of lights around and in front of equipment and work, and erection and maintenance of adequate warning, danger, and direction signs.



- .4 Protect travelling public from damage to person and property.
- .5 Contractor's traffic on roads selected for hauling material to and from site to interfere as little as possible with public traffic.
- .6 Verify adequacy of existing roads and allowable load limit on these roads. Contractor: responsible for repair of damage to roads caused by construction operations.
- .7 Construct access and haul roads necessary.
- .8 Haul roads: constructed with suitable grades and widths; sharp curves, blind corners, and dangerous cross traffic shall be avoided.
- .9 Provide necessary lighting, signs, barricades, and distinctive markings for safe movement of traffic.
- .10 Dust control: adequate to ensure safe operation at all times.
- .11 Location, grade, width, and alignment of construction and hauling roads: subject to approval by Owner.
- .12 Lighting: to assure full and clear visibility for full width of haul road and work areas during night work operations.
- .13 Provide snow removal during period of Work.
- .14 Remove, upon completion of work, haul roads designated by Owner.

#### **1.16 CLEAN-UP**

- .1 Remove construction debris, waste materials, packaging material from work site daily.
- .2 Clean dirt or mud tracked onto paved or surfaced roadways.
- .3 Store materials resulting from demolition activities that are salvageable.
- .4 Stack stored new or salvaged material not in construction facilities.

### **2 PRODUCTS**

#### **2.01 NOT USED**

- .1 Not Used.

### **3 EXECUTION**

#### **3.01 TEMPORARY EROSION AND SEDIMENTATION CONTROL**

- .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction, sediment and erosion control drawings and sediment and erosion control plan where provided and applicable, specific to site, that complies with requirements of authorities having jurisdiction.
- .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

- .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

**END OF SECTION**

## **1 GENERAL**

### **1.01 RELATED REQUIREMENTS**

- .1 Refer to Owner's tender and bid documents.
- .2 Refer to hoarding requirements on drawings, where indicated.
- .3 Refer to Section 01 35 29\_06 Health and Safety Requirements.

### **1.02 REFERENCE STANDARDS**

- .1 Canadian General Standards Board (CGSB):
  - .1 [CGSB 1.59-\[97\]](#), Alkyd Exterior Gloss Enamel.
  - .2 [CAN/CGSB 1.189-\[00\]](#), Exterior Alkyd Primer for Wood.
- .2 CSA Group (CSA):
  - .1 [CSA-O121-\[M1978\(R2003\)\]](#), Douglas Fir Plywood.
  - .2 [CAN/CSA-Z317.13:22](#), Infection Control During Construction, Renovation, and Maintenance of Health Care Facilities.
- .3 Reserved.

### **1.03 INSTALLATION AND REMOVAL**

- .1 Provide temporary controls in order to execute Work expeditiously.
- .2 Remove from site all such work after use.

### **1.04 HOARDING**

- .1 Exterior hoarding, where applicable:
  - .1 Erect temporary site enclosures using 38 x 89 mm construction grade lumber framing at 600 mm centres and 1200 x 2400 x 13 mm exterior grade fir plywood to CSA 0121.
  - .2 Apply plywood panels vertically flush and butt jointed.
  - .3 Provide lockable truck entrance gates and at least one pedestrian door as directed and conforming to applicable traffic restrictions on adjacent streets. Equip gates with locks and keys. Coordinate with Owner and Consultant.
  - .4 Erect and maintain pedestrian walkways including roof and side covers, complete with signs and electrical lighting as required by law.
  - .5 Paint public side of site enclosure in selected colours with one coat primer to [CAN/CGSB 1.189](#) and one coat exterior paint to [CGSB 1.59](#). Maintain public side of enclosure in clean condition.
  - .6 Erect temporary site enclosure using steel wire mesh fencing complete with visual barrier. Provide lockable truck gates as required. Provide maximum height as allowed by local municipal regulations, where regulations do not specify, confirm with Owner height requirement.
  - .7 Provide barriers around trees and plants designated to remain. Protect from damage by equipment and construction procedures.
- .2 Interior hoarding, where applicable:
  - .1 Interior construction hoarding adjacent to public or occupied areas of the building is be constructed from a minimum of galvanized metal stud framing, mineral wool insulation, polyethylene sheet membrane and Type X gypsum wall board panels on both sides of stud framing. Finish all joints, paint hoarding on side visible to public.
  - .2 Submit hoarding plan for Owner and Consultant's review prior to installation.

#### **1.05 GUARD RAILS AND BARRICADES**

- .1 Provide secure, rigid guard rails and barricades around deep excavations, open shafts, open stair wells, open edges of floors and roofs.
- .2 Guard rails to be in accordance with NBC design load requirements.

#### **1.06 WEATHER ENCLOSURES**

- .1 Provide weather tight closures to unfinished door and window openings, tops of shafts and other openings in floors and roofs.
- .2 Close off floor areas where walls are not finished; seal off other openings; provide vermin protection; enclose building interior work for temporary heat.
- .3 Design enclosures to withstand wind pressure and snow loading.

#### **1.07 DUST BARRIERS**

- .1 Provide dust barriers to localize dust generating activities, and for protection of workers, finished areas of Work and public.
- .2 Maintain and relocate protection until such work is complete.
- .3 Unless otherwise noted or directed by Owner. Erect full height dust barriers extending from top of floor slab to underside of floor assembly above (ie. concrete slab, metal deck etc.), terminating dust barrier at underside of existing suspended ceilings is not acceptable.
- .4 Erect dust barrier from polyethylene sheets supported by galvanized metal stud framing with all seams laps and taped to be airtight.

#### **1.08 ACCESS TO SITE**

- .1 Provide and maintain access roads, sidewalk crossings, ramps and construction runways as may be required for access to Work.

#### **1.09 PUBLIC TRAFFIC FLOW**

- .1 Provide and maintain competent signal flag operators, traffic signals, barricades and flares, lights, or lanterns as required to perform Work and protect public.

#### **1.10 FIRE ROUTES**

- .1 Maintain access to property including overhead clearances for use by emergency response vehicles.

#### **1.11 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY**

- .1 Protect surrounding private and public property from damage during performance of Work.
- .2 Be responsible for damage incurred.

#### **1.12 PROTECTION OF BUILDING FINISHES**

- .1 Provide protection for finished and partially finished building finishes and equipment during performance of Work.
- .2 Provide necessary screens, covers, and hoardings.

- .3 Confirm with Owner and Consultant locations and installation schedule prior to installation.
- .4 Be responsible for damage incurred due to lack of or improper protection.

#### **1.13 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate waste materials in accordance with Division 1.

#### **1.14 PROTECTION OF EXISTING FLOOR DRAINS**

- .1 Provide protection to newly installed and existing floor drains to remain from debris generated from construction activities. Coordinate protection requirements with Mechanical Consultant.

### **2 PRODUCTS**

#### **2.01 NOT USED**

- .1 Not Used.

### **3 EXECUTION**

#### **3.01 NOT USED**

- .1 Not Used.

**END OF SECTION**

## **1 GENERAL**

### **1.01 RELATED REQUIREMENTS**

- .1 Refer to all applicable technical specification sections for additional requirements.

### **1.02 REFERENCE STANDARDS**

- .1 General Conditions of the Contract.
- .2 Within text of each specifications section, reference may be made to reference standards.
- .3 Conform to these reference standards, in whole or in part as specifically requested in specifications.
- .4 If there is question as to whether products or systems are in conformance with applicable standards, Consultant reserves right to have such products or systems tested to prove or disprove conformance.
- .5 Cost for such testing will be paid by Contractor.

### **1.03 QUALITY**

- .1 Refer to Contract.
- .2 Reserved.
- .3 Products, materials, equipment and articles incorporated in Work shall be new, not damaged or defective, and of best quality for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.
- .4 Procurement policy is to acquire, in cost effective manner, items containing highest percentage of recycled and recovered materials practicable consistent with maintaining satisfactory levels of competition. Make reasonable efforts to use recycled and recovered materials and in otherwise utilizing recycled and recovered materials in execution of work.
- .5 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective products at Contractor's own expense and be responsible for delays and expenses caused by rejection.
- .6 Should disputes arise as to quality or fitness of products, decision rests strictly with Consultant based upon requirements of Contract Documents.
- .7 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.
- .8 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

### **1.04 AVAILABILITY**

- .1 Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays for items. If delays in supply of products are foreseeable, notify Owner and Consultants of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.
- .2 In event of failure to notify Owner and Consultant at commencement of Work and should it

subsequently appear that Work may be delayed for such reason, Consultant reserves right to substitute more readily available products of Consultant's choice, at no increase in Contract Price or Contract Time.

#### **1.05 STORAGE, HANDLING AND PROTECTION**

- .1 Handle and store products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.
- .2 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in Work.
- .3 Store products subject to damage from weather in weatherproof enclosures.
- .4 Store cementitious products clear of earth or concrete floors, and away from walls.
- .5 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.
- .6 Store sheet materials, such as lumber and sheathing panels on flat, solid supports and keep clear of ground. Slope to shed moisture.
- .7 Store and mix paints in heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.
- .8 Remove and replace damaged products at own expense and to satisfaction of Consultant.
- .9 Replace damaged factory finished surfaces to Consultant's satisfaction. Do not use touch-up paint unless otherwise permitted by Consultant.

#### **1.06 TRANSPORTATION**

- .1 Pay costs of transportation of products required in performance of Work.
- .2 Transportation cost of products supplied by Owner will be paid for by Owner. Contractor to unload, handle and store such products.

#### **1.07 MANUFACTURER'S INSTRUCTIONS**

- .1 Unless otherwise indicated in specifications, install or erect products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with products. Obtain written instructions directly from manufacturers.
- .2 Notify Consultant in writing, of conflicts between specifications and manufacturer's instructions, so that Consultant will establish course of action.
- .3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes Consultant to require removal and re-installation at no increase in Contract Price or Contract Time.

#### **1.08 QUALITY OF WORK**

- .1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed.
- .2 Do not employ anyone unskilled in their required duties. Consultant reserves right to require dismissal from site, workers deemed to not be qualified, incompetent or careless.
- .3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with

Consultant, whose decision is final.

#### **1.09 CO-ORDINATION**

- .1 Ensure co-operation of workers in laying out Work. Maintain efficient and continuous supervision.
- .2 Be responsible for coordination and placement of openings, sleeves and accessories.

#### **1.10 CONCEALMENT**

- .1 In finished areas conceal pipes, ducts and wiring in floors, walls and ceilings, except where indicated otherwise.
- .2 Before installation inform Consultant if there is interference. Install as directed by Consultant.

#### **1.11 REMEDIAL WORK**

- .1 Refer to Contract and Section 01 73 00 - Execution Requirements.
- .2 Reserved.
- .3 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Co-ordinate adjacent affected Work as required.
- .4 Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of Work.

#### **1.12 LOCATION OF FIXTURES**

- .1 Consider location of fixtures, outlets, and mechanical and electrical items indicated as approximate.
- .2 Inform Consultant of conflicting installation. Install as directed.

#### **1.13 FASTENINGS**

- .1 Provide metal fastenings and accessories in same texture, colour and finish as adjacent materials, unless indicated otherwise.
- .2 Prevent electrolytic action between dissimilar metals and materials.
- .3 Use non-corrosive hot dip galvanized steel fasteners and anchors for securing exterior work, unless stainless steel or other material is specifically requested in affected specification Section.
- .4 Space anchors within individual load limit or shear capacity and ensure they provide positive permanent anchorage. Wood, or any other organic material plugs are not acceptable.
- .5 Keep exposed fastenings to a minimum, space evenly and install neatly.
- .6 Fastenings which cause spalling or cracking of material to which anchorage is made are not acceptable.

#### **1.14 FASTENINGS - EQUIPMENT**

- .1 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.
- .2 Use heavy hexagon heads, semi-finished unless otherwise specified. Use No. 304 stainless steel for exterior areas.



- .3 Bolts may not project more than one diameter beyond nuts.
- .4 Use plain type washers on equipment, sheet metal and soft gasket lock type washers where vibrations occur. Use resilient washers with stainless steel.

#### **1.15 PROTECTION OF WORK IN PROGRESS**

- .1 Prevent overloading of parts of building. Do not cut, drill or sleeve load bearing structural members unless specifically indicated without written approval of Consultant.

#### **1.16 EXISTING UTILITIES**

- .1 When breaking into or connecting to existing services or utilities, execute Work at times directed by local governing authorities, with minimum of disturbance to Work, and/or building occupants and pedestrian and vehicular traffic. Refer to Section 01 14 00 Work Restrictions.
- .2 Protect, relocate or maintain existing active services. When services are encountered, cap off in manner approved by authority having jurisdiction. Stake and record location of capped service.

### **2 PRODUCTS**

#### **2.01 NOT USED**

- .1 Not Used.

### **3 EXECUTION**

#### **3.01 NOT USED**

- .1 Not Used.

**END OF SECTION**

## **1 GENERAL**

### **1.01 RELATED REQUIREMENTS**

- .1 Refer to Owner's tender and bid documents where applicable.

### **1.02 RESERVED**

- .1 Not used.

### **1.03 REQUIREMENTS**

- .1 Refer to all applicable specification sections for product requirements and methods to achieve Work stipulated under each Section.
- .2 Co-ordinate affected related Work and modify surrounding Work to integrate Work associated with each accepted product substitution.
- .3 Named product alternates or equals, indicated by the phrase "or approved equal", shall be interpreted to mean that named product alternate or equal, if accepted in lieu of specified product, meets or exceeds performance, appearance, general arrangement, dimensions, availability, codes and standards compliance, and colour of specified product. Be responsible for costs and modifications associated with the inclusion of named product alternate or equal at no additional cost to the Owner.

### **1.04 CONTRACTOR PROPOSED PRODUCT SUBSTITUTIONS**

- .1 Proposed product substitutions must match or exceed the performance, appearance, general arrangement, dimensions, availability, code and standards compliance, and colour of specified product.
- .2 When proposing product substitutions for approval, submit the following for review unless otherwise stated by Consultant:
  - .1 Description of proposed product substitution(s), including detailed comparative specification of proposed substitution with the specified product.
  - .2 Manufacturer's product data sheets and samples (where requested) for proposed product substitutions.
  - .3 Respective costs of items originally specified and the proposed product substitution.
  - .4 Confirmation of proposed product substitution delivery lead time, in writing by product Manufacturer.
  - .5 Impact on compatibility and interface with adjacent building materials and components.
  - .6 Compliance with intent of design.
  - .7 Effect on contract time.
  - .8 Reason for request.
  - .9 Letter of Equivalence: provide a letter from product manufacturer confirming the proposed product substitution matches or exceeds the quality of specified product.
- .3 Consultant may review contractor proposed product substitutions if directed by Owner but in any case with the understanding that Contract Time will not be altered due to the time required by the Consultant to review the submission and by the Contractor to implement the product substitution

in the Work.

- .4 Consultant's services to review contractor proposed product substitution will be performed on an additional services basis to their contract with the Owner. Costs of these services will be discounted from any reductions in the Contract Price that might be forthcoming from the product substitution. Therefore, to be acceptable, a product substitution must present a reduction in the construction cost at least equal to the cost to the Owner of the Consultant's additional services to review the product substitution. The Contractor shall cover directly costs and administration associated with courier services, reproduction costs, and other direct costs associated with reviews of these product substitutions.
- .5 It is the sole discretion of the Consultant to accept or reject the proposed product substitution. The Consultant's decision concerning acceptance or rejection of proposed product substitution is final. Should it appear to the Consultant that the value of services required to evaluate the product substitution will exceed the potential reduction in construction costs the Consultant will advise the Owner that the product substitution does not merit consideration before proceeding with a full evaluation. If the Consultant deems that the product substitution will produce a reduction in construction cost commensurate with or exceeding the value of the Consultant's services to evaluate the product substitution the Consultant will request the Owner's direction to proceed with the evaluation.
- .6 Where product substitution is acceptable, include for all costs associated with modifications necessary to other adjacent Work. No additional costs will be accepted as a result of the accepted product substitution.
- .7 Proposed product substitutions will not be reviewed during tender stage but after award to successful Bidder and before preparation and submission of shop drawings.
- .8 Do not install any substituted products not reviewed and accepted by Consultant. Consultant will instruct Contractor to remove installed unacceptable substituted products at Contractor's cost.

## **2 PRODUCTS**

### **2.01 NOT USED**

- .1 Not Used.

## **3 EXECUTION**

### **3.01 NOT USED**

- .1 Not Used.

**END OF SECTION**

## **1 GENERAL**

### **1.01 RELATED REQUIREMENTS**

- .1 Refer to all applicable technical specification sections.
- .2 Refer to Contract.

### **1.02 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit name, address, and registration information of land surveyor to Owner and Consultant.
- .2 Submit documentation that verifies accuracy of site engineering work when requested by Consultant and where indicated in Contract Documents.
- .3 Submit certificate signed by surveyor indicating elevations and locations of completed Work that conform to Contract Documents and those that do not conform.

### **1.03 QUALIFICATIONS**

- .1 Surveyor: Qualified, registered land surveyor, licensed to practice at the Place of the Work, and acceptable to Owner and Consultant.

### **1.04 RECORDS**

- .1 Maintain a complete, accurate log of control and survey work as Work progresses.
- .2 On completion of foundations and major site improvements, prepare and submit a certified survey showing dimensions, locations, angles, and elevations of Work.
- .3 Record locations of maintained, re-routed, and abandoned service lines.

## **2 PRODUCTS**

### **2.01 NOT USED**

- .1 Not Used.

## **3 EXECUTION**

### **3.01 EXAMINATION REQUIREMENTS**

- .1 Verification of Conditions:
  - .1 Verify that substrate conditions are acceptable for installation of materials, assemblies, and systems in accordance with manufacturer's instructions and recommendations.
  - .2 Inspect existing conditions, including elements subject to damage or movement during cutting and patching.
  - .3 After uncovering, inspect conditions affecting performance of Work.
  - .4 Proceed with installation only after unacceptable conditions are remedied.
  - .5 Proceeding with cutting, patching, or installation means acceptance of existing conditions.
  - .6 Existing Services:
    - .1 Confirm locations and extent of service lines in area of Work before beginning work on site. Notify Owner and Consultant of findings.
    - .2 Remove abandoned service lines within 2 m of structures. Cap or seal lines at cut-off points as per Contract Documents or as directed by Consultant.

- .7 Location of Equipment and Fixtures:
  - .1 Location of equipment, fixtures and outlets indicated or specified are to be considered as approximate.
  - .2 Locate equipment, fixtures and distribution systems to provide minimum interference and maximum usable space and in accordance with manufacturer's recommendations for safety, access and maintenance.
  - .3 Inform Consultant of impending installation and obtain approval for actual location.
  - .4 Submit field drawings to indicate relative position of various services and equipment when required by Consultant.
- .8 Subsurface Conditions:
  - .1 For all areas of work, verify locations of existing subsurface services and utilities via appropriate means. Mark locations of identified services on floor and submit report with photos to Consultant for review.
  - .2 Notify Consultant in writing if subsurface conditions differ materially from those indicated in Contract Documents.
- .2 Pre-Installation Testing:
  - .1 Perform manufacturer-recommended pre-installation site test of substrate and submit report of test results indicating whether test results meet the manufacturer's minimum requirements and recommendations.
- .3 Evaluation and Assessment:
  - .1 Verify that pre-existing substrate conditions are acceptable for installation of materials, assemblies, and systems in accordance with manufacturer's instructions and recommendations.
  - .2 Proceed with installation only after unacceptable conditions are remedied.

### **3.02 PREPARATION**

- .1 Common Requirements for Protection of In-Place Conditions:
  - .1 Provide supports to ensure structural integrity of surroundings. Provide devices and methods to protect other portions of Project from damage.
  - .2 Provide protection from weather and other potentially damaging conditions at areas which will be exposed when uncovering work. Maintain excavations free of water by dewatering.
- .2 Refer to product manufacturer's recommendations for surface preparation.
- .3 Survey Reference Points:
  - .1 Reserved.
  - .2 Locate and confirm reference points, topographic elevations before starting site work. Protect permanent reference points during construction.
  - .3 Changes or relocations should not be made without prior written notice to Owner and Consultant.
  - .4 Notify Owner and Consultant if a reference point is lost or destroyed.
    - .1 Surveyor to replace reference points in accordance with original land survey.
  - .5 Notify Owner and Consultant if a reference point requires relocation because of necessary changes in grades or locations.
    - .1 Surveyor to register new reference points with land titles department and appropriate authority having jurisdiction.
- .4 Survey Requirements:
  - .1 Establish permanent benchmarks on site, referenced to established benchmarks by survey reference points. Record locations with horizontal and vertical data in Project record documents.
  - .2 Establish lines and levels, location and layout, by instrumentation.
  - .3 Stake for grading, fill and topsoil placement and landscaping features.

- .4 Stake slopes and berms.
- .5 Establish pipe invert elevations.
- .6 Stake batter boards for foundations.
- .7 Establish foundation column locations and floor elevations.
- .8 Establish lines and levels for mechanical and electrical work.

**END OF SECTION**

## **1 GENERAL**

### **1.01 RELATED REQUIREMENTS**

- .1 Refer to all technical specification sections where applicable.

### **1.02 SECTION INCLUDES**

- .1 Common requirements for installing, applying, and erecting products. Includes procedures and submittals for cutting and patching to existing conditions, and required repairs arising from tests and destructive inspections.

### **1.03 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit proof of anchor and fastener load carrying capacity for a work result, when requested.
- .3 Submit written request before cutting or altering to existing conditions which may affect the following:
  - .1 Structural integrity of existing elements: Submit structural details and calculations performed by a professional structural engineer registered or licensed in Ontario, Canada. Include evidence of unsatisfactory structural integrity of the elements according to Consultant.
  - .2 Integrity of weather-exposed and moisture-resistant elements
  - .3 Efficiency, maintenance, safety, or accessibility of operational elements
  - .4 Visual qualities of sight-exposed elements.
  - .5 Work of other contractor(s).
- .4 Submit a request for cutting or altering which includes:
  - .1 Identification of the Project; and
  - .2 Location and description of affected existing conditions including changes to structural elements, function of elements, and visual appearance of existing elements; and the location and identification of utilities that will be temporarily out of service during cutting and patching activities.
- .5 Submit a report including drawings and photographs indicating relative location of various services and equipment upon the commencement of Work. Refer to structural requirements where applicable for cutting and coring through existing concrete floor and roof slabs.
- .6 Submit a work plan including:
  - .1 A statement why cutting or altering is unavoidable or describe alternatives to cutting and patching if available;
  - .2 A description of proposed work and proposed Products;
  - .3 The effect of cutting or altering on work by Owner or other contractors;
  - .4 Written acknowledgement by other contractors affected by cutting or altering, if applicable; and
  - .5 Proposed dates and times work will be executed.

## **1.04 QUALIFICATIONS**

- .1 Licensed Professionals: Engage a structural engineer licensed at the Place of the Work, to submit details and calculations when altering existing structural elements.

## **2 PRODUCTS**

### **2.01 MATERIALS**

- .1 Patching Materials: If possible, use the same materials found in the existing conditions, except in fire-resistance rated materials and assemblies.
- .2 Materials Visible from the Floor Area: Use materials that visually match existing adjacent surfaces, and match existing functional performance.

## **3 EXECUTION**

### **3.01 COMMON INSTALLATION/ APPLICATION/ ERECTION REQUIREMENTS**

- .1 Inspect existing conditions, including elements subject to damage or movement during cutting and patching.
- .2 After uncovering, inspect conditions affect performance of Work.
- .3 Beginning of cutting or patching means acceptance of existing conditions.
- .4 Provide supports to assure structural integrity of surrounding; provide devices and methods to protect other portions of project from damage.
- .5 Provide protection from elements for areas which are to be exposed by uncovering work; maintain excavations free of water.
- .6 Fit several parts together, to integrate with other Work.
- .7 Remove and replace defective and non-conforming Work.
- .8 Unless otherwise indicated in specifications, install, or erect products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with products. Obtain written instructions directly from manufacturers.
- .9 Notify Consultant in writing, of conflicts between specifications and manufacturer's instructions, so that Consultant will establish course of action.
- .10 Improper installation or erection of products, due to failure in complying with these requirements, authorizes Consultant to require removal and re-installation at no increase in Contract Price or Contract Time.
- .11 Provide openings in non-structural elements for penetrations of mechanical and electrical work.
- .12 Conceal pipes, ducts and wiring in floor, wall, partition, and ceiling assemblies in finished areas, except where indicated otherwise.
- .13 In addition to the manufacturer's recommendations for safety, access, accessibility, and maintenance, locate equipment, fixtures, and distribution systems where it shall provide minimal



interference and shall maximize on usable space.

- .1 Location of equipment, fixtures, and outlets indicated on Drawings and specifications are approximate.
- .2 Notify Consultant of impending installation and obtain approval for actual locations.

### **3.02 BRACING AND ANCHORING**

- .1 Anchors and Fasteners: Unless otherwise indicated elsewhere:
  - .1 Provide any necessary anchors and fasteners to fasten each component securely for its intended purpose. Allow for building movement, including from thermal expansion and contraction of materials and assemblies;
  - .2 Prevent electrolytic reaction between dissimilar metals and materials;
  - .3 Provide hot-dip galvanized steel anchors and fasteners for securing exterior work unless otherwise noted;
  - .4 locate anchors and fasteners within individual load limit or shear capacity. Ensure anchors and fasteners are permanently secured;
  - .5 Where exposed to view, evenly distribute anchors and fasteners in a single area; and
  - .6 Where exposed to view, provide metal anchors, fasteners, and related accessories with the same texture, colour, and finish as adjacent materials.
- .2 Non-Conforming Work: Anchors and fasteners installed which cause substrate cracks or spalling is not acceptable.

### **3.03 CUTTING AND PATCHING**

- .1 Proceed with cutting and patching after the review and acceptance by the Consultant of all submittals listed in Article 1.03, Actions and Informational Submittals.
- .2 Perform cutting, fitting, and patching including excavation and fill, to complete Work in accordance with related technical specification Sections.
- .3 Use special techniques to avoid damaging existing conditions that will remain, and which will result in proper surfaces to receive patching and finishing.
- .4 Employ original installer to perform cutting and patching for weather-exposed elements, moisture-resistant elements, and surfaces exposed to view.
- .5 Cut rigid materials using masonry saw, core drill, or other tool recommended by the product manufacturer or applicable industry association. Pneumatic or impact tools are not allowed on masonry work without the approval of Owner.
- .6 Fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces. Where penetrations are through fire separations, install firestop assemblies tested to CAN/ULC-S115.
- .7 Refinish surfaces to match adjacent finishes. Refinish continuous surfaces to nearest intersection (e.g., edges of partition). Refinish assemblies by refinishing entire unit. Provide entire surface with uniform finish, colour, and texture.

### **3.04 ADJUSTING**

- .1 Remove and replace patching that is visually unsatisfactory to Consultant.

**END OF SECTION**

## **1 GENERAL**

### **1.01 RELATED REQUIREMENTS**

- .1 Refer to all applicable technical specification sections.

### **1.02 REFERENCE STANDARDS**

- .1 Refer to Contract.

### **1.03 PROJECT CLEANLINESS**

- .1 Maintain Work in tidy condition, free from accumulation of waste products and debris.
- .2 Remove waste materials from site at daily regularly scheduled times or dispose of as directed by Owner. Do not burn waste materials on site.
- .3 Clear snow and ice from access to building and construction site, and as needed to perform the Work. Bank/pile snow in designated areas only.
- .4 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .5 Provide on-site disposal containers for collection of waste materials and debris as required.
- .6 Provide and use marked separate bins for recycling. Refer to Section 01 74 19 - Waste Management and Disposal.
- .7 Dispose of waste materials and debris at designated and appropriate facilities.
- .8 Clean interior areas prior to start of finishing work, and maintain areas free of dust and other contaminants during finishing operations.
- .9 Store volatile waste in covered metal containers, and remove from premises at end of each working day.
- .10 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.
- .11 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.
- .12 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.

### **1.04 FINAL CLEANING**

- .1 Refer to Contract.
- .2 When Work is Substantially Performed remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.
- .3 Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy.
- .4 Prior to final review remove surplus products, tools, construction machinery and equipment.
- .5 Remove waste products and debris.

- .6 Remove waste materials from site at regularly scheduled times or dispose of as directed by Owner. Do not burn waste materials on site.
- .7 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .8 Clean and polish glass, mirrors, hardware, wall tile, stainless steel, chrome, porcelain enamel, baked enamel, plastic laminate, and mechanical and electrical fixtures. Replace broken, scratched or disfigured glass.
- .9 Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, furniture fitments, walls, floors, ceiling and any Work provided as part of project.
- .10 Clean lighting reflectors, lenses, and other lighting surfaces.
- .11 Vacuum clean and dust building interiors, behind grilles, louvres and screens.
- .12 Wax, seal, shampoo or prepare floor finishes, as recommended by manufacturer.
- .13 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.
- .14 Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds.
- .15 Remove dirt and other disfiguration from exterior surfaces.
- .16 Clean and sweep roofs, gutters, areaways, and sunken wells.
- .17 Sweep and wash clean paved areas.
- .18 Clean equipment and fixtures to sanitary condition; clean or replace filters of mechanical equipment.
- .19 Clean roofs, downspouts, and drainage systems.
- .20 Remove debris and surplus materials from crawl areas and other accessible concealed spaces.
- .21 Remove snow and ice from access to building.

## **1.05 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

## **2 PRODUCTS**

### **2.01 NOT USED**

- .1 Not Used.

## **3 EXECUTION**

### **3.01 NOT USED**

- .1 Not Used.

**END OF SECTION**

## **1 GENERAL**

### **1.01 SUMMARY**

- .1 This Section includes requirements for management of construction waste and disposal, which forms the Contractor's commitment to reduce and divert waste materials from landfill and includes the following:
  - .1 Preparation of a Construction Waste Management Plan that will be used to track the success of the Construction Waste Management Plan against actual waste diversion from landfill.
  - .2 Preparation of a Construction Waste Management Plan that provides guidance on a logical progression of tasks and procedures to be followed in a pollution prevention program to reduce or eliminate the generation of waste, the loss of natural resources, and process emissions through source reduction, reuse, recycling, and reclamation.
  - .3 Preparation of monthly progress reports indicating cumulative totals representing progress towards achieving diversion and reduction goals of waste materials away from landfill and identifying any special programs, landfill options or alternatives to landfill used during construction.
  - .4 Preparation of a Construction Waste Management Report containing detailed information indicating total waste produced by the Project, types of waste material and quantity of each material, and total waste diverted and diversion rates indicated as a percentage of the total waste produced.
- .2 Reserved.
- .3 Owner has established that this Project shall generate the least amount of waste possible and that processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors be employed by the Contractor.

### **1.02 RELATED REQUIREMENTS**

- .1 Refer to all applicable Division 1 and technical specifications.

### **1.03 DEFINITIONS**

- .1 Clean Waste: Untreated and unpainted; not contaminated with oils, solvents, sealants or similar materials.
- .2 Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from all construction operations.
- .3 Hazardous: Exhibiting the characteristics of hazardous substances including properties such as ignitability, corrosiveness, toxicity, or reactivity.
- .4 Non-hazardous: Exhibiting none of the characteristics of hazardous substances, including properties such as ignitability, corrosiveness, toxicity, or reactivity.
- .5 Non-toxic: Not poisonous to humans either immediately or after a long period of exposure.
- .6 Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.
- .7 Recycle: To remove a waste material from the Project site to another site for remanufacture into a new product for reuse by others.
- .8 Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form; recycling does not include burning, incinerating, or thermally destroying waste.

- .9 Return: To give back reusable items or unused products to vendors for credit.
- .10 Reuse: To reuse a construction waste material in some manner on the Project site.
- .11 Salvage: To remove a waste material from the Project site to another site for resale or reuse by others.
- .12 Sediment: Soil and other debris that has been eroded and transported by storm or well production run off water.
- .13 Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.
- .14 Toxic: Poisonous to humans either immediately or after a long period of exposure.
- .15 Trash: Any product or material unable to be reused, returned, recycled, or salvaged.
- .16 Volatile Organic Compounds (VOC's): Chemical compounds common in and emitted by many building products over time through outgassing:
  - .1 Solvents in paints and other coatings;
  - .2 Wood preservatives; strippers and household cleaners;
  - .3 Adhesives in particleboard, fiberboard, and some plywood; and foam insulation.
  - .4 When released, VOC's can contribute to the formation of smog and can cause respiratory tract problems, headaches, eye irritations, nausea, damage to the liver, kidneys, and central nervous system, and possibly cancer.
- .17 Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.
- .18 Construction Waste Management Plan: A project related plan for the collection, transportation, and disposal of the waste generated at the construction site; the purpose of the plan is to ultimately reduce the amount of material being landfilled.

#### **1.04 REFERENCE STANDARDS**

- .1 ASTM International (ASTM):
  - .1 [ASTM E 1609](#) 01, Standard Guide for Development and Implementation of a Pollution Prevention Program.
- .2 Canadian Construction Association (CCA):
  - .1 Standard Construction Document CCA 27-1997: A Guide on Construction Environmental Management.
  - .2 Standard Construction Document CCA 81-2001: A Best Practices Guide to Solid Waste Management.
- .3 Ontario Environmental Protection Act and applicable regulations.
- .4 Applicable local municipal waste management regulations or guidelines.
- .5 Recycling Certification Institute (RCI):
  - .1 RCI Certification Construction and Demolition Materials Recycling.

#### **1.05 ADMINISTRATIVE REQUIREMENTS**

- .1 Coordination: Coordinate waste management requirements with all Divisions of the Work for the Project, and ensure that requirements of the Construction Waste Management Plan are followed.
- .2 Preconstruction Meeting: Arrange a pre-construction meeting in accordance with Section 01 31 19 - Project Meetings before starting any Work of the Contract attended by the Owner,

- Contractor, affected Subcontractor 's and Consultants to discuss the Contractor 's Construction Waste Management Plan and to develop mutual understanding of the requirements for a consistent policy towards waste reduction and recycling.
- .3 Arrange waste management service agreements with waste haulers and receiving facilities.
  - .4 Supervise on-site waste management activities daily.
  - .5 Coordinate waste management tasks with Subcontractors to ensure timely and orderly progress of the work.
  - .6 Prepare waste management documentation and submittals for all shipments of waste materials from the site.
  - .7 Report waste management progress to Owner and Consultants.

#### **1.06 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit required information in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Action Submittals: Provide the following submittals before starting any work of this Section:
  - .1 Draft Construction Waste Management Plan (Draft CWM Plan): Submit to Consultant a preliminary analysis of anticipated site generated waste by listing a minimum of five (5) construction or demolition waste streams that have potential to generate the most volume of material indicating methods that will be used to divert construction waste from landfill and source reduction strategies; Consultants will provide commentary before development of Contractor 's Construction Waste Management Plan.
  - .2 Construction Waste Management Plan (CWM Plan): Submit a CWM Plan for this Project before any waste removal from site and that includes the following information:
    - .1 Reserved.
    - .2 Material Streams: Analysis of the proposed jobsite waste being generated, including material types and quantities forming a part of identified material streams in the Draft CWM Plan; materials removed from site destined for alternative daily cover at landfill sites and land clearing debris cannot be considered as contributing to waste diversion and will be included as a component of the total waste generated for the site.
    - .3 Recycling Haulers and Markets: Investigate local haulers and markets for recyclable materials, and incorporate into CWM Plan.
    - .4 Alternative Waste Disposal: Prepare a listing of each material proposed to be salvaged, reused, recycled or composted during the course of the Project, and the proposed local market for each material.
    - .5 Landfill Materials: Identify materials that cannot be recycled, reused or composted and provide explanation or justification; energy will be considered as a viable alternative diversion strategy for these materials where facilities exist.
    - .6 Landfill Options: The name of the landfill where trash will be disposed of; landfill materials will form a part of the total waste generated by the Project.
    - .7 Materials Handling Procedures: A description of the means by which any recycled waste materials will be protected from contamination, and a description of the means to be employed in recycling the above materials consistent with requirements for acceptance by designated facilities.
    - .8 Transportation: A description of the means of transportation of the recyclable materials, whether materials will be site separated and self hauled to designated centers, or whether mixed materials will be collected by a waste hauler and removed from the site, and destination of materials.

#### **1.07 PROJECT CLOSEOUT SUBMITTALS**

- .1 Record Documentation: Submit as constructed information in accordance with Section 01 78 00 -

Closeout Submittals as follows:

- .1 Construction Waste Management Report (CWM Report): Submit a CWM Report for this Project in a format acceptable to project submittal requirements and that includes the following information:
  - .1 Accounting: Submit information indicating total waste produced by the Project.
  - .2 Composition: Submit information indicating types of waste material and quantity of each material.
  - .3 Diversion Rate: Submit information indicating total waste diverted from landfill as a percentage of the total waste produced by the Project.
  - .4 Transportation Documentation: Submit copies of transportation documents or shipping manifests indicating weights of materials, and other evidence of disposal indicating final location of waste diverted from landfill and waste sent to landfill.
  - .5 Alternative Daily Cover (ADC): Submit quantities of material that were used as ADC at landfill sites, and that form a part of the total waste generated by the Project.
  - .6 Multiple Waste Hauling: Compile all information into a single CWM Report where multiple waste hauling and diversion strategies were used for the project.
  - .7 Photographs: Submit photographs of waste diversion facilities documenting location and signage describing usage of waste separation containers.

## **1.08 QUALITY ASSURANCE**

- .1 Resources for Development of Construction Waste Management Report (CWM Report): The following sources may be useful in developing the Draft Construction Waste Management Plan:
  - .1 Recycling Haulers and Markets: Investigate local haulers and markets for recyclable materials, and incorporate into CWM Plan.
  - .2 Waste-to-Energy Systems: Investigate local waste-to-energy incentives where systems for diverting materials from landfill for reuse or recycling are not available.
- .2 Certifications: Provide proof of the following during the course of the Work:
  - .1 Compliance Certification: Provide proof that recycling center is third party verified and is listed as a Certified Facility through the registration and certification requirements of the Recycling Certification Institute.
- .3 Minimize the amount of solid waste (including land-clearing debris generated by all construction activities.
- .4 Comply with all applicable provincial and municipal regulations related to construction waste management including the Ontario Environmental Protection Act Regulations.
- .5 Comply with Canadian Construction Association's Code of Practice as outlined in Standard Construction Document CCA 27-1997.

## **1.09 DELIVERY, STORAGE, AND HANDLING**

- .1 Storage Requirements: Implement a recycling/reuse program that includes separate collection of waste materials as appropriate to the Project waste and the available recycling and reuse programs in the Project area.
- .2 Handling Requirements: Clean materials that are contaminated before placing in collection containers and ensure that waste destined for landfill does not get mixed in with recycled materials:
  - .1 Deliver materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to recycling process.
  - .2 Arrange for collection by or delivery to the appropriate recycling or reuse facility.

- .3 Hazardous Waste and Hazardous Materials: Handle in accordance with applicable regulations.

## **2 PRODUCTS**

### **2.01 NOT USED**

- .1 Not Used.

## **3 EXECUTION**

### **3.01 (CWM PLAN) IMPLEMENTATION**

- .1 Manager: Contractor is responsible for designating an on site party or parties responsible for instructing workers and overseeing and documenting results of the CWM Plan for the Project.
- .2 Distribution: Distribute copies of the CWM Plan to the job site foreman, each Subcontractor, the Owner, the Consultant and other site personnel as required to maintain CWM Plan.
- .3 Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, composting and return methods being used for the Project to Subcontractor 's at appropriate stages of the Project.
- .4 Separation Facilities: Lay out and label a specific area to facilitate separation of materials for potential recycling, salvage, reuse, composting and return:
  - .1 Recycling and waste bin areas are to be kept neat and clean and clearly marked in order to avoid contamination of materials.
  - .2 Hazardous wastes shall be separated, stored, and disposed of in accordance with local regulations.
- .5 Progressive Documentation: Submit a monthly summary of waste generated by the Project to ensure that waste diversion goals are on track with Project requirements:
  - .1 Submittal of waste summary can coincide with application for progress payment, or similar milestone event as agreed upon between the Owner, Contractor and Consultant.
  - .2 Monthly waste summary shall contain the following information:
    - .1 The amount in tonnes or m<sup>3</sup> and location of material landfilled,
    - .2 The amount in tonnes or m<sup>3</sup> and location of materials diverted from landfill, and
    - .3 Indication of progress based on total waste generated by the Project with materials diverted from landfill as a percentage.

### **3.02 SUBCONTRACTOR'S RESPONSIBILITY**

- .1 Subcontractors shall cooperate fully with the Contractor to implement the CWM Plan.
- .2 Failure to cooperate may result in the Owner not achieving their environmental goals, and may result in penalties being assessed by the Contractor to the responsible Subcontractors.

### **3.03 SAMPLE CONSTRUCTION WASTE MANAGEMENT FORMS**

- .1 Reserved.

**END OF SECTION**



## **1 GENERAL**

### **1.01 RELATED REQUIREMENTS**

- .1 Refer to all technical specification sections for applicable required closeout submittals.

### **1.02 REFERENCE STANDARDS**

- .1 General Conditions of the Contract.
- .2 Canadian Environmental Protection Act (CEPA)
  - .1 SOR/2008-197, Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations.

### **1.03 ADMINISTRATIVE REQUIREMENTS**

- .1 Acceptance of Work Procedures:
  - .1 Contractor's Inspection: conduct inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.
    - .1 Inspect completed work for deficiencies, note down observed deficiencies and submit deficiencies list to Consultant and Owner. Deficiency list must include scheduled timeline of when noted deficiencies will be corrected and approximate value of deficiencies.
    - .2 Notify Consultant in writing of satisfactory completion of Contractor's inspection and submit verification that corrections have been made.
    - .3 Request Consultant's review of corrections.
  - .2 Consultant's Review:
    - .1 Consultant to review Work and identify defects and deficiencies.
    - .2 Contractor to correct Work as directed.
  - .3 Completion Tasks: submit written certificates in English that tasks have been performed as follows:
    - .1 Work: completed and inspected for compliance with Contract Documents.
    - .2 Defects: corrected and deficiencies completed.
    - .3 Equipment and systems: tested, adjusted and balanced and fully operational.
    - .4 Certificates required by Boiler Inspection Branch, Fire Commissioner, Utility companies etc.: submitted.
    - .5 Operation of systems: demonstrated to Owner's personnel.
    - .6 Commissioning and applicable Decommissioning of mechanical systems: completed in accordance with commissioning requirements and copies of final Commissioning Report submitted to Consultant.
    - .7 Underground and Aboveground storage tank inspection documentation, registration, forms, decommissioning and removal in accordance with CEPA SOR/2008-197.
    - .8 Work: complete and ready for final inspection.
  - .4 Final Inspection:
    - .1 When completion tasks are done, request final inspection of Work by Consultant.
    - .2 When Work deemed incomplete by Consultant, complete outstanding items and request re-review.
    - .3 Arrange all inspections required by Authorities Having Jurisdiction (AHJ) to comply with full or partial occupancy requirements and close all permits related to Work.
  - .5 Declaration of Substantial Performance: when Consultant considers deficiencies and defects corrected and requirements of Contract substantially performed, make application for Certificate of Substantial Performance.
  - .6 Commencement of Lien and Warranty Periods: date of Owner's acceptance of submitted declaration of Substantial Performance to be date for commencement for warranty period and commencement of lien period unless required otherwise by lien statute of Place of

- Work.
- .7 Final Payment:
  - .1 When Consultant considers final deficiencies and defects corrected and requirements of Contract met, make application for final payment.
  - .2 Refer to Contract terms: when Work deemed incomplete by Consultant, complete outstanding items and request re-review.
- .8 Payment of Holdback: after issuance of Certificate of Substantial Performance of Work, submit application for payment of holdback amount in accordance with contractual agreement.

#### **1.04 FINAL CLEANING**

- .1 Clean in accordance with Section 01 74 00 - Cleaning.
  - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Waste Management: to 01 74 19 - Waste Management and Disposal.
- .3 Immediately prior to Consultant's review to determine if Substantial Performance of the Work has been achieved, remove surplus Products and construction machinery and equipment not required for the performance of the remaining work.
- .3 Remove waste Products and debris other than that caused by the Owner, and leave the Work clean and suitable for occupancy by owner.
- .4 At completion of the Work, remove surplus products, tools, construction machinery and equipment.
- .5 Clean glass, mirrors, hardware, wall tile, stainless steel, chrome, porcelain enamel, prefinished surfaces and fixtures.
- .6 Remove Stains, spots, marks and dirt from decorative parts of the Work, electrical and mechanical fixtures, furniture fittings, walls and floors.
- .7 Vacuum clean and remove dust from building interiors, behind grilles, vacuum clean interior of electrical equipment.
- .8 Clean floor finishes to recommendations of manufacturer.
- .9 Remove non-permanent labels.
- .10 Remove dirt and residue from surfaces.
- .11 Inspect finishes, fittings and equipment and ensure specified workmanship and operation.
- .12 At completion of the Work, remove protective coatings, clean surfaces and remove excess compounds and sealant materials. Make good defective, scratches or damages work.
- .13 Broom clean and wash exterior walks, steps and surfaces.
- .14 Remove dirt and other disfigurements from exterior surfaces.
- .15 Clean and sweep roofs, gutters, areaways, downspouts, and drainage systems.
- .16 Sweep and wash clean paved areas at the Place of the Work.
- .17 Clean equipment and fixtures to a sanitary condition, clean or replace filters of mechanical equipment.

- .18 Remove seal wrap on mechanical and electrical Products and materials and clean as required.
- .19 Clean and/or replace lamps, light fixtures, lenses and grilles.
- .20 Remove protective coverings and labels from lamps, hardware, and specialty items.
- .21 Under the direction of the Consultants, aim adjustable luminaires.
- .22 All Work shall appear new, undamaged, unsoiled and be free of any construction residue, dust and or paint overspray, Owner and Consultants reserves the right to request additional cleaning at Contractors cost where cleaning is not completed to satisfaction of Owner and Consultants.

#### **1.06 SYSTEM DEMONSTRATION & PROJECT COMMISSIONING**

- .1 Refer also to requirements of mechanical and electrical technical specifications and equipment manufacturer's requirements, and commissioning procedures with respect to commission for control systems, communications systems, mechanical/ electrical systems.
- .2 Perform system demonstration and commission work no later than ten (10) Working Days prior to submitting request for Consultant's review to determine if Substantial Performance of the Work has been achieved.
- .3 Submit required certificates of approval or acceptance from authorities having jurisdiction.
- .4 Meet with other consultants; commission, acoustical, communications systems, structural, mechanical, electrical, to coordinate demonstration, instruction, commission and completion.
- .5 Review condition of equipment such as lighting, elevators and heating systems, which have been used in the course of the Work to ensure turning over at completion in "as new condition" with warranties dated and certified from time specified.
- .6 When partial occupancy of uncompleted project is required by Owner, coordinate Owner's uses, requirements, access, and the like, with Contractor's requirements to complete the Work.
- .7 Demonstration and instruction:
  - .1 Demonstrate operation of each system to Owner and Consultant.
  - .2 Instruct Owner's personnel in operation, adjustment and maintenance of equipment and systems, using operation and maintenance data provided as the basis for instructions. Arrange and coordinate instruction of Owner's staff in care, maintenance and operation of building systems and finishes by Suppliers and Subcontractors.
  - .3 Contractor, manufacturer's representatives, and responsible personnel from Subcontractors whose work is being demonstrated shall be present at these demonstrations.
  - .4 Instruct Owner's representative on use of software required for operation and maintenance of building systems and provide a toll-free telephone number or website address for further assistance to the Owner.
  - .5 Prepare and insert additional data in the operation and maintenance data manuals when the need for additional data becomes apparent during demonstration or instruction.
  - .6 Demonstration and instruction report: Submit a written report of such demonstration, instruction, and commissioning to the Consultant as part of the contract closeout submittals described earlier in this section. Report shall include time and date of each demonstration, instruction, and commission activity, complete with a list of persons present.
- .8 Correct deficiencies and defects identified during demonstration, instruction, or commissioning.
- .9 Attend 'end-of-work' testing and break-in or start-up demonstration.

## **1.07 WARRANTY PERIOD**

- .1 Provide on-going review and attendance to building call-back, maintenance and repair problems during the warranty periods.
- .2 At the beginning of the 12<sup>th</sup> month after Substantial Performance of the Work, the Owner, Contractor and consultant, along with key Subcontractors as designated, shall carry out a complete review of the Work, including the building and its systems, to determine which deficiencies are to be rectified under warranty. Contractor shall be responsible for timely written notification of Owner, and Consultant prior to such end of warranty period inspection and any delay in such notification shall extend such warranty period until proper notification is received by Owner and Consultant.

## **2 PRODUCTS**

### **2.01 NOT USED**

- .1 Not Used.

## **3 EXECUTION**

### **3.01 NOT USED**

- .1 Not Used.

**END OF SECTION**

## **1 GENERAL**

### **1.01 RELATED REQUIREMENTS**

- .1 Refer to all technical specification sections for required closeout submittals.

### **1.02 REFERENCE STANDARDS**

- .1 General Conditions of the Contract.
- .2 Canadian Environmental Protection Act (CEPA):
  - .1 SOR/2008-197, Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations.

### **1.03 ADMINISTRATIVE REQUIREMENTS**

- .1 Closeout and Pre-warranty Meeting:
  - .1 Convene meeting minimum 14 days before intended substantial performance date with Consultants and Owner to:
    - .1 Verify Project requirements.
    - .2 Review completed Work and warranty requirements.
  - .2 Owner and Contractor to establish communication procedures for:
    - .1 Notifying construction warranty defects.
    - .2 Determine priorities for type of defects.
    - .3 Determine reasonable response time.
  - .3 Contact information for bonded and licensed company for warranty work action: provide name, telephone number and address of company authorized for construction warranty work action.
  - .4 Ensure contact is located within local service area of warranted construction, is continuously available, and is responsive to inquiries for warranty work action.

### **1.04 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures and in accordance with individual specification Sections.
- .2 Two weeks before Substantial Performance of the Work, submit to the Consultant a complete digital draft copy of Operation and Maintenance Manuals in English, all disciplines. Consultants will review and provide comments for inclusion in final operating and maintenance manuals package.
- .3 Provide list of spare parts, maintenance materials and special tools of same quality and manufacture as products provided in Work, and verify date of submission to Owner.
- .4 Provide evidence, if requested, for type, source and quality of products supplied.
- .5 Collect and assemble required closeout submittals executed by Subcontractors, Suppliers and Manufacturers. Prior to submitting draft closeout submittals to the Consultant, Contractor shall undertake to review contents for completeness.
- .6 Submit three hard copies of final Operation and Maintenance Manual and one electronic version.

### **1.05 FORMAT – OPERATION AND MAINTENANCE MANUALS**

- .1 Operation and Maintenance Manual – Hard Copy:
  - .1 Organize data as instructional manual.
  - .2 Binders: Vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face

- pockets.
- .3 When multiple binders are used correlate data into related consistent groupings.
  - .1 Identify contents of each binder on spine.
- .4 Cover: Identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.
- .5 Arrange content by specification division under Section numbers and sequence of Table of Contents.
- .6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
- .7 Text: manufacturer's printed data, or typewritten data.
- .8 Drawings: Provide with reinforced punched binder tab.
  - .1 Bind in with text; fold larger drawings to size of text pages.
- .2 Operation and Maintenance Manual – Digital Copy:
  - .1 PDF format on CD or electronic USB key storage device.
  - .2 Electronic version shall not deviate from the hard copy.
  - .3 As-built drawings to be 1:1 scaled AutoCAD files in .dwg format. Refer to Owner's requirements for particular AutoCAD formatting.

#### **1.06 CONTENTS – OPERATION AND MAINTENANCE MANUALS**

- .1 Operation and Maintenance Manual to consist of the following general components:
  - .1 Project Data Book.
  - .2 Submittal Manuals.
  - .3 Warranty Manuals.
  - .4 Independent Testing Agency Reports and/or Manufacturer's Review Reports.
  - .5 As-built Drawings.
- .2 Project Data Book: shall include the following information supplemented by additional required data specified elsewhere in the Contract Documents:
  - .1 Maintenance and care instructions for finished surfaces and materials as described further below in this Section.
  - .2 Description, operation and maintenance instructions for equipment and systems as described further below in this Section, and parts list. Indicate nameplate information such as make, size, capacity, serial number.
  - .3 Names, addresses and phone numbers of Subcontractors and Suppliers, as applicable.
  - .4 Additional material only used in the Work listed under various sections showing names of manufacturer and source of supply.
  - .5 Charts, diagrams and reports identified in Mechanical and Electrical Divisions of the specifications.
  - .6 Report recording demonstration and instruction provided to Owner for operation and maintenance of building systems as described in Section 01 79 00 – Demonstration and Training.
  - .7 Include summary of required maintenance materials for each supplied product, as required in individual specification Sections, to be provided to Owner for future use, for items described further below in this Section.
  - .8 Key construction photos.
  - .9 Permits and forms:
    - .1 Workplace Safety & Insurance Board Certificate of Clearance.
    - .2 All certificates of approval and certifications of the Work by all Authorities Having Jurisdiction.
    - .3 Occupancy permits where provided by local Building Department.
- .3 Submittal Manuals:
  - .1 Submit one copy of each final reviewed and accepted submittal for the Work on which have been recorded changes made during fabrication and installation caused by unforeseen conditions. Refer to individual specification Sections for all required

- submittals, including but not limited to Product Data Sheets, WHMIS SMS, Shop Drawings, Samples and Schedule Submittals.
- .2 Engineered shop drawings shall include copies of the certificate of insurance, the engineer's field review reports, and the engineer's letter of general conformity that were provided as part of the engineered submittal in accordance with Section 01 33 00 appended to the pertinent engineered shop drawing in the shop drawings manual.
- .4 Warranty Manuals: Submit copies of all required bonds, guarantees, warranties and extended warranties, complete with an indexed summary list of warranties and expiration dates.
- .5 Independent Testing Agency Reports and/or Manufacturer's Review Reports: Submit all required independent testing reports and/or manufacturer's review reports in accordance with all technical specification Sections.
- .6 As-built Drawings:
  - .2 Submit one hard copy of as-built drawings in each hard copy operation and maintenance manual.
  - .2 Submit one PDF copy of as-built drawings in each digital copy operation and maintenance manual, and 1:1 scaled AutoCAD file in .dwg format.

#### **1.07 AS-BUILT DOCUMENTS AND SAMPLES**

- .1 Maintain, in addition to requirements in General Conditions, at site for Owner one record copy of:
  - .1 Contract Drawings.
  - .2 Specifications.
  - .3 Addenda.
  - .4 Change Orders and other modifications to Contract.
  - .5 Reviewed shop drawings, product data, and samples.
  - .6 Site test records.
  - .7 Inspection certificates.
  - .8 Manufacturer's certificates.
- .2 Store record documents and samples in site office apart from documents used for construction.
  - .1 Provide files, racks, and secure storage.
- .3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual.
  - .1 Label each document "PROJECT RECORD" in neat, large, printed letters.
- .4 Maintain record documents in clean, dry and legible condition.
  - .1 Do not use record documents for construction purposes.
- .5 Keep record documents and samples available for inspection by Owner and Consultant.

#### **1.08 RECORDING INFORMATION ON PROJECT RECORD DOCUMENTS**

- .1 Record information on set of black line opaque drawings, and in copy of Project Manual.
- .2 Use felt tip marking pens, maintaining separate colours for each major system, for recording information.
- .3 Record information concurrently with construction progress.
  - .1 Do not conceal Work until required information is recorded.
- .4 Contract Drawings and shop drawings: mark each item to record actual construction, including:
  - .1 Measured depths of elements of foundation in relation to finish first floor datum.
  - .2 Measured horizontal and vertical locations of underground utilities and appurtenances, paving, sidewalks, manholes and catch basins, referenced to permanent surface

- improvements.
- .3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
- .4 Site changes of dimension and detail.
- .5 Changes made by Change Orders and Supplemental Instructions.
- .6 Locations of interior mechanical and electrical equipment and distribution.
- .7 Details not on original Contract Drawings.
- .8 Referenced Standards to related shop drawings and modifications.
- .5 Specifications: mark each item to record actual construction, including:
  - .1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.
  - .2 Changes made by Addenda and change orders.
- .6 Other Documents: Maintain manufacturer's certifications, inspection certifications, site test records, required by individual specifications Sections.
- .7 Provide digital photos, if requested, for site records.

## **1.09 FINAL SURVEY**

- .1 Reserved.

## **1.10 EQUIPMENT AND SYSTEMS**

- .1 For each item of equipment and each system include description of unit or system, and component parts.
  - .1 Give function, normal operation characteristics and limiting conditions.
  - .2 Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
- .2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.
- .3 Include installed colour coded wiring diagrams.
- .4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences.
  - .1 Include regulation, control, stopping, shut-down, and emergency instructions.
  - .2 Include summer, winter, and any special operating instructions.
- .5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- .6 Provide servicing and lubrication schedule, and list of lubricants required.
- .7 Include manufacturer's printed operation and maintenance instructions.
- .8 Include sequence of operation by controls manufacturer.
- .9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- .10 Provide installed control diagrams by controls manufacturer.
- .11 Provide Contractor's coordination drawings, with installed colour coded piping diagrams.
- .12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and



control diagrams.

- .13 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- .14 Include test and balancing reports as specified in Contract Documents.
- .15 Underground and Aboveground storage tank inspection documentation, registration, forms, decommissioning and removal in accordance with CEPA SOR/2008-197.
- .16 Additional requirements: As specified in individual specification Sections.

#### **1.11 MATERIALS AND FINISHES**

- .1 Building products, applied materials, and finishes: Include product data, with catalogue number, size, composition, and colour and texture designations.
  - .1 Provide information for re-ordering custom manufactured products.
- .2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .3 Moisture-protection and weather-exposed products: Include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .4 Additional requirements: As specified in individual specifications Sections.

#### **1.12 MAINTENANCE MATERIALS**

- .1 Spare Parts:
  - .1 Provide spare parts, in quantities specified in individual specification Sections.
  - .2 Provide items of same manufacture and quality as items in Work.
  - .3 Deliver to location as directed; place and store.
  - .4 Receive and catalogue items.
    - .1 Submit inventory listing to Owner.
    - .2 Include approved listings in Maintenance Manual.
  - .5 Obtain receipt for delivered products and submit before final payment.
- .2 Extra Stock Materials:
  - .1 Provide maintenance and extra materials, in quantities specified in individual specification Sections.
  - .2 Provide items of same manufacture and quality as items in Work.
  - .3 Deliver to location as directed; place and store.
  - .4 Receive and catalogue items.
    - .1 Submit inventory listing to Owner.
    - .2 Include approved listings in Maintenance Manual.
  - .5 Obtain receipt for delivered products and submit before to final payment.
- .3 Special Tools:
  - .1 Provide special tools, in quantities specified in individual specification Section.
  - .2 Provide items with tags identifying their associated function and equipment.
  - .3 Deliver to location as directed; place and store.
  - .4 Receive and catalogue items.
    - .1 Submit inventory listing to Owner.
    - .2 Include approved listings in Maintenance Manual.

### **1.13 DELIVERY, STORAGE, AND HANDLING**

- .1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.
- .2 Store in original and undamaged condition with manufacturer's seal and labels intact.
- .3 Store components subject to damage from weather in weatherproof enclosures.
- .4 Store paints and freezable materials in a heated and ventilated room.
- .5 Remove and replace damaged products at own expense and for review by Consultant.

### **1.14 WARRANTIES AND BONDS**

- .1 Develop warranty management plan to contain information relevant to Warranties.
- .2 Submit warranty management plan, 30 days before planned pre-warranty conference, to Consultant approval.
- .3 Warranty management plan to include required actions and documents to assure that Owner receives warranties to which it is entitled.
- .4 Provide plan in narrative form and contain sufficient detail to make it suitable for use by future maintenance and repair personnel.
- .5 Submit, warranty information made available during construction phase, to Owner for approval before each monthly pay estimate.
- .6 Assemble approved information in binder, submit upon acceptance of work and organize binder as follows:
  - .1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.
  - .2 List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
  - .3 Obtain warranties and bonds, executed in duplicate by Subcontractors, suppliers, and manufacturers, within ten days after completion of applicable item of work.
  - .4 Verify that documents are in proper form, contain full information, and are notarized.
  - .5 Co-execute submittals when required.
  - .6 Retain warranties and bonds until time specified for submittal.
- .7 Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial Performance is determined.
- .8 Conduct joint 12 month warranty inspection, measured from time of acceptance, with Owner.
- .9 Include information contained in warranty management plan as follows:
  - .1 Roles and responsibilities of personnel associated with warranty process, including points of contact and telephone numbers within the organizations of Contractors, Subcontractors, manufacturers, or suppliers involved.
  - .2 Listing and status of delivery of Certificates of Warranty for all extended warranty items.
  - .3 Provide list for each warranted equipment, item, feature of construction or system indicating:
    - .1 Name of item.
    - .2 Model and serial numbers.
    - .3 Location where installed.
    - .4 Name and phone numbers of manufacturers or suppliers.
    - .5 Names, addresses and telephone numbers of sources of spare parts.
    - .6 Warranties and terms of warranty: include one-year overall warranty of construction. Indicate items that have extended warranties and show separate

- warranty expiration dates.
- .7 Cross-reference to warranty certificates as applicable.
- .8 Starting point and duration of warranty period.
- .9 Summary of maintenance procedures required to continue warranty in force.
- .10 Cross-Reference to specific pertinent Operation and Maintenance manuals.
- .11 Organization, names and phone numbers of persons to call for warranty service.
- .12 Typical response time and repair time expected for various warranted equipment.
- .4 Contractor's plans for attendance at 12 month post-construction warranty inspections.
- .5 Procedure and status of tagging of equipment covered by extended warranties.
- .6 Post copies of instructions near selected pieces of equipment where operation is critical for warranty and/or safety reasons.
- .10 Respond in timely manner to oral or written notification of required construction warranty repair work.
- .11 Written verification to follow oral instructions.
  - .1 Failure to respond will be cause for the Owner to proceed with action against Contractor.

### **1.15 WARRANTY TAGS**

- .1 Tag, at time of installation, each warranted item. Provide durable, oil- and water-resistant tag approved by Owner and Consultants.
- .2 Attach tags with copper wire and spray with waterproof silicone coating.
- .3 Leave date of acceptance until project is accepted for occupancy.
- .4 Indicate the following information on tag:
  - .1 Type of product/material.
  - .2 Model number.
  - .3 Serial number.
  - .4 Contract number.
  - .5 Warranty period.
  - .6 Inspector's signature.
  - .7 Construction Contractor.

## **2 PRODUCTS**

### **2.01 NOT USED**

- .1 Not Used.

## **3 EXECUTION**

### **3.01 NOT USED**

- .1 Not Used.

**END OF SECTION**

## **1 GENERAL**

### **1.01 RELATED REQUIREMENTS**

- .1 Section 01 77 00 – Closeout Procedures.

### **1.02 ADMINISTRATIVE REQUIREMENTS**

- .1 Demonstrate operation and maintenance of equipment and systems to Owner's personnel two weeks before date of substantial performance.
- .2 Owner: Provide list of personnel to receive instructions, and coordinate their attendance at agreed-upon times.
- .3 Preparation:
  - .1 Verify conditions for demonstration and instructions comply with requirements.
  - .2 Verify designated personnel are present.
  - .3 Ensure equipment has been inspected and put into operation in accordance with Mechanical and Electrical Contract Documents, and manufacturer's instructions.
  - .4 Ensure testing, adjusting, and balancing has been performed in accordance with Mechanical Contract Documents and equipment and systems are fully operational.
- .4 Demonstration and Instructions:
  - .1 Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, and maintenance of each item of equipment.
  - .2 Instruct personnel in phases of operation and maintenance using operation and maintenance manuals as basis of instruction.
  - .3 Review contents of manual in detail to explain aspects of operation and maintenance.
  - .4 Prepare and insert additional data in operation and maintenance manuals when needed during instructions.
- .5 Time Allocated for Instructions: allocate sufficient time required for instruction of each item of equipment or system to the Owner's satisfaction.

### **1.03 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit schedule of time and date for demonstration of each item of equipment and each system two weeks before designated dates, for Owner's approval.
- .3 Submit reports within one week after completion of demonstration, that demonstration and instructions have been satisfactorily completed.
- .4 Give time and date of each demonstration, with list of persons present.
- .5 Provide copies of completed operation and maintenance manuals for use in demonstrations and instructions.

### **1.04 QUALITY ASSURANCE**

- .1 When specified in individual Sections requiring manufacturer to provide authorized representative to demonstrate operation of equipment and systems:
  - .1 Instruct Owner's personnel.
  - .2 Submit written report that demonstration and instructions have been completed.

## **2 PRODUCTS**

### **2.01 NOT USED**

.1 Not Used.

## **3 EXECUTION**

### **3.01 NOT USED**

.1 Not Used.

**END OF SECTION**

## **1 GENERAL**

### **1.01 SUMMARY**

- .1 This Section includes the following:
  - .1 Demolition and removal of selected portions of interior building components and finishes.
  - .2 Repair procedures for selective demolition operations.
- .2 This section does not include the following:
  - .1 Removal of hazardous materials or asbestos abatement.
  - .2 Demolition of exterior building components or structural elements.
  - .3 Mechanical or electrical equipment, except as required to make minor modifications to allow the work to be completed.
- .3 Reserved.

### **1.02 RELATED REQUIREMENTS**

- .1 Refer to all applicable mechanical, electrical, structural, civil, landscape demolition requirements where available.

### **1.03 DEFINITIONS**

- .1 Demolish: Detach items from existing construction and legally dispose of them off site, unless indicated to be removed and salvaged or removed and reinstalled.
- .2 Salvage: Detach items from existing construction and deliver to owner as indicated on drawings.
- .3 Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.
- .4 Existing to Remain: Existing items of construction that are not removed and that are not otherwise indicated as being removed, removed and salvaged, or removed and reinstalled.
- .5 Waste Management Coordinator (WMC): Contractor representative responsible for supervising waste management activities as well as coordinating related, required submittal and reporting requirements.
- .6 Draft Construction Waste Management Plan (Draft CWM Plan): Detailed inventory of materials in building indicating estimated quantities of reuse, recycling and landfill, prepared in accordance with Division 1 by the Contractor and as follows:
  - .1 Involves quantifying by volume/weight amounts of materials and wastes generated during construction, demolition, deconstruction, or renovation project.
- .7 Construction Waste Management Plan (CWM Plan): Written plan addressing opportunities for reduction, reuse, or recycling of materials prepared in accordance with Division 1.
- .8 Construction Waste Management Report (CWM Report): Written report identifying actual materials that formed CWM Plan for reduction, reuse, or recycling of materials prepared in accordance with Division 1.
- .9 Hazardous Substances: Dangerous substances, dangerous goods, hazardous commodities and hazardous products may include asbestos, mercury and lead, PCB's, poisons, corrosive agents, flammable substances, radioactive substances, or other material that can endanger human health or wellbeing or environment if handled improperly as defined by the Federal Hazardous Products Act (RSC 1985) including latest amendments.

#### 1.04 REFERENCE STANDARDS

- .1 American National Standards Institute (ANSI):
  - .1 ANSI A10.8 2011, Safety Requirements for Scaffolding.
- .2 ASTM International (ASTM):
  - .1 [ASTM C 475/C 475M-15](#), Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
- .3 Canadian Green Building Council (CaGBC):
  - .1 LEED Reference Guide for Building Design and Construction, Version 4.
- .4 CSA Group (CSA):
  - .1 [CSA S350](#) M1980 (R2003), Code of Practice for Safety in Demolition of Structures.
- .5 Department of Justice Canada (Jus):
  - .1 Canadian Environmental Assessment Act (CEAA), 2012.
  - .2 Canadian Environmental Protection Act (CEPA), 2012.
    - .1 SOR/2003-2, On-Road Vehicle and Engine Emission Regulations.
    - .2 SOR/2006-268, Regulations Amending the On-Road Vehicle and Engine Emission Regulations.
    - .3 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.
    - .4 Motor Vehicle Safety Act (MVSA), 1995.
    - .5 Hazardous Materials Information Review Act, 1985.
- .6 National Fire Protection Association (NFPA):
  - .1 [NFPA 241](#) 13, Standard for Safeguarding Construction, Alteration, and Demolition Operations.

#### 1.05 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination: Coordinate with Owner for the material ownership as follows:
  - .1 Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain, demolished materials shall become Contractor's property and shall be removed from Project site.
  - .2 Coordinate selective demolition work so that work of this Section adheres to aesthetic criteria established by the Drawings and specified dimensions with all elements in plans as drawn, maintaining their relationships with all other building elements.
  - .3 Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to Owner that may be encountered during selective demolition remain Owner's property:
    - .1 Carefully remove and salvage each item or object in a manner to prevent damage and deliver promptly to Owner.
    - .2 Coordinate with Owner, who will establish special procedures for removal and salvage.
- .2 Pre Demolition Meeting: Convene pre-installation meeting prior to beginning work of this Section, with Contractor and applicable trades to:
  - .1 Confirm extent of salvaged and demolished materials.
  - .2 Review Contractor's demolition plan.
    - .1 Verify existing site conditions adjacent to demolition work
    - .2 Coordination with other construction sub trades.
- .3 Hold project meetings as required and ensure key personnel attend.
- .4 WMC must provide written report on status of waste diversion activity when requested by Owner and/or Consultant.

## **1.06 ACTION AND INFORMATION SUBMITTALS**

- .1 Action Submittals: Provide the following submittals before starting any work of this Section:
  - .1 Schedule of Selective Demolition Activities to indicate the following:
    - .1 Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity.
    - .2 Coordinate with Owner's ongoing site operations, and limit the number of interruptions during regular business hours.
    - .3 Interruption of utility services.
    - .4 Coordination for shutoff, capping, and continuation of utility services.
    - .5 Use of elevator and stairs.
    - .6 Locations of temporary partitions and means of egress, including for others affected by selective demolition operations.
    - .7 Coordination with Owner's continuing occupancy of portions of existing building Owner's partial occupancy of completed Work.
  - .2 Demolition Plan: Reserved.
  - .3 Scan Report: Performing scanning of existing concrete slab where coring and cutting of existing concrete walls and slabs are required. Submit scan report to Consultant for review. Allow 10 working days for Consultant to review. Do not proceed with coring and or cutting until Consultant has provided review of scan report. Scan report to include photos and drawings depicting accurate location of service and reinforcements with dimensions.
- .2 Informational Submittals: Provide the following submittals when requested by the Consultant:
  - .1 Qualification Data: Submit information for companies and personnel indicating their capabilities and experience to perform work of this Section including; but not limited to, lists of completed projects with project names and addresses, names and addresses of architects and owners, for work of similar complexity and extent.
  - .2 Sustainable Design Submittals:
    - .1 Reserved.

## **1.07 QUALITY ASSURANCE**

- .1 Regulatory Requirements: Perform work as follows; use most restrictive requirements where differences occur between the municipal, provincial and federal jurisdictions:
  - .1 Provincial and Federal Requirements: Perform work in accordance with governing environmental notification requirements and regulations of the Authority Having Jurisdiction.
  - .2 Municipal Requirements: Perform hauling and disposal operations in accordance with regulations of Authority Having Jurisdiction.
- .2 Qualifications: Provide proof of qualifications when requested by Consultant:
  - .1 Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project:
    - .1 Conform to the provincial Occupational Health and Safety Act and Regulation.
    - .2 Conform to Workers' Compensation Board Regulations.
    - .3 Conform to local municipal bylaws and regulations governing this type of work.

## **1.08 SITE CONDITIONS**

- .1 Owner will occupy portions of building immediately adjacent to selective demolition area:
  - .1 Conduct selective demolition so that Owner's operations will not be disrupted.
  - .2 Where work activities are anticipated to impact building services including but not limited to shut down of utilities, obstruction of building entrances and corridors, Contractor must submit formal request and obtain approval from Owner prior to proceed with work. Coordinate with Owner's approval procedures.
- .2 Maintain access to existing means of egress, walkways, corridors, exits, and other adjacent



occupied or used facilities:

- .1 Do not close or obstruct means of egress, walkways, corridors, exits, or other occupied or used facilities without written acceptance from authorities having jurisdiction.
- .3 Reserved.
- .4 Discovery of Hazardous Substances: It is not expected that Hazardous Substances will be encountered in the Work; immediately notify Owner if materials suspected of containing hazardous substances are encountered and perform the following activities:
  - .1 Refer to Division 1 for directives associated with specific material types.
  - .2 Hazardous materials will be as defined in the Hazardous Materials Act.
  - .3 Reserved.
  - .4 If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Consultant and Owner. Hazardous materials will be removed by Owner under a separate contract or as a change to the Work.
- .5 Hazardous Substances: Hazardous Substances are present in building to be selectively demolished. A report on the presence of Hazardous Substances is provided by the Owner for review and use:
  - .1 Examine report to become aware of locations where hazardous materials are present.
  - .2 Coordinate with Section 02 81 00 - Hazardous Materials where provided.
  - .3 Do not disturb Hazardous Substances or items suspected of containing Hazardous Substances.

## **2 PRODUCTS**

### **2.01 TEMPORARY SUPPORT STRUCTURES**

- .1 Design temporary support structures required for demolition work and underpinning and other foundation supports necessary for the project using a qualified professional engineer registered or licensed in province of the Work.

### **2.02 DESCRIPTION**

- .1 This section of the Work includes, but is not necessarily limited to, the following:
  - .1 Demolition, removal completely from site, and disposal of all identified components, materials, equipment and debris.
  - .2 Selective demolition to allow new walls, bulkheads, ceilings and other materials to meet existing construction as indicated.
  - .3 All material from demolition shall be removed from site immediately with no salvage, selling, sorting or burning permitted on site.
  - .4 Retain items indicated on drawings for re use in new construction.

### **2.03 DEBRIS**

- .1 Make all arrangements for transport and disposal of all demolished materials from the site.

### **2.04 EQUIPMENT**

- .1 Provide all equipment required for safe and proper demolition of the building interiors indicated.

### **2.05 REPAIR MATERIALS**

- .1 Use repair materials identical to existing materials:
  - .1 If identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
  - .2 Use a material whose installed performance equals or surpasses that of existing material.

- .3 Comply with material and installation requirements specified in individual Specification Sections.
- .2 Floor Patching and Levelling Compounds: Cement based, trowelable, self levelling compounds compatible with specified floor finishes; gypsum based products are not acceptable for work of this Section.
- .3 Concrete Unit Masonry: Lightweight concrete masonry units, and mortar, cut and trimmed to fit existing opening to be filled. Provide standard hollow core units, square end units and bond beam units as indicated on drawings.
- .4 Prefinished Sheet Steel: Prefinished sheet steel, colour and profile to match existing.
- .5 Gypsum Board Patching Compounds: Joint compound to [ASTM C 475/C 475M](#), bedding and finishing types thinned to provide skim coat consistency to patch and prepare existing gypsum board walls ready for new finishes in accordance with Section 09 21 16 - Gypsum Board Assemblies.
- .6 Hoarding and Dust Screens: Refer to Section 01 56 00 - Temporary Barriers and Enclosures for stud framing and gypsum board sheathing materials.

## **2.06 EXISTING MATERIALS**

- .1 Items to be retained for re use in new construction, provide adequate protection for all items to remain.

## **3 EXECUTION**

### **3.01 EXAMINATION**

- .1 Verify that utilities have been disconnected and capped.
- .2 Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- .3 Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.
- .4 Notify Consultant where existing mechanical, electrical, or structural elements conflict with intended function or design:
  - .1 Investigate and measure the nature and extent of conflict and submit a written report to Consultant.
- .5 Perform surveys as the work progresses to detect hazards resulting from selective demolition activities.

### **3.02 UTILITY SERVICES**

- .1 Coordinate existing services indicated to remain and protect them against damage during selective demolition operations.
- .2 Locate, identify, disconnect, and seal or cap off indicated utilities serving areas to be selectively demolished.
  - .1 Arrange to shut off affected utilities with utility companies.
  - .2 If utility services are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary utilities that bypass area of selective demolition and that maintain continuity of service to other parts of building.

- .3 Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.
- .4 Cut off pipe or conduit to a minimum of 25 mm below slab, and remove concrete mound. Patch concrete using concrete patching compound.
- .3 Coordinate with Mechanical and Electrical Divisions for shutting off, disconnecting, removing, and sealing or capping utilities.
- .4 Do not start selective demolition work until utility disconnecting and sealing have been completed and verified in writing and Owner's approval is obtained.

### **3.03 PREPARATION**

- .1 Identify and mark all equipment and materials identified to be retained or to be re used in subsequent construction. Separate and store items to be retained in an area away from area of demolition and protect from accidental disposal.
- .2 Post warning signs on electrical lines and equipment that must remain energized to serve other areas during period of demolition.
- .3 Confirm that all electrical and telephone service lines entering buildings are not disconnected.
- .4 Do not disrupt active or energized utilities crossing the demolition site.
- .5 Provide and maintain barricades, warning signs, protection for workmen and the public during the full extent of the Work. Read drawings carefully to ascertain extent of protection required.
- .6 Mark all materials required to be re used, store in a safe place until ready for re installation.
- .7 Adjust all junction boxes, receptacles and switch boxes flush with new wall construction where additional layers to existing construction are indicated.
- .8 Remove permanent marker lines used or found on exposed surfaces and at surfaces indicated for subsequent finish materials. Mechanically remove permanent marker lines and associated substrates where permanent marker lines occur and patch surface. Sealing or priming over permanent marker lines is not acceptable.

### **3.04 CONCRETE SLAB REINFORCING**

- .1 Locate location of reinforcing steel in concrete slabs prior to cutting or coring using non destructive, non ionizing radio frequency locators.
- .2 Core concrete slabs to avoid reinforcing steel, electrical conduit or water pipes; adjust core location and coordinate with Engineer where slab features interfere with core drilling.
- .3 Notify the Engineer immediately for further instructions where coring or cutting will damage existing slab features.

### **3.05 SELECTIVE DEMOLITION**

- .1 Demolish and dismantle work in a neat and orderly manner and in strict accordance with all regulations.
- .2 At end of each day's work, leave Work in safe condition so that no part is in danger of toppling or falling.
- .3 Demolish in a manner to minimize dusting and to prevent migration of dust.
- .4 Selling or burning of materials on the site is not permitted.

- .5 Remove concrete bases by cutting and chipping, take precautions against slab cracking and degradation. Grind edges smooth, fill and make level with self levelling grout.
- .6 Fill all openings in concrete block walls with concrete masonry units, coursing to match existing, prepare ready to receive new finishes to match existing.
  - .1 Provide bond beams in new openings cut into existing concrete masonry unit walls.
  - .2 Provide finished end masonry units to patch and repair for new jamb sections in existing concrete masonry unit walls.
- .7 Fill all openings in gypsum board walls with gypsum board and steel framing to match existing, skim coat to make wall smooth and even.
- .8 Demolish existing carpet, resilient flooring and adhesive remnants as follows:
  - .1 Vacuum existing carpet thoroughly, prior to removal, using vacuum equipped with power head/sweeper.
  - .2 Apply fine mist water spray to carpet as required to minimize dust generation during removal. Avoid spraying near electrical outlets.
  - .3 Demolish existing carpet and resilient floor finishes, remove and dispose of off site.
  - .4 Remove adhesive to the greatest extent possible using scrapping tools and as follows:
    - .1 Do not use solvent based cleaners to remove adhesive remnants.
    - .2 Lightly shot blast or grind floor using machine designed for purpose to remove adhesive remnants.
    - .3 Vacuum floor ready for application of skim coating.
    - .4 Repair all slab depressions and damage with cementitious patching compound.
    - .5 Skim coat floor with minimum 1 mm thick cementitious floor underlayment compatible with new flooring materials.
  - .5 Floor substrate shall be smooth, free from ridges and depressions, and adhesive remnants that could telegraph through resilient flooring materials and carpets.
  - .6 Recycle materials in accordance with Division 1.
- .9 Where indicated on drawings, demolish existing ceramic tile finishes. Remove setting bed or adhesive to the greatest extent possible using mechanical scrapping tools and as follows:
  - .1 Saw cut edge of tile for clean and even transition joint between existing tile to remain and new flooring materials.
  - .2 Lightly shot blast or grind floor to remove remnants of setting materials.
  - .3 Vacuum floor ready for application of skim coating.
  - .4 Repair all slab depressions and damage with cementitious patching compound. Skim coat floor with minimum 1 mm thick cementitious floor underlayment compatible with new flooring materials.
- .10 Demolish completely all ceiling panels and grid as indicated.
- .11 Remove all wall coverings scheduled for demolition. Patch and repair wall surfaces with skim coat of gypsum board joint compound leaving wall surfaces smooth and even ready for new wall finishes.
- .12 Patch and repair all walls, floor and ceilings damaged during demolition with material matching adjacent walls, prepare ready for new finishes.
- .13 Patch and repair all mechanical equipment and electrical fixtures damaged or exposed during demolition to match adjacent finished surfaces.
- .14 When temporarily removing ceilings and wall finishes to perform mechanical and electrical work. Contractor shall be responsible for all costs associated with the anticipated means and methods to perform work. If anticipated construction means and methods differ from requirements indicated on drawings, Contractor shall include for all costs associated with the Contractor's proposed means and methods to complete the proposed work.

### **3.06 PATCHING AND REPAIRING**

- .1 Make good all construction and finishes impacted by demolition work.
- .2 Floors and Walls:
  - .1 Where walls or partitions that are demolished extend from one finished area into another, patch and repair floor and wall surfaces in the new space.
  - .2 Provide a level and smooth surface having uniform finish colour, texture, and appearance.
  - .3 Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform colour and appearance.
  - .4 Patch with durable seams that are as invisible as possible.
  - .5 Provide materials and comply with installation requirements specified in other Sections of these Specifications.
  - .6 Where patching occurs in a painted surface, apply primer and intermediate paint coats over patch and apply final paint coat over entire unbroken surface containing patch. Provide additional coats until patch blends with adjacent surfaces.
  - .7 Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
- .3 Ceilings: patch, repair, or re hang existing ceilings as necessary to provide an even plane surface of uniform appearance.

### **3.07 PROTECTION**

- .1 Prevent debris from blocking drainage inlets and systems and ground draining, and protect material and electrical systems and services that must remain in operation.
- .2 Arrange demolition and shoring work so that interference with the use of adjoining areas is minimized.
- .3 Maintain safe access to and egress from occupied areas adjoining.
- .4 Provide and maintain fire prevention equipment and alarms accessible during demolition.

### **3.08 CLEANING**

- .1 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Division 1.
- .2 Waste Management: Separate waste materials in accordance with Division 1, and as follows:
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.
- .3 Divert excess materials from landfill.
- .4 Promptly as the Work progresses, and on completion, clean up and remove from the site all rubbish and surplus material. Remove rubbish resulting from demolition work daily.
- .5 Maintain access to exits clean and free of obstruction during removal of debris.
- .6 Keep surrounding and adjoining roads, lanes, sidewalks, municipal rights of way clean and free of dirt, soil or debris that may be a hazard to vehicles or persons.
- .7 Transport material designated for alternate disposal using approved facilities listed in CWM Plan and in accordance with applicable regulations.
  - .1 Written authorization from Owner is required to deviate from facilities listed in CWM Plan.
- .8 Dispose of materials not designated for alternate disposal in accordance with applicable

regulations.

- .1 Disposal facilities must be those approved of and listed in CWM Plan.
- .2 Written authorization from Owner is required to deviate from disposal facilities listed in CWM Plan.

**END OF SECTION**

## **PART 1 – GENERAL**

### **1.1 GENERAL INSTRUCTIONS**

- 1.1.1 Read and conform to:
  - 1.1.1.1 Drawings and Schedules.
  - 1.1.1.2 Division 01 requirements and documents.

### **1.2 DEFINITIONS**

- 1.2.1 The following Definitions shall apply in this Specification:
- 1.2.2 Contract Documents
  - 1.2.2.1 The Contract Documents consist of the Drawings, Specifications and Reports which form part of the agreed Contract.
- 1.2.3 Consultant
  - 1.2.3.1 The Consultant is the Architect, SER, persons or entities engaged by the Owner. The term Consultant means the Consultant or the Consultant's authorized representative.
- 1.2.4 Contractor
  - 1.2.4.1 The term Contractor is defined to include any of the following: Construction Manager, General Contractor, Structural Steel Erector, Structural Steel Fabricator, Subcontractor or Supplier.
- 1.2.5 Owner
  - 1.2.5.1 The Owner is the person or entity identified as such in the Contract. The term Owner means the Owner or the Owner's authorized agent or representative but does not include the Consultant.

### **1.2 WORK INCLUDED**

- 1.2.1 Comply with Division 1 - General Requirements and all documents referred to therein.
- 1.2.2 Provide all labour, materials, plant and equipment to complete the cast-in-place concrete Work indicated on the Drawings and specified in this Section.

### **1.3 RELATED WORK SPECIFIED ELSEWHERE**

- 1.3.1 Concrete Forming, Section 03 10 00 – Concrete Forming.
- 1.3.2 Concrete Reinforcement, Section 03 20 00 – Concrete Reinforcement.
- 1.3.3 Concrete Floor Finishing, Section 03 35 10 – Concrete Floor Finishing.
- 1.3.4 Structural Steel, Section 05 12 00 – Structural Steel.
- 1.3.5 Backfilling beneath slabs and behind walls, Section 31 23 00 – Excavation and Fill.
- 1.3.6 Fill under slab-on-grade (including moisture barrier), Section 31 23 00 – Excavation and Fill.
- 1.3.7 Grouting beneath base plates bearing on masonry, Section 04 20 00 – Unit Masonry.

### **1.4 REFERENCE STANDARDS, CODES AND ACTS**

- 1.4.1 Conform to the requirements of the local building code identified on the Structural General Notes as amended by all subsequent Regulations issued to the date of this Specification and applicable acts of authorities having jurisdiction.

- 1.4.2 All references to the Standards and publications noted below shall be to the edition referenced in the local building code identified on the Structural General Notes, or to the edition referenced in the latest published editions or revisions of all Standards published by the Canadian Standards Association issued to the date of this Specification, whichever is the later edition or revision.
- 1.4.3 All references noted below, which are not referenced by the local building code or the Standards published by the Canadian Standards Association, shall be to the latest edition and revision published to the date of this Specification.
- 1.4.4 Standards and publications referenced by the Standards noted below are to apply even if they are not included in the list. Where such reference is made, it shall be to that latest edition and revision published to the date of this Specification.
- 1.4.4.1 CSA A23.1/ CSA A23.2 Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete
- 1.4.4.2 CSA A23.3 Design of Concrete Structures
- 1.4.4.3 CSA S413 Parking Structures
- 1.4.4.4 CSA A3000 Cementitious Materials Compendium.
- 1.4.5 Where there are differences between the Specifications and Drawings and the codes, standards or acts, the most stringent shall govern.

## **1.5 TOLERANCES**

- 1.5.1 Perform placing operations so that completed Work will be within the tolerances set out in CSA A23.1.
- 1.5.2 Variations in building lines which result in extension of the building over lot lines or restriction lines will not be permitted.
- 1.5.3 These tolerances are acceptable with regard to structural requirements. Interfacing tolerances may not be compatible with the above. Review and coordinate interfacing tolerances so that the various elements come together properly.

## **1.6 QUALIFICATIONS**

- 1.6.1 The 'foreperson' or 'lead hand' supervising the placement, consolidation, finishing and curing of the concrete shall be certified under an industry recognized concrete finishing program, such as the ACI Concrete Flatwork Finisher/Technician Certification Program.
- 1.6.2 The concrete supplier shall be certified by the Ready Mixed Concrete Association of Ontario (RMCAO) and shall hold a current "Certificate of Ready Mixed (or Mobile Mix) Concrete Production Facilities" as issued by the RMCAO.
- 1.6.3 Where concrete toppings are specified in the Contract Documents, the Contractor shall ensure that the concrete flooring contractor assumes responsibility for all aspects of the topping construction. This will include, but is not limited to the base course or substrate preparation, review of concrete mix design, concrete supply, bonding agents, placing, finishing, and curing etc.

## **1.7 CONCRETE MIX DESIGN**

- 1.7.1 Design of Concrete Mixes
- 1.7.1.1 Concrete mixes are to be designed in accordance with the Performance Alternative outlined in CSA A23.1. The mixes shall be designed such that they will be homogeneous, uniformly workable, readily placeable into corners and angles



of forms and around reinforcement by the methods of placing and consolidation employed on the Work, but without permitting materials to segregate or without permitting excessive free water to collect on the surface. The concrete, when hardened, shall have the qualities specified in the Contract Documents and in the concrete mix design.

- 1.7.1.2 When designing the concrete mixes, the Contractor shall ensure that the supplier is cognizant of the curing requirements outlined in the Contract Documents and CSA A23.1. If a particular concrete mix requires curing in addition to that specified, the Contractor shall be responsible for providing this additional curing.
- 1.7.1.3 Specified Strength: As called for on Drawings.
- 1.7.1.4 Modulus of Elasticity (E): For each concrete mix design, the Modulus of Elasticity, shall not to be less than  $[(3300\sqrt{f'_c} + 6900) \times (Y_c/2300)] 1.5 \text{ MPa}$ .
- 1.7.1.5 1) The above noted formula is normally used, but may not be adequate for high strength concretes.
- 1.7.1.6 2) Admixtures and supplementary cementitious materials (slag) may cause a reduction in E, review this issue with the Inspection and Testing company on each project.
- 1.7.1.7 Fly Ash: The use of fly ash in concrete that will be exposed to view or in concrete that will be exposed to freeze-thaw cycles or de-icing chemicals is subject to review and acceptance by the Consultant.
- 1.7.1.8 Use of calcium chloride shall not be permitted.
- 1.7.1.9 The Contractor shall coordinate the mix designs for suitability with concrete pumping.
- 1.7.1.10 The Contractor shall design concrete mixes so they maintain their workability based on assumed minimum discharge and placing rates.
- 1.7.1.11 Toppings
- 1.7.1.12 Design mix in accordance with requirements of Contract Documents and provisions of CSA A23.1.

## **1.8 SAMPLES AND ASSISTANCE**

### **1.8.1 Concrete Test Cylinders**

- 1.8.1.1 Supply materials for concrete test cylinders, the cost of which shall be paid for by the Contractor.
- 1.8.1.2 Cooperate in the execution of the concrete quality testing program. Furnish concrete required, protect specimens against injury and loss, and assist in the sampling and storage of specimens, as required.
- 1.8.1.3 Sample concrete, cast cylinders and store in accordance with CSA A23.1.
- 1.8.1.4 For all concrete compressive strength tests, 100mm x 200mm cylinders shall be used.
- 1.8.1.5 In accordance with requirements of CSA A23.1, and the direction of the Inspection and Testing Company, provide storage facilities with continuous power supply for a Site storage container for test cylinders.
- 1.8.1.6 Provide sufficient field curing storage facilities so that cylinders representing the various areas can be safely stored in locations representing the curing conditions

for those areas. Move the field cured cylinder storage facilities from area to area as the Work progresses.

1.8.2 Pullout Tests

1.8.2.1 If requested by the Consultant, install pullouts to the requirements of the inspection and testing company.

1.8.2.2 Installation of pullouts shall comply with the requirements of ASTM C900 and ACI 228.1.

1.8.3 Maturity Tests

1.8.3.1 If pull-out tests are required, maturity meters shall be used to determine when pullout tests can be made.

1.8.3.2 Installation, equipment and procedures shall comply with ACI 228R.

1.8.4 Substrate (Soil/Rock) Inspection

1.8.4.1 Assist the geotechnical Consultant in making their inspections or tests.

**1.9 SUBMITTALS**

1.9.1 Certificates

1.9.1.1 The Contractor shall ensure that the concrete supplier submits a current "Certificate of Ready Mixed (or Mobile Mix) Concrete Production Facilities," as issued by the RMCAO.

1.9.1.2 Prior to beginning Work and when any change in materials or source of supply is proposed, provide the following certificates prepared by an independent inspection company;

1.9.1.2.1 Certification that all raw materials used in the production of concrete proposed for the Work comply with the requirements of the Specifications and CSA A23.1.

1.9.1.2.2 Certification that compressive strength, slump, entrained air content, and other specified properties will be met, using the proposed mixes.

1.9.1.2.3 Certification that concrete exposure class C-1 will meet the 56-day limits specified in CSA A23.1 for the rapid chloride permeability test, using the proposed mixes.

1.9.1.2.4 Certification that the chloride ion content in the concrete, before exposure, shall not exceed 0.06% by mass of the cementing materials.

1.9.1.3 The Contractor shall ensure that the concrete supplier submits representative chloride permeability test data distributed over a period of 56 days for concrete exposure class C-1 with and without calcium nitrite corrosion inhibitor or any other admixture containing ionic salts.

1.9.1.4 The Contractor shall ensure that the concrete supplier submits their most current "Concrete Mix Design Statistical Analysis" records for the proposed concrete plant. These records shall indicate the concrete supplier's average strength, standard deviation, coefficient of variation and target strength, as per the requirements of CSA-A23.1 and the RMCAO.

1.9.2 Concrete Mix Designs

- 1.9.2.1 Well in advance of the supply of concrete to the project submit, using the standard RMCAO form for Concrete Mix Design Submissions, all concrete mix designs for review. The mix designs shall include, as a minimum the following information:
  - 1.9.2.1.1 Concrete strength;
  - 1.9.2.1.2 Exposure class;
  - 1.9.2.1.3 Water-cement ratio;
  - 1.9.2.1.4 Maximum aggregate size;
  - 1.9.2.1.5 Maximum SCM replacement;
  - 1.9.2.1.6 Additional durability and architectural requirements;
  - 1.9.2.1.7 Slump range;
  - 1.9.2.1.8 Plastic air range;
  - 1.9.2.1.9 Method of placement;
  - 1.9.2.1.10 Dosage of corrosion inhibitor;
  - 1.9.2.1.11 Other specific information regarding the source and type of all materials being proposed;
  - 1.9.2.1.12 Source of Supplementary Cementing Materials (SCM's).
  - 1.9.2.1.13 Assumed minimum discharge and placing rates.
- 1.9.2.2 Describe in detail on the mix design summary, the location(s) where each mix is to be placed in the structure.
- 1.9.3 Concrete Quality Plan
  - 1.9.3.1 At least four weeks prior to the supply of concrete to the project, submit a complete "Concrete Quality Plan", in the format provided by the Ready Mixed Concrete Association of Ontario.
- 1.9.4 Curing Procedures
  - 1.9.4.1 At least four weeks prior to implementation in the field, submit a detailed description of the procedures which will be employed to cure the structure.
  - 1.9.4.2 As a minimum, the procedures shall indicate:
    - 1.9.4.2.1 The method for protecting the concrete from evaporation of surface moisture from the fresh concrete;
    - 1.9.4.2.2 The type of curing method to be used;
    - 1.9.4.2.3 Details of how various surfaces will be cured (slabs, walls, columns, ramps etc.)
    - 1.9.4.2.4 How the surface will be kept moist, and the quality control requirements for keeping the surface moist;
    - 1.9.4.2.5 The time of initiation and duration of curing;
    - 1.9.4.2.6 Provisions to address potential problems such as high winds and hot and cold weather;
    - 1.9.4.2.7 The limitations of access, if any, to the surfaces being cured; and
    - 1.9.4.2.8 A Quality assurance/Quality control program detailing how the curing program will be implemented, monitored and documented.

- 1.9.4.3 Submit a 300mm x 300mm sample of each type of material (absorptive mat, fabric, plastic film, waterproof paper etc.) which will be used to cure the concrete.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- 2.1.1 Concrete: Normal density concrete with an air-dry density between 2350 and 2450 kg/m<sup>3</sup>. Conform to CSA A23.1.
- 2.1.2 Cement Type: GU General Use Portland Cement.
- 2.1.3 Supplementary Cementing Materials: Conform to CSA.A3001.
- 2.1.4 Water: Clean, potable and not detrimental to concrete.
- 2.1.5 Nominal Size of Coarse Aggregate: 20 mm, except as noted below.
- 2.1.5.1 Use pea gravel (5 mm to 10 mm) where concentration of reinforcement requires the use of a smaller diameter aggregate.
- 2.1.5.2 Use 10 mm (maximum) aggregate in toppings that are less than or equal to 75 mm in thickness, and 20 mm aggregate in toppings greater than 75 mm in thickness.
- 2.1.6 Admixtures: Conform to CSA A23.1.
- 2.1.6.1 Corrosion Inhibitor Admixture: Calcium nitrite based corrosion inhibitor, such as "DCI" or "DCI(S)" by W.R. Grace & Co. (or approved equivalent), shall be added at the rate of 10.1 litres per cubic metre of concrete, to all concrete designated Exposure Class 'C-1', unless noted otherwise in the Contract Documents. The corrosion inhibitor shall contain 30 ± 3 percent of calcium nitrite by weight. The selection of "DCI" or "DCI(S)" (or approved equivalent) shall be as directed by the admixture supplier, based on anticipated placing and curing conditions and the specific concrete mix design selected.
- 2.1.7 Bonding Agent: Use Sika Sikdur 32 epoxy bonding agent for all bonded topping installations.
- 2.1.8 Curing Compound: Conform to CSA A23.1.
- 2.1.9 Grout Beneath Base Plates: Non-shrink flowable grout in-Pakt by King Construction Products or approved equivalent, having a compressive strength at 28 days of at least 35 MPa. Where grout is exposed to view or weather, use non-ferrous grout.
- 2.1.10 Unshrinkable Fill
- 2.1.10.1 Cement type-General Use GU Portland
- 2.1.10.2 Minimum 24 hour strength - 0.07 MPa
- 2.1.10.3 Maximum 28 day strength - 0.4 MPa
- 2.1.10.4 Class of exposure - Not Applicable
- 2.1.10.5 Size of coarse aggregate - 20 mm to 40 mm
- 2.1.10.6 Slump at point of discharge - 150 mm to 200 mm
- 2.1.10.7 Calcium chloride or pozzolanic mineral admixtures shall not be used. Air entraining admixtures may be added if desired by the Contractor.

- 2.1.11 Sealant for Exposed Separation Strips, Construction Joints, and Temporary Opening Joints: Multi-Component Polyurethane 'Sikaflex 2C-SL' by Sika, or an equivalent approved by the Consultant.

### **PART 3 - EXECUTION**

#### **3.1 GENERAL**

- 3.1.1 Ensure minimum concrete discharge and placing rates are maintained to avoid unexpected cold joints from forming in the structure.

#### **3.2 FOOTINGS**

- 3.2.1 During cold weather conditions, carefully protect footing bases from freezing.
- 3.2.2 Found footings on naturally consolidated undisturbed soil capable of safely supporting the allowable bearing capacity shown on the Drawings within acceptable limits of settlement.
- 3.2.3 Founding elevations shown in the Contract Documents are based upon the geotechnical investigation.
- 3.2.4 Founding elevations and allowable bearing capacities must be verified by the geotechnical Consultant before footing concrete is placed.
- 3.2.5 If, upon excavating to the elevations shown in the Contract Documents, the required bearing capacities are not achieved, or if they are achieved at a higher elevation, inform the Consultant who will provide instructions as to how to proceed.
- 3.2.6 Record actual footing founding elevations.
- 3.2.7 Construct footings in a particular area commencing from the lowest footing elevation and proceeding to the higher elevations.
- 3.2.8 Remove water, disturbed soil and foreign matter from footing excavations before placing concrete. Do not permit the soil at founding elevations to soften due to the presence of water in the excavations or construction activity.
- 3.2.9 During cold weather, prevent soil adjacent to and beneath all footings from freezing. Do not pour footings on frozen soil or soil which has been allowed to freeze. If the soil at founding elevations is frozen or was frozen and thawed, remove affected material and found footings on unaffected soil with the required characteristics at no extra cost to the Owner.
- 3.2.10 Where excavations for mechanical or electrical services, pits, adjacent foundations and the like encroach upon a 7 in 10 slope noted above between corners of footings and bottom corners of excavations, lower footings a suitable amount so as not to exceed the slope noted above at no extra cost to the Owner.

#### **3.3 CONSTRUCTION JOINTS**

- 3.3.1 Obtain approval from the Consultant for location and details of construction joints not shown on the structural Drawings.
- 3.3.2 Provided proper placing, curing and protection means and methods are employed by the Contractor, the maximum length/height of concrete pours shall be as follows
- 3.3.2.1 The maximum length of a suspended concrete slab pour shall be 30 m.
- 3.3.2.2 The maximum length of a concrete slab on steel deck pour shall be 30 m.
- 3.3.2.3 The maximum length of a slab-on-grade pour shall be 30 m.
- 3.3.2.4 The maximum length of a concrete foundation wall pour shall be 15 m.

- 3.3.2.5 The maximum height of a concrete pour shall be 4.5 m unless otherwise approved by the Consultant and appropriate measures are taken to ensure proper placing and consolidation of the concrete, and to prevent segregation of the materials within the concrete.

- 3.3.3 If the construction joints (including joints around temporary openings) will be exposed in its permanent condition, the joints must be caulked as outlined in this Specification.

### **3.4 SLABS-ON-GRADE**

#### **3.4.1 General**

- 3.4.1.1 Do not place concrete slab-on-grade until the specified sub-floor material has been placed, inspected and approved.
- 3.4.1.2 Do not place concrete on a frozen sub-grade, or on one that contains frozen materials.
- 3.4.1.3 Do not place concrete on a sub-grade that has been frozen and thawed until the sub-grade has been reviewed by the geotechnical Consultant and approved. If, in the geotechnical consultant's opinion, the safe bearing capacity of the sub-grade has been reduced to below 25 kPa, remove the affected materials and replace with compacted granular fill at no additional cost to the Owner.
- 3.4.1.4 Place clear crushed stone over the sub-base, to depths indicated in the Contract Documents. Thoroughly roll and consolidate to the lines and levels required, with a maximum surface variation of +/- 10mm.
- 3.4.1.5 Upon approval of the placement of the sub-floor material and setting of reinforcement, place and consolidate concrete and finish and cure as specified in this Section.
- 3.4.1.6 Place a bond breaker, minimum 1 layer of building pape, between edges of slab-on-grade and abutting surfaces. Where slab-on-grade is exposed to de-icing chemicals, provide an approved sealant at the joint between the slab-on-grade and abutting surfaces.
- 3.4.1.7 In the case where foundations consist of piles, drilled piers or caissons, the bond breaker MUST be specified as one layer of building paper only - to ensure that the tie forces in the slab-on-grade can be transferred through the base of the columns into the supporting foundation.
- 3.4.1.8 Saw-cut slabs-on-grade as shown in the Contract Document, or to the Consultant's approval.
- 3.4.1.9 Carry out cutting in accordance with recommendations contained in CSA A23.1.
- 3.4.1.10 For slabs exposed to view in the finished building, mask edges of saw-cuts as required to prevent concrete floors from becoming stained

#### **3.4.2 Colored Concrete**

- 3.4.2.1 Provide colored concrete slab-on-grade in the areas indicated on the architectural and structural drawings.
- 3.4.2.2 Refer to the architectural drawings and specifications for additional information about color.

### **3.5 UNSHRINKABLE FILL**

- 3.5.1 Unshrinkable fill is intended for use locally in place of granular backfill below slabs-on-grade or within excavations where compaction of granular material is difficult to

achieve. It is not intended for use below footings or around foundation walls, tunnels, laterally loaded caissons, etc., where vertical and/or lateral structural bearing capacities are required. Obtain written approval from the Consultant prior to using unshrinkable fill.

3.5.2 The unshrinkable fill material shall flow into the excavation so that it fills the entire space. Care shall be taken to ensure that no air is entrapped beneath horizontal projections or in other locations within the excavation.

3.5.3 Where bracing, shoring and/or sheeting is used to support the sides of the excavation or to prevent movements that could damage other services or adjacent pavements, this support system shall be removed as backfilling proceeds.

### **3.6 PLACING CONCRETE**

3.6.1 Place all concrete in accordance with CSA A23.1, the concrete supplier's requirements and as specified in this Section.

3.6.2 Immediately before placing concrete, clean forms and reinforcement of foreign matter.

3.6.3 Discharge concrete into forms in accordance with the time frames specified in

3.6.4 Place concrete on steel deck floors in a manner that avoids piling up of concrete. Do not drop concrete directly from buckets, but employ suitable means of distribution. Wet down deck during hot weather prior to concreting.

3.6.5 Remove concrete spilled onto forms around hoisting equipment before depositing concrete in these areas.

3.6.6 Pumping Concrete

3.6.6.1 Pumping or pneumatic placing of concrete shall only be used if the velocity of discharge is reduced to a point where no separation or scattering of the concrete occurs, and the consistency of the mix has been designed to allow such a system with no adverse effects on the quality of concrete.

3.6.6.2 Excess grout or mortar used to lubricate pipelines, or washout water, must not be discharged into the forms.

3.6.7 Shotcrete

3.6.7.1 The use of shotcrete to construct any part of the Work shall be at the sole discretion of the Consultant.

### **3.7 CURING CONCRETE**

3.7.1 Cure all concrete in accordance with CSA A23.1, the concrete supplier's requirements and as specified in this Section.

### **3.8 PROTECTION**

3.8.1 Protect all concrete in accordance with CSA A23.1, the concrete supplier's requirements and as specified in this Section; to prevent freshly deposited concrete from adverse conditions such as high winds, precipitation, freezing, being exposed to abnormally high temperatures or temperature differentials, premature drying, and moisture loss, for a period of time necessary to develop the specified properties of the concrete.

3.8.2 Cold Weather Concreting

3.8.2.1 Between the 15th of October of any year and the 15th of April of the following year, or when the temperature is at or below 5°C or anticipated to fall below 5°C within 24 hours of placing concrete, provide on hand and ready for use all



- equipment necessary for adequate cold weather protection and curing before concrete placement is begun.
- 3.8.2.2 When fresh concrete is to be cast against existing concrete, prevent the loss of heat by extending the protection for the fresh concrete over the existing concrete.
  - 3.8.2.3 Insulate, or enclose within the protective housing, tie rods, reinforcement or metal which projects from the concrete being protected.
  - 3.8.2.4 Construct enclosures tight and safe for wind and snow loadings.
  - 3.8.2.5 Maintain housing, enclosures and supplementary heat in place for entire period of protection, except that sections may be temporarily removed as required to permit placing additional forms or concrete provided the uncovered concrete is not permitted to freeze. Make up time lost from the required period of protection at the required temperature before protection is discontinued and removed. Protection is not to be completely removed until the concrete has cooled to within the temperature differential limits specified in CSA A23.1.
  - 3.8.2.6 Locate heating units to avoid heating concrete locally or drying it excessively. Avoid high temperature and dry heating within enclosures.
  - 3.8.2.7 Take particular care to maintain edges and corners of concrete at the required temperature owing to their greater vulnerability to freezing.
  - 3.8.2.8 Provide sufficient insulation, and heat as necessary, to prevent freezing of frost susceptible soil which lies against structural elements; in particular protect soil beneath footings and behind foundation walls until the building is completed.
  - 3.8.2.9 Hot Weather Concreting
  - 3.8.2.10 When the rate of moisture evaporation exceeds 0.5kg/m<sup>2</sup> per hour or when the temperature is greater than or equal to 27°C, employ the following measures in addition to the requirements of CSA A23.1:
    - 3.8.2.11 Use ice as mixing water, or an approved equivalent temperature reducing or set retarding admixture to lower the concrete temperature.
    - 3.8.2.12 Dispatch ready-mix trucks and organize Work to keep mixing time to a minimum. Minimize exposure of mixing trucks to the hot sun while waiting. Water shall be made available to spray the exterior of the drum while the truck is waiting to discharge its concrete.
    - 3.8.2.13 Provide adequate personnel and organize Work to keep placing time to a minimum.
    - 3.8.2.14 Place concrete in layers thin enough and areas small enough so that the time interval for placing is reduced and compaction will ensure complete union of adjacent portions.
    - 3.8.2.15 With formed concrete, reliance shall not be placed on the forms alone to provide curing. Spray formwork with water to keep it tight and free from cracking.
  - 3.8.2.16 Protection of Completed Work
  - 3.8.2.17 At all times during the Work, protect exposed concrete, exposed masonry and other exposed members from staining or becoming coated with concrete leakage due to continuing concreting operations. Members which become coated may be classed as defective by the Consultant.
  - 3.8.2.18 Protect exposed members from staining due to rusting of reinforcement projecting beyond construction joints.



3.8.2.19 Take suitable measures to prevent spalling and cracking damage occurring to the structure due to water freezing in expansion joints, small holes, slots, depressions and take suitable measures to prevent damage occurring to foundations and the like due to frost action in the soil or backfill.

3.8.2.20 The application of de-icing salts on completed Work is not permitted.

### **3.9 TOPPINGS**

#### **3.9.1 General**

3.9.1.1 Conform to CSA A23.1 and the requirements noted below, unless noted otherwise in the Contract Documents.

3.9.1.2 Set screeds and bulkheads rigidly and accurately to prevent displacement during concreting.

3.9.1.3 Special provisions for bonded and unbonded toppings:

3.9.1.3.1 The maximum pour size for bonded and unbonded toppings is to be limited to 100 m<sup>2</sup>.

3.9.1.3.2 Maintain a one to one length to width aspect ratio for all pours, where extent and geometry of topping permits.

3.9.1.3.3 Toppings are to be poured in a "checker board" pattern to minimize the effects of shrinkage. Adjacent sections of topping shall be poured no sooner than 3 days after the adjoining section was poured.

3.9.1.3.4 Ensure temperature of base course is 10°C minimum prior to pouring toppings.

3.9.1.3.5 Provide hot and cold weather protection for toppings in accordance with CSA A23.1.

#### **3.9.2 Monolithic Toppings**

3.9.2.1 Monolithic toppings are constructed by applying a concrete mixture to a "freshly" poured base course that has lost all slump and bleed water, prior to its final set. Alternatively, monolithic toppings can be poured with the main base course to a final thickness equal to the thickness of the base course plus the thickness of the topping. Examples of monolithic toppings include built-up slopes to drain on cast-in-place concrete slabs.

3.9.2.2 Where monolithic toppings are specified in the Contract Documents, place reinforcement and maintain cover requirements based on the thickness of the base slab only. Provide additional layer of reinforcement in monolithic toppings where noted on the Contract Documents.

#### **3.9.3 Bonded Toppings**

3.9.3.1 Bonded toppings are constructed by applying the topping mixture over a hardened concrete base to which a bonding agent has been applied. By definition, bonded toppings are designed to bond to the concrete base or an existing concrete surface. Bonded toppings include toppings on all precast concrete slabs and toppings generally less than 75 mm thick.

3.9.3.2 Bond strength between topping and base course shall not be less than 0.90 MPa, per CSA A23.1.

- 3.9.3.3 For bonded toppings on precast concrete slabs, conform with the requirements of the precast concrete manufacturer's specifications.
- 3.9.3.4 Base Course Finishing and Preparation
  - 3.9.3.4.1 Base courses which are to receive bonded toppings are to be finished by one of two of the following methods:
    - 3.9.3.4.1.1 Rough broom finish (very rough finish – amplitude  $\pm$  5mm).
    - 3.9.3.4.1.2 Steel trowel finish.
  - 3.9.3.4.2 When a rough broom finish is provided, the slab surface shall be cleaned by high-pressure water blasting to ensure all laitance, dirt, dust, construction debris and the like are removed prior to application of the bonding agent. The bonding agent shall be applied in strict accordance with manufacturer's recommendations.
  - 3.9.3.4.3 When a steel trowel finish is provided, the slab is to be roughened by means of shot blasting prior to the application of the bonding agent. Ensure all laitance, dirt, dust, construction debris and the like are removed immediately prior to the application of the bonding agent. Employ all necessary means to control dust and debris during shot blasting.
- 3.9.3.5 Placing and Finishing Toppings
  - 3.9.3.5.1 Place and finish the toppings in accordance with CSA A23.1.
- 3.9.3.6 Curing
  - 3.9.3.6.1 Continuously wet cure bonded toppings for a minimum of seven days.
- 3.9.3.7 Jointing
  - 3.9.3.7.1 Bonded toppings do not require special provisions with respect to jointing provided all the provisions noted above are adhered to.
  - 3.9.3.7.2 The location of joints in the topping shall match those in the base course.
- 3.9.4 Unbonded (Loose Laid) Toppings
  - 3.9.4.1 Unbonded or loose laid toppings are constructed by applying the topping mixture over a bond breaker and hardened concrete base, to which no bonding agent has been applied. By definition, unbonded toppings are specifically designed so as not to bond to the concrete base. Unbonded toppings include toppings that include heating cables and toppings typically greater than 75 mm in thickness.
  - 3.9.4.2 Base Course Finishing and Preparation
    - 3.9.4.2.1 Base courses which are to receive unbonded or loose laid toppings are to be finished smooth by means of a steel trowel.
  - 3.9.4.3 Placing and Finishing Toppings
    - 3.9.4.3.1 Place toppings on bond breaker and finish the toppings in accordance with CSA A23.1.

3.9.4.4 Curing

3.9.4.4.1 Continuously wet cure unbonded toppings for a minimum of seven days.

3.9.4.4.2 Jointing

3.9.4.4.3 Unbonded toppings are to be saw cut, as per the typical detail for slabs-on-grade, at a maximum spacing of 3.0 metres in both directions, unless noted otherwise in the Contract Documents. For toppings that are to receive hard architectural floor finishes, the jointing shall be laid out in accordance with the Consultant's requirements and is subject to final approval by the Consultant.

3.9.5 Cracks in Toppings

3.9.5.1 All cracks in concrete toppings shall be repaired by the Contractor. Extent of repair and method of crack repair shall meet the requirements of the flooring installation Contractor and the Owner.

**3.10 OPENINGS THROUGH COMPLETED MEMBERS**

3.10.1 Do not cut openings through completed members without the Consultant's approval.

3.10.2 Where the location of openings is approved, locate the reinforcement by x-ray, cover meter or other positive means as required by the Consultant and adjust the location of the opening so that no reinforcement is cut unless specifically approved otherwise in writing by the Consultant.

3.10.3 In the case of precast concrete slabs, holes shall be cut or drilled only by the precast concrete Contractor.

**3.11 MAKING GOOD**

3.11.1 Make good temporary openings left in concrete construction around pipes, ducts and the like using a mortar of the same proportions as the surrounding Work. Reinforce mortar with welded wire fabric where openings exceed 75 mm. Roughen existing surfaces to receive mortar or apply suitable bonding agent such that mortar will be securely bonded to existing concrete.

**3.12 GROUTING BENEATH BASE PLATES**

3.12.1 Grout beneath plates bearing on concrete with an approved non-shrink flowable grout. Comply with the manufacturer's directions for mixing and placing grout. Completely fill voids below plates. Fill voids left by shims after shims are removed.

3.12.2 During cold weather, preheat base plates and footings and maintain temperature at minimum 12°C for 6 days after grouting.

3.12.3 Refer to Section 05 12 00 – Structural Steel for lifting of base plates to determine adequacy of grouting. If defects are found, more base plates will be raised.

**3.13 TREATMENT OF FORMED SURFACES**

3.13.1 Do Work in accordance with CSA A23.1 and as follows:

3.13.1.1 Provide smooth form finish to concrete surfaces exposed to public view and surfaces to receive plaster, damp-proofing, moisture resistant membrane and the like.

3.13.1.2 Remove traces of form lining compound from concrete surfaces which may affect the bonding of following surface application.

### **3.14 QUALITY CONTROL**

- 3.14.1 Implement a system of quality control to ensure that the minimum standards specified in this Section are attained.
- 3.14.2 Adhere to the requirements of the project "Concrete Quality Plan" prepared and submitted as required by this Specification.
- 3.14.3 Bring to the attention of the Consultant any defects in the Work or departures from the Contract Documents which may occur during Construction. The Consultant will decide upon corrective action and will provide recommendations in writing.
- 3.14.4 The Consultant's general review during construction and inspection and testing by independent inspection and testing agencies reporting to the Consultant are both undertaken to inform the Owner of the Contractor's performance and shall in no way augment the Contractor's quality control or relieve the Contractor of its contractual responsibility.

### **3.15 NOTIFICATION**

- 3.15.1 Prior to commencing significant segments of the Work, give the Consultant and independent inspection and testing companies appropriate notification so as to afford them reasonable opportunity to review the Work. Failure to meet this requirement may be cause for the Consultant to classify the Work as defective.

### **3.16 INSPECTION AND TESTING**

- 3.16.1 Appointment of Independent Inspection and Testing Companies
  - 3.16.1.1 The Owner or Consultant will appoint the independent inspection and testing companies to make inspections or perform tests as the Consultant directs. The independent inspection and testing companies shall be responsible only to the Consultant, and shall make only such inspections or tests as the Consultant may direct.
  - 3.16.1.2 When defects are revealed, the Owner may request, at the Contractor's expense, additional inspection or testing to ascertain the full extent of the defect.
- 3.16.2 Concrete Quality Tests
  - 3.16.2.1 Concrete quality tests shall be carried out in accordance with CSA A23.1 and shall include the following:
    - 3.16.2.1.1 Slump
    - 3.16.2.1.2 Air content of fresh concrete
    - 3.16.2.1.3 Temperature of fresh concrete
    - 3.16.2.1.4 Compressive strength
  - 3.16.2.2 Compressive Strength Tests: Compressive cylinder testing will be carried out in accordance with CSA A23.1 and as follows: Three companion laboratory cured concrete standard compression test cylinders; one tested at 7 days and two tested at 28 days, constitute a strength test. During the placing of concrete in cold weather one additional field cured test cylinder will be made and tested at 7 days.
- 3.16.3 Grout under Baseplates: At least one strength test may be made each day that grout is placed under baseplates.
- 3.16.4 Inspection of Substrate (Soil/Rock)
  - 3.16.4.1 Substrate (Soil/Rock) at footing founding elevations will be inspected.

**3.17 DEFECTIVE MATERIALS AND WORK**

- 3.17.1 Where evidence exists that defective Work has occurred or that Work has been carried out incorporating defective materials, the Consultant may have tests, concrete coring, inspections or surveys performed, analytical calculations of structural strength made and the like in order to help determine whether the Work must be repaired or replaced. Tests, inspections or surveys or calculations carried out under these circumstances will be made at the Contractor's expense, regardless of their results, which may be such that, in the Consultant's opinion, the Work may be acceptable.
- 3.17.2 All testing shall be conducted in accordance with the requirements of the local building code identified on the Structural General Notes, except where this would in the Consultant's opinion cause undue delay or give results not representative of the rejected material in place. In this case, the tests shall be conducted in accordance with the standards given by the Consultant.
- 3.17.3 Materials or Work which fails to meet the requirements specified in the Contract Documents may be rejected by the Consultant whenever found at any time prior to the Total Performance of the Work regardless of previous inspection. If rejected, defective materials or Work shall be promptly removed and replaced or repaired to the satisfaction of the Consultant, at no expense to the Owner.

**END OF SECTION**

## **1 GENERAL**

### **1.01 RELATED REQUIREMENTS**

- .1 Section 05 50 00 - Metal Fabrications.

### **1.02 REFERENCE STANDARDS**

- .1 ASTM International (ASTM):
  - .1 [ASTM A 1064/A 1064M-\[18a\]](#) Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
  - .2 [ASTM C 73-\[17\]](#) Standard Specification for Calcium Silicate Brick (Sand-Lime Brick).
- .2 CSA Group (CSA):
  - .1 [CAN/CSA-A82:\[14\]](#), Fired Masonry Brick Made From Clay or Shale.
  - .2 [CSA A165](#) Series-[14], CSA Standards on Concrete Masonry Units (Consists of A165.1 Concrete Block Masonry Units, A165.2 Concrete Brick Masonry Units, and A165.3 Prefaced Concrete Masonry Units).
  - .3 [CAN/CSA-A179-\[14\]](#), Mortar and Grout for Unit Masonry.
  - .4 [CAN/CSA-A370:\[14\]](#), Connectors for Masonry.
  - .5 [CAN/CSA A371-\[14\]](#), Masonry Construction for Buildings.
  - .6 [CSA G30.18-\[09\]](#), Carbon Steel Bars for Concrete Reinforcement.
  - .7 [CSA S304-\[14\]](#), Design of masonry structures.
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
  - .1 Safety Data Sheets (SDS).

### **1.03 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Division 1.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, product literature and data sheets for unit masonry products, mortar and grout, connectors, anchorage and reinforcing, and accessories. Include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Submit WHMIS SDS in accordance with Division 1.
- .3 Samples:
  - .1 When requested, submit samples of each unit exposed in final construction for review and acceptance.
  - .2 Samples will be returned for inclusion into work.
  - .3 Submit duplicate full size samples of each type of masonry unit, mortar, connector, anchorage and reinforcing, and accessory.
- .4 Sustainability Standards Certification:
  - .1 Reserved.

### **1.04 DELIVERY, STORAGE, AND HANDLING**

- .1 Perform in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials in accordance with manufacturer's recommendations in clean, well-ventilated area.
  - .2 Store and protect masonry products from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new ones.

.4 Packaging Waste Management: Remove in accordance with Division 1.

## **1.05 COLD WEATHER REQUIREMENTS**

.1 Supplement requirements of [CAN/CSA-A371](#) as follows:

- .1 Maintain temperature of mortar at manufacturer's specified temperature range.
- .2 Provide temporary heating when constructing in temperature below those specified by manufacturer.

## **1.06 HOT WEATHER REQUIREMENTS**

.1 Supplement requirements of [CAN/CSA-A371](#) as follows:

- .1 Protect freshly laid masonry from drying too rapidly by using waterproof, non-staining coverings.

## **2 PRODUCTS**

### **2.01 SUSTAINABILITY CHARACTERISTICS**

.1 Reserved.

### **2.02 MASONRY UNITS**

.1 Standard concrete block units: To [CSA A165](#) (specifically [CSA A165.1](#))

- .1 Classification: refer to drawings.
- .2 Size: refer to drawings.
- .3 Texture(s)/Profile(s): Smooth.
- .4 Special shapes: Provide square units for exposed corners. Provide purpose-made shapes for lintels and bond beams. Provide additional special shapes as indicated.

.2 Special fire resistant concrete block units: To [CSA A165](#) (specifically [CSA A165.1](#)) as modified below:

- .1 Classification: refer to drawings except as modified by fire resistance requirements specified below.
- .2 Fire resistant characteristics: Aggregate used in units and equivalent thickness of units to Ontario Building Code (OBC), for fire-resistance ratings indicated.
- .3 Size: refer to drawings.
- .4 Special shapes: Provide square units for exposed corners. Provide purpose-made shapes for lintels and bond beams and provide additional shapes as indicated.

### **2.03 REINFORCEMENT AND CONNECTORS**

.1 Bar reinforcement: To [CAN/CSA-A371](#) and [CSA G30.18](#), Grade 400.

.2 Wire reinforcement: to [CAN/CSA-A371](#) and [ASTM A 1064/A 1064M](#), truss type.

.3 Connectors: To [CAN/CSA-A370](#)

.1 Corrosion resistance: To [CAN/CSA-A370](#).

- .1 Exterior: Level III.
- .2 Interior: Level II.

.2 Ties:

- .1 Dovetail type.

.3 Anchors: As indicated on Drawings.

.4 Repair anchors: As indicated on drawings and or to suit application.

## **2.04 MORTAR AND GROUT**

- .1 Mortar: To [CAN/CSA-A179](#).
  - .1 Use aggregate passing 1.18 mm sieve where 6 mm thick joints are indicated.
  - .2 Colour: Unless otherwise indicated on drawings, provide ground coloured natural aggregates or metallic oxide pigments.
- .2 Mortar Type:
  - .1 Exterior non-loadbearing walls and parapet walls: Type S based on proportion specifications.
  - .2 Interior non-loadbearing walls: Type N based on proportion specifications.
- .3 Mortar for foundation walls, manholes, sewers, pavements, walks, patios and other exterior masonry at or below grade: Type M based on proportion specifications.
- .4 Following applies regardless of mortar types and uses specified above:
  - .1 Mortar for stonework: Type N based on proportion specifications.
  - .2 Mortar for grouted reinforced masonry: Type S based on specifications.
- .5 Grout: To [CAN/CSA-A179](#), Table 3.
- .6 Parging mortar: Type N to [CAN/CSA-A179](#).

## **2.05 ACCESSORIES**

- .1 Weep Hole Vents: Purpose-made polypropylene fibre filter, colour to be selected by Consultant.
  - .1 Construct brick vents from stainless steel minimum 3 mm thick with 6-mm structural ribs: Sizes of brick vents as indicated on Drawings.
  - .2 Insect screen on interior face of vent.
  - .3 Provide weepholes at 610 mm on centre unless otherwise noted on drawings.
  - .4 Temporary protective masking cover on exposed surfaces before shipping.
- .2 Cavity Screening: Three dimensional random weave plastic mesh, thickness to match cavity, minimum height three brick masonry courses.
- .3 Anchor Bolts: 12 mm diameter x 150 mm long with embedded ends bent 50 mm at 90°, exposed ends threaded with washer and nut.
- .4 Embedded Flexible Flashings: Self-adhering sheet 1.0 mm thick consisting of rubberized asphalt compound banded to high density cross laminated polyethylene film, complete with manufacturer's recommended primer.
- .5 Loose Steel Lintels: In accordance with OBC and Section 05 50 00 - Metal Fabrications, galvanized for exterior, prime painted for interior.

## **3 EXECUTION**

### **3.01 EXAMINATION**

- .1 Verification of Conditions: Verify that conditions of substrates previously installed under other Sections or Contracts are acceptable for product installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate.
  - .2 Correct unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied.



### 3.02 INSTALLATION

- .1 Do masonry work in accordance with [CAN/CSA-A371](#) except where specified otherwise.
  - .1 Bond: Running stretcher bond with vertical joints in perpendicular alignment and centred on adjacent stretchers above and below.
  - .2 Coursing height: 200 mm for one concrete block and one joint and or for three clay bricks and three joints.
  - .3 Jointing: Tool where exposed or where paint or other finish coating is specified to provide smooth compressed concave surface.
- .2 Build masonry plumb, level, and true to line, with vertical joints in alignment.
- .3 Layout coursing and bond to achieve correct coursing heights, and continuity of bond above and below openings with a minimum amount of cutting.

### 3.03 CONSTRUCTION

- .1 Exposed masonry:
  - .1 Remove chipped, cracked, and otherwise damaged units in exposed masonry and replace with undamaged units.
  - .2 Cut out for electrical switches, outlet boxes, and other recessed or built-in objects. Make cuts straight, clean, and free from uneven edges.
- .2 Building-in:
  - .1 Install masonry connectors and reinforcement where indicated on drawings.
  - .2 Build-in items required to be built into masonry.
  - .3 Prevent displacement of built-in items during construction. Check plumb, location and alignment frequently, as work progresses.
  - .4 Brace door jambs to maintain plumb. Fill spaces between jambs and masonry with mortar.
  - .5 Install loose steel lintels centred over openings where indicated, with minimum 200 mm end bearing unless otherwise noted on drawings.
- .3 Concrete block lintels:
  - .1 Install reinforced concrete block lintels over openings in masonry where steel or reinforced concrete lintels are not indicated.
  - .2 End bearing: Not less than 200 mm unless otherwise noted on drawings.
- .4 Support of loads:
  - .1 Use minimum 25 MPa concrete unless otherwise indicated on drawings, where concrete fill is used in lieu of solid units.
  - .2 Use grout to [CAN/CSA-A179](#) where grout is used in lieu of solid units.
  - .3 Install building paper below voids to be filled with concrete and/or grout; keep paper 25 mm back from faces of units.
- .5 Provision for movement:
  - .1 Leave 6 mm space below shelf angles. Refer to drawings.
  - .2 Leave minimum 6 mm space between top of non-loadbearing walls and partitions and structural elements. Do not use wedges. Refer to drawings.
  - .3 Built masonry to tie in with stabilizers with provision for vertical movement.
  - .4 Build expansion and control joints where and as indicated.
- .6 Interface with other work:
  - .1 Cut openings in existing work as indicated.
  - .2 Make good existing work. Use materials to match existing.
- .7 Build-in flashings in masonry in accordance with [CAN/CSA-A371](#).
  - .1 Install flashings under exterior masonry bearing on foundation walls, slabs, shelf angles,

- and steel angles over openings. Install flashings under weep hole courses and as indicated. Seal laps, penetrations and terminations to resist water penetration.
- .2 In cavity walls and veneered walls, carry flashings from front edge of masonry, under outer wythe, then up backing not less than 150 mm, and as follows:
  - .1 For self-adhesive flashing, apply primer and firmly press sheet against backing. Lap under air-barrier membrane. Seal penetrations with recommended sealant or mastic. Installation shall be free of wrinkles, fish-mouths and punctures.
  - .2 Turned up end dams a minimum 50 mm high at ends of all flashings.
  - .3 For masonry backing, embed flashing 25 mm in joint.
  - .4 For concrete backing, insert flashing into reglets.
  - .5 For wood frame backing, staple flashing to walls behind sheathing paper.
  - .6 For gypsum board backing, bond to wall using manufacturer's recommended adhesive.
- .3 Lap joints 150 mm and seal with adhesive or mastic.
- .8 Install weep hole vents in vertical joints immediately over flashings, in exterior wythes of cavity wall and masonry veneer wall construction, at maximum horizontal spacing of 610 mm on center.
- .9 Place drainage mesh in cavity as indicated as construction progresses.

### **3.04 REINFORCING AND CONNECTING**

- .1 Install masonry connectors and reinforcement in accordance with [CAN/CSA-A370](#), [CAN/CSA-A371](#) and [CSA S304](#) unless otherwise indicated.

### **3.05 BONDING AND TYING**

- .1 Bond walls of two or more wythes using metal connectors in accordance with [CAN/CSA-A371](#), and as indicated.
- .2 Tie masonry veneer to backing in accordance with OBC, [CAN/CSA-A371](#), [CSA S304](#) and as indicated.

### **3.06 MODIFICATIONS TO EXISTING MASONRY**

- .1 Match existing bond and coursing height of adjacent masonry to remain.
- .2 Tooth new masonry into existing masonry in run of wall and at intersections with existing partitions.
- .3 At new openings in masonry walls, remove units, clean and re-install rotated to conceal cut and expose finish surface.
- .4 Clean bond areas of adjacent masonry to remain, remove loose material and prepare masonry to receive new masonry toothed in.
- .5 Install reinforcement as necessary to provide continuity of reinforcing and stability between existing and new masonry work.
- .6 Provide repair anchors as necessary to stabilize existing masonry adjacent to and affected by the Work.

### **3.07 REINFORCED LINTELS AND BOND BEAMS**

- .1 Reinforce masonry lintels and bond beams as indicated.
- .2 Place and grout reinforcement in accordance with [CAN/CSA-A179](#), [CAN/CSA-A371](#).

### **3.08 GROUTING**

- .1 Grout masonry in accordance with [CAN/CSA-A179](#), [CAN/CSA-A371](#) and as indicated.

### **3.09 ANCHORS**

- .1 Supply and install metal anchors as indicated.

### **3.10 LATERAL SUPPORT AND ANCHORAGE**

- .1 Supply and install lateral support and anchorage in accordance with [CSA S304](#) and as indicated.

### **3.11 SITE TOLERANCES**

- .1 Tolerances of [CAN/CSA-A371](#) apply.

### **3.12 SITE QUALITY CONTROL**

- .1 Perform inspection and testing to ensure specification requirements have been adhered to.

### **3.13 CLEANING**

- .1 Progress Cleaning: Perform in accordance with Division 1.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: Upon completion remove surplus materials, rubbish, tools and equipment in accordance with Division 1.
- .3 Waste Management:
  - .1 Separate waste materials in accordance with Division 1.
  - .2 Return pallets to masonry manufacturer for re-use.

### **3.14 PROTECTION**

- .1 Keep masonry dry using waterproof, non-staining coverings that extend over walls and down sides sufficient to protect from wind-driven rain until masonry work is completed and protected by flashings or other permanent construction.
- .2 Protect masonry and other work from marking and other damage. Protect completed work from mortar droppings. Use non-staining coverings.
- .3 Repair damage to adjacent materials caused by masonry products installation.

**END OF SECTION**

## **PART 1 – GENERAL**

### **1.1 GENERAL INSTRUCTIONS**

#### **1.1.1 Read and conform to:**

1.1.1.1 Drawings and Schedules.

1.1.1.2 Division 01 requirements and documents.

### **1.2 DEFINITIONS**

#### **1.2.1 The following Definitions shall apply in this Specification.**

#### **1.2.2 Contract Documents**

1.2.2.1 The Contract Documents consist of the Drawings, Specifications and Reports which form part of the agreed Contract.

#### **1.2.3 Consultant**

1.2.3.1 The Consultant is the Architect, SEOR, persons or entities engaged by the Owner. The term Consultant means the Consultant or the Consultant's authorized representative.

#### **1.2.4 Contractor**

1.2.4.1 The term Contractor is defined to include any of the following: Construction Manager, General Contractor, Structural Steel Erector, Structural Steel Fabricator, Subcontractor or Supplier.

#### **1.2.5 Owner**

1.2.5.1 The Owner is the person or entity identified as such in the Contract. The term Owner means the Owner or the Owner's authorized agent or representative, but does not include the Consultant.

#### **1.2.6 SEOR**

1.2.6.1 The SEOR is defined as the Structural Engineer of Record for the Contract.

### **1.3 WORK INCLUDED**

#### **1.3.1 Comply with Division 1 - General Requirements and all documents referred to therein.**

#### **1.3.2 Provide all labour, materials, plant and equipment to complete the structural steel Work indicated in the Contract Documents and specified in this Section.**

#### **1.3.3 It is the responsibility of the Contractor to verify the availability of the steel sections specified in the Contract Documents at time of tender, and to immediately notify the Consultant if any of the steel sections are not readily available and need to be substituted. Substitutions made after tender will be at the expense of the Contractor.**

- 1.3.4 It is the responsibility of the Contractor to verify that steel members which are shown to be curved or cranked in the Contract Documents, can be fabricated as shown without any reduction in the load carrying capacity of the member. If curved or cranked steel members cannot be fabricated as shown in the Contract Documents, the Contractor shall identify, at the time of tender, which steel members cannot be fabricated as shown in the Contract Documents, and to propose alternative steel sections for consideration by the Consultant. Any cost associated with any alterations to such members identified after tender will be at the expense of the Contractor.

#### **1.4 RELATED WORK SPECIFIED ELSEWHERE**

- 1.4.1 Concrete Reinforcement: Section 03 20 00 – Concrete Reinforcement.
- 1.4.2 Grouting beneath column bases and bearing assemblies on concrete members: Section 03 30 00 – Cast-in-Place Concrete.
- 1.4.3 Cast-in-Place Concrete: Section 03 30 00 – Cast-in-Place Concrete.
- 1.4.4 Structural Precast Concrete: Section 03 41 00 – Structural Precast Concrete.
- 1.4.5 Anchors for casting into concrete and embedding into masonry:  
Section 04 20 00 – Unit Masonry
- 1.4.6 Grouting beneath base plates bearing on masonry:  
Section 04 20 00 – Unit Masonry.
- 1.4.7 Reinforcement of edges of openings in steel deck that are not larger than 450 mm in roof deck and 300 mm in floor deck: Section 05 31 10 – Steel Deck.
- 1.4.8 Painting: Section 09 91 00 – Painting.

#### **1.5 REFERENCE STANDARDS, CODES AND ACTS**

- 1.5.1 Conform to the requirements of the local building code identified on the Structural General Notes as amended by all subsequent Regulations issued to the date of this Specification and applicable acts of authorities having jurisdiction.
- 1.5.1.1 All references to the Standards and publications noted below shall be to the edition referenced in the local building code identified on the Structural General Notes, or to the edition referenced in the latest published editions or revisions of all Standards published by the Canadian Standards Association issued to the date of this Specification, whichever is the later edition or revision.
- 1.5.1.2 All references noted below, which are not referenced by the local building code or the Standards published by the Canadian Standards Association, shall be to the latest edition and revision published to the date of this Specification.
- 1.5.1.3 Standards and publications referenced by the Standards noted below shall apply even if they are not included in the list. Where such reference is made, it shall be to that latest edition and revision published to the date of this Specification.
- 1.5.1.4 ASTM A992/A992M      Standard Specification for Steel for Structural Shapes for Use in Building Framing.
- 1.5.1.5 AWS D1.1/D1.1M      Structural Welding Code – Steel.

- |          |                                                                                                                                 |                                                                         |
|----------|---------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|
| 1.5.1.6  | AWS A2/1-DC                                                                                                                     | Welding Symbol Chart                                                    |
| 1.5.1.7  | CAN/CSA G40.20/                                                                                                                 | General Requirements for Rolled or Welded                               |
| 1.5.1.8  | G40.21                                                                                                                          | Structural Quality Steel/Structural Quality Steel                       |
| 1.5.1.9  | CSA-S16                                                                                                                         | Design of Steel Structures                                              |
| 1.5.1.10 | CSA-W47.1                                                                                                                       | Certification of Companies for Fusion Welding of Steel Structures       |
| 1.5.1.11 | CSA-W48                                                                                                                         | Filler Metals and Allied Materials for Metal Arc Welding                |
| 1.5.1.12 | CSA-W55.3                                                                                                                       | Certification of Companies for Resistance Welding of Steel and Aluminum |
| 1.5.1.13 | CSA-W59                                                                                                                         | Welded Steel Construction (Metal Arc Welding)                           |
| 1.5.1.14 | SSPC (The Society for Protective Coatings) (formerly SSPC – Steel Structures Painting Council) Steel Structures Painting Manual |                                                                         |
| 1.5.1.15 | CISC Guide for Specifying Architecturally Exposed Structural Steel, latest edition                                              |                                                                         |
| 1.5.1.16 | CISC Code of Standard Practice for Structural Steel.                                                                            |                                                                         |

1.5.2 Where there are differences between the Contract Documents and the standards, codes or acts, the most stringent shall govern.

## 1.6 CISC CODE OF STANDARD PRACTICE FOR STRUCTURAL STEEL

1.6.1 The CISC's Code of Standard Practice for Structural Steel shall govern the Work, subject to the modifications noted below.

1.6.1.1 Revise Clause 1.4 Responsibility for Design as follows:

1.4 **Responsibility for Design.** When the Owner provides the structural Drawings and Specifications, the Contractor shall not be responsible for determining the adequacy of the design nor liable for the loss or damage resulting from an inadequate design. *The SEOR shall be responsible for the overall behaviour of the structure, the sizing of steel members and their supports as required by the Building Code and the provision of connection forces indicated on the structural Drawings. The Contractor shall be responsible for the design and detailing of all connections and components, members and standardized assemblies. (See also Clause 5.6.)*

1.6.1.2 Add the following to Clause 1.5, Responsibility for Erection Procedure:

1.5 **Responsibility for Erection Procedure.** The Contractor shall ensure that in the event the Fabricator's contract does not include the erection of the structural steel, the Erector shall be responsible for determining the erection procedure, for checking the adequacy of the connections for the uncompleted structure, for providing erection bracing or connection details and for coordinating the erection of the steelwork with the Fabricator.

1.6.1.3 With respect to Clause 3.3 Revisions to the Contract Documents, revise Clause 3.3.4 as follows:

- 3.3.4 Unless specifically stated to the contrary, the issue of revision documents or changes indicated on submittal reviews is not authorization by the Owner to release these revisions for construction. Any and all revisions to the Contract shall be made in accordance with the provisions set out in the Contract Documents, and will be based on the Contractor's assessment of the impact of the proposed revisions on the Contract Price and schedule for completion of the Work.
- 1.6.1.4 Revise Clause 3.4, Discrepancies as follows:
- 3.4 **Discrepancies.** In case of discrepancies between Contract Documents, the provisions of Standard Construction Document – CCDC2-2008 shall govern, unless agreed or instructed otherwise. In case of discrepancies between the structural documents and Documents of other Sections, the documents for the Section responsible for deriving the required information shall govern.
- 1.6.1.5 If there is a conflict within Contract Documents:
- 4.1.1 At the time tenders are called, the Contractor shall receive a complete set of the Contract Documents (*including Drawings and Specifications*) for all design disciplines and specialty Consultants engaged on the project. When appropriate, these documents shall include complete structural Drawings, conforming to the requirements for design drawings of the governing technical standard. Structural steel Specifications should include any special requirements controlling the fabrication and erection of the structural steel, surface preparation and coating, and should indicate the extent of non-destructive examination, if any, to be carried out.
- 1.6.1.6 Clause 4.1.2, delete the last two words in the last sentence.
- 1.6.1.7 Revise Clause 4.2 as follows:
- 4.2 **Architectural, Mechanical, Electrical and Additional Specialty Consultants Drawings.** Architectural, mechanical, electrical and additional specialty Consultants Drawings may be used as a supplement to the structural Drawings to define detail configurations and construction information.
- 1.6.1.8 Revise Clause 5.6 as follows:
- 5.6 **Review of Fabrication and Erection Documents.** Erection diagrams, standard and non-standard connection design details, shop details and fieldwork details shall be submitted for review by the SEOR in accordance with the provisions of the Contract Documents. The submittals will be reviewed and returned in accordance with the provisions of the Contract Documents. The documents will be reviewed on a sampling basis for general conformity with the Contract Documents only. The SEOR's review does not relieve the Contractor, Fabricator, Erector or their engineer(s) of any responsibility for same. (Note: The remainder of this clause, as noted in the Code of Standard Practice, is to be deleted.)
- 1.6.1.9 Revise Clause 6.7 as follows:
- 6.7 **Inspection of Steelwork.** Should the Owner wish to have an independent inspection and/or non-destructive examination of the steelwork, they shall reserve the right to do so in the Contract Documents. The Contractor shall notify the inspection and testing company of the progress of the Work so that timely inspection and testing may be arranged. The cost of this inspection and testing is the responsibility of the Owner. However, deficiencies in the Work

of the Contractor requiring re-inspection and re-testing due to the frequency of the deficiency shall be the responsibility of the Contractor.

## **1.7 TOLERANCES**

- 1.7.1 Fabricated members and erected structural steel tolerances shall conform to the ones specified in the typical details and CSA-S16.
- 1.7.2 Interfacing tolerances may not be compatible with the above. Review and coordinate interfacing tolerances so that the various elements come together properly.
- 1.7.3 Fabricating, shall be such that the effects of galvanizing, bending, cambering and the like, on the alignment of the completed members is minimized.

## **1.8 QUALIFICATIONS**

- 1.8.1 Any organization undertaking to weld shall be certified by the CWB to the requirements of Division 1, or Division 2.1 of CSA-W47.1.
- 1.8.2 The Contractor shall ensure that the potential steel Subcontractors can successfully demonstrate that they have sufficient relevant experience of Work similar in size, scope, complexity and risk to that shown on the Contract Documents and described in this Section.
- 1.8.3 Design calculations shall be carried out by or under the direct supervision of a qualified Professional Engineer licensed in the Province having jurisdiction, with a minimum of 5 years Canadian experience in the design of structural steelwork, connections including design of weldments, or joist systems, as appropriate.
- 1.8.4 The Contractor shall ensure that engineers responsible for welding design, procedures and practice are certified in accordance with CSA W47.1, section 6.1.
- 1.8.5 The Contractor shall ensure that professional Engineers responsible for the design of steelwork, connections, joist systems and the like, are insured in accordance with section 74(1) of Regulation 941 of the Ontario Professional Engineers Act or shall be covered under the Contractor's General Liability Insurance Policy. Note: If the professional engineer is insured in accordance with Regulation 941 of the Ontario Professional Engineers Act, the alternative outlined in section 74(2) is not acceptable.

## **1.9 DESIGN**

- 1.9.1 General
  - 1.9.1.1 Design connections for the loads indicated or implied in the Contract Documents in accordance with requirements of CSA-S16.
  - 1.9.1.2 If the Contractor requires additional information or clarification to aid in the design of the Work, this information shall be requested in a timely manner.
- 1.9.2 Connections
  - 1.9.2.1 The Contractor shall be solely responsible for the design and detailing of all connections between the steel members including, but not limited to columns, beams, girders, trusses and braces, and between such members as spandrel angles and beams, hangers, stiffeners, etc., and their supporting members



- 1.9.2.2 The Contractor shall also be responsible for the design and detailing of stiffeners, doubler plates and the like required to maintain the local strength and stability of a member and where these stiffeners and doubler plates are an integral part of the connection or where they affect the connection of other steel framing members. Examples include cranked sections, moment connections between columns and beams, connections to hollow structural sections and the like. Where connections are exposed to view, the detailing of stiffeners, double plates and the like is subject to review by the Consultant.
- 1.9.2.3 Use types of shop or field connections shown on the Contract Documents, or in the absence of such information, use the most appropriate type of connections given the applied loads and the arrangement of members.
- 1.9.2.4 Design connections to safely withstand the combined primary effects of axial force, shear, moment and torque and any secondary effects due to welding. Connections shall also safely withstand any temporary loads which may occur during the construction.
- 1.9.2.5 Shear connections shall not be less than one half the depth of the connected member.
- 1.9.2.6 Where no axial force is indicated for beam to column connections, connect beams framing into columns such that the combined capacities of the connection are able to resist a total horizontal force of 2% of the factored axial load in the column, in any direction. The column bracing force shall be proportioned and resisted by the members framing into the joint according to their relative axial stiffnesses, unless noted otherwise in the Contract Documents.
- 1.9.2.7 Unless noted otherwise in the Contract Documents, the design of all beams and girders is based on the assumption that fastener holes through flanges will not exceed 15% of the gross flange area. If the area of holes exceeds 15%, the member size shall be altered or reinforced accordingly. Documentation noting the alteration is to be submitted for review.
- 1.9.2.8 Design bracing member connections for field adjustability to accommodate maximum construction tolerances and to achieve bracing preloads where specified in the Contract Documents.
- 1.9.2.9 Design connections for fastening together double angles, double rectangular plates or bars, and the like, used to resist compression, tension, or bending in such a way that the slenderness ratio of any component, based on its least radius of gyration and the distance between interconnections, shall not exceed that of the built-up member. As a minimum, provide two intermediate battens or spacers along the length of all members.
- 1.9.2.10 The following types of connections are to be designed as slip-critical connections:
  - 1.9.2.10.1 Connections that utilize oversized holes;
  - 1.9.2.10.2 Connections that utilize slotted holes, except those where the applied load is normal to the long dimension of the slot.
  - 1.9.2.10.3 Connections subject to fatigue or frequent load reversal.

- 1.9.2.11 Bolts in the following types of connections are to be pretensioned in accordance with the requirements of S16;
  - 1.9.2.11.1 Slip-critical connections,
  - 1.9.2.11.2 Connections governed by seismic requirements,
  - 1.9.2.11.3 Connections for all elements resisting crane loads,
  - 1.9.2.11.4 Connections for members directly supporting running machines or other live loads that produce impact or cyclic load,
  - 1.9.2.11.5 Connections where bolts are subject to tensile loads.
  - 1.9.2.11.6 Connections using oversized or slotted holes unless specifically designed to accommodate movement.
- 1.9.2.12 Design connections that are exposed to weather so that moisture and foreign matter cannot be trapped or gain entry to the interior of hollow built up members.
- 1.9.2.13 Design connections that are susceptible to the accumulation of moisture so that moisture and foreign matter cannot be trapped within the connectors or members framing into the connection.
- 1.9.2.14 Design and detail connections so they do not encroach upon architectural clearance lines or finishes.
- 1.9.2.15 Where connections between beams and columns and the like result in a loss of bearing for the steel deck, design and provide support for the steel deck, as required.
- 1.9.2.16 Design and provide end bearing connections of inclined members such that the bearing plane between the inclined members and their supporting members is horizontal.
- 1.9.2.17 Design connections to cast in plates to provide for the maximum deviation that can occur in erection and based upon the following:
  - 1.9.2.17.1 Specified steel erection tolerances,
  - 1.9.2.17.2 Maximum permissible tolerances in the location of inserts cast into concrete, specified in Section 03 10 00 – Concrete Forming.

1.9.3 Joists

- 1.9.3.1 Design joists and anchorages for the loads indicated in the Contract Documents and CSA S16.
- 1.9.3.2 Bracing and bridging shown on the Drawings is intended as a guideline only. Design and provide bracing and bridging as per the requirements of CSA S16.
- 1.9.3.3 Design joist shoes based on the loads and assumed shoe depths noted on the Drawings. If joist shoes of different depths are provided, the Contractor is responsible for any and all revisions this may have on top of steel elevations and the like.

- 1.9.3.4 Design the first compression web member subject to transverse shear, and its connections, at each end of joists, in accordance with CSA S16 Cl 16.5.7.3.
- 1.9.3.5 Design roof joists, bridging and anchorages to safely resist net uplift forces indicated in the Contract Documents and, in any event, a minimum of 0.5 kPa.
- 1.9.3.6 Design roof joists so that the joist stiffness is at least twice the critical stiffness defined in Commentary H, Equation (1) of the User's Guide - NBC 2010, Structural Commentaries (Part 4 of Division B).
- 1.9.3.7 Design joists and connection to joists to safely resist horizontal forces introduced into top chords of joists by horizontal cross-bracing shown on the Drawings.
- 1.9.3.8 Design and connect joists to furnish lateral support to the chords or flanges of supporting steel members. Design joists with joist bearing points offset (in plan), such that their reaction is transferred to the centerline of the supporting member. For joists exposed to view, design joists to frame into the supporting member at the same location, with a maximum gap between the ends of adjacent joists of 20 mm.
- 1.9.3.9 Provide tie joists for all joists framing into columns, unless noted otherwise on the Drawings. Where tie joists frame into columns, extend top and bottom chords and connect to columns to safely develop one percent of column axial load but not less than 25 kN in tension or compression.
- 1.9.3.10 Design anchorage of each line of bridging to abutting walls and other supporting structural steel members to safely resist forces indicated in the Contract Documents, or to at least develop the safe capacity of the bridging members in tension.
- 1.9.3.11 Limit floor joist deflection due to specified live loads to  $L/360$  of span.
- 1.9.3.12 Limit roof joist deflection due to specified live loads to  $L/360$  of span.
- 1.9.3.13 Deflection Criteria for All Other Buildings Application Maximum
- 1.9.3.14 Where joists span parallel to load bearing walls, limit joist deflection to  $[2L/360]$  of span, where L is measured perpendicular to the load bearing wall, from the centerline of the joist to the load bearing wall.
- 1.9.3.15 Design joists supporting masonry partitions so the deflection, when subjected to full live load, shall not exceed  $L/600$ , where L is the span of the supporting joists.
- 1.9.3.16 Design joists supporting moveable partitions so that the deflection when subjected to full live load including partitions stacked at any point, or fully extended shall not exceed that required by the manufacturer of the moveable partition.
- 1.9.3.17 Camber joists in accordance with the provisions of S16 unless noted otherwise in the Contract Documents.
- 1.9.3.18 Adjust stiffness and required camber of joists adjacent to masonry walls, columns, steel beams of shorter span, other joists with different loading or stiffness characteristics and the like to permit the proper fastening of the steel

deck. As a guide, limit the deflection of the adjacent joist, under all dead loads, to  $L/120$ , where  $L$  is the span of the steel deck perpendicular to the joists.

- 1.9.3.19 Where ducts or services pass through joists, design and locate web members and bridging connections to accommodate the sizes and runs of ducts and services shown.

1.9.4 Colour Coding

- 1.9.4.1 When different grades of steel are supplied, use a colour coding technique to aid in the shop and field identification of these different grades. Each member used shall bear its particular colour code as required by G40.21.

**1.10 SUBMITTALS**

1.10.1 Shop Drawings

1.10.1.1 General

- 1.10.1.1.1 The Contractor shall ensure that professional engineer(s) responsible for the structural steelwork, connections, joist systems and the like shall either:

1.10.1.1.1.1 Seal and sign all necessary shop drawings, or

1.10.1.1.1.2 Submit a sealed and signed letter prior to commencement of shop drawing preparation stating that they have been retained by the steel Fabricator to carry out the design of steel connections, joist systems and the like AND shall submit a second letter after shop drawing preparation is complete stating that the design of the steelwork, for which they are responsible, has been completed in accordance with the Contract Documents and relevant building codes, standards and acts.

- 1.10.1.1.2 Unless noted otherwise in the Contract Documents, provide adequate space on all shop drawings immediately above the drawings title block for the Consultant's Shop Drawing review stamp. Where requested by the Consultant, the stamp is to be inserted by this section directly into the shop drawing prior to submission. The stamp shall be positioned in the same location on each shop drawing, and in no case shall the allocated space be less than 63 mm x 75 mm. Request the details of these requirements from the Consultant no less than 2 weeks before the commencement of shop drawings.

- 1.10.1.1.3 If the professional engineer(s) choose to seal and sign the shop drawings, as noted above, all shop drawings must be sealed and signed, except for erection diagrams which only contain design information (member sizes, forces, loads and the like) which is indicated on the Contract Documents. If any fieldwork details, notes to the Erector or notifications are made on the erection

diagrams, then they must be sealed and signed by the Contractor's engineer.

- 1.10.1.1.4      Reproduction of the structural Drawings, to serve as a basis for the preparation of erection or setting drawings, will be permitted, subject to a separate agreement between the Consultant and the Contractor/Fabricator. If the Fabricator and/or Erector make use of the structural Drawings for this purpose, they shall take full responsibility for verifying all information shown on the Drawings and the completeness of the information provided in a manner equivalent to the preparation of erection diagrams. Cost of reproduction of the structural Drawings for this purpose to be paid for by the Contractor. Any identification or reference to the Owners or Consultants is to be removed from all structural Drawings which are used by the Fabricator and erector.
- 1.10.1.1.5      Well in advance of fabrication; submit structural steel connection design details shop, erection, and setting drawings for review by the Consultant. Submit fieldwork details for review by the Consultant.
- 1.10.1.1.6      Shop drawings shall be submitted for all structural steel Work and shall be submitted in complete packages so that individual parts and the assembled unit can be reviewed together. This section and the applicable drawings used in the development of the shop drawings shall be clearly referenced on each shop drawing to facilitate review. Detail member marks shall be cross referenced on the erection drawings to facilitate a quick identification of the members.
- 1.10.1.1.7      When shop drawings are revised and resubmitted, all revisions to the drawings shall be clearly identified by means of "bubbles", "clouds" or other obvious means.
- 1.10.1.1.8      All shop drawings submitted must clearly indicate the initials of the individual who checked the shop drawings before they were submitted for review.

#### 1.10.1.2 Erection Drawings

- 1.10.1.2.1      Submit erection drawings for review prior to preparation of detailed piece drawings.
- 1.10.1.2.2      Erection drawings shall clearly indicate or highlight the member marks that are being submitted for review.
- 1.10.1.2.3      Erection drawings shall clearly show all setting out dimensions for the structural steel frame, including dimensions that have been confirmed by Site measurement. Dimensions shall be tied to relevant grid lines or reference points.

- 1.10.1.2.4 Indicate on erection diagrams steel lintels and other structural shapes which are embedded in masonry or cast-in-place concrete and not connected to structural steel.
- 1.10.1.2.5 When erection drawings are being submitted for “marks only” or for “reference only”, this shall be clearly indicated on the drawings or transmittal.

#### 1.10.1.3 Detailed Piece Drawings

- 1.10.1.3.1 Submit detailed piece drawings for all structural members.
- 1.10.1.3.2 As a minimum, show the following:
  - 1.10.1.3.2.1 layout;
  - 1.10.1.3.2.2 member sizes;
  - 1.10.1.3.2.3 connection details, including appropriate reference to connection design calculations;
  - 1.10.1.3.2.4 splice locations and details;
  - 1.10.1.3.2.5 truss details;
  - 1.10.1.3.2.6 holes;
  - 1.10.1.3.2.7 camber;
  - 1.10.1.3.2.8 finishes;
  - 1.10.1.3.2.9 grades of steel;
  - 1.10.1.3.2.10 bolt material and sizes;
  - 1.10.1.3.2.11 weld details, sizes and grade of electrodes;
  - 1.10.1.3.2.12 identify location and extent of all pretensioned bolts, slip critical bolts and class of surface preparation;
  - 1.10.1.3.2.13 clearly identify locations and details of all slip critical connections;
  - 1.10.1.3.2.14 architectural clearance lines and finishes where connections and the like may encroach with other Work.

#### 1.10.1.4 Fieldwork Details

- 1.10.1.4.1 Submit details for all fieldwork in accordance with the requirements of Division 1 – General Requirements.
- 1.10.1.4.2 The location of fieldwork details shall be clearly identified or referenced on the erection drawings.

- 1.10.1.4.3 Prepare setting drawings showing dimensions and details for setting structural steel bearings, anchorages, assemblies and the like where they interface with other building components.
- 1.10.1.4.4 Co-ordinate structural steel shop and erection drawings with shop drawings of other interfacing Work.
- 1.10.1.4.5 Submit all non-prequalified welding procedures, stamped as approved by the Canadian Welding Bureau and correlated to the appropriate shop and erection drawings.
- 1.10.1.4.6 Furnish inspection company with a copy of each shop, erection, and setting drawing bearing the Consultant's shop drawing stamp marked reviewed.

#### 1.10.1.5 As-Built Drawings

- 1.10.1.5.1 Mark on a complete set of final drawings any changes, additions, or deletions that occur during construction as a result of the Contractor's Work, change orders or for any other reason.
- 1.10.1.5.2 For all shop drawings marked "Reviewed as Noted" or "Revise and Resubmit", update and submit a record set of these drawings at the completion of the structural Work. Ensure that these drawings reflect the changes and are coordinated with the final drawings noted above.

### 1.10.2 Surveys

- 1.10.2.1 Work by Others: Examine all Work prepared to receive Work of this Section and report any defects affecting installation to the Consultant for correction. Commencement of Work will be construed as complete acceptance of preparatory Work by others. This Section alone shall be responsible for checking of the dimensions and coordination of the structural steel Work with the Work of other Specification Sections.
- 1.10.2.2 Submit surveys showing position of structural steel members. Submit survey results on any given floor before concrete is placed on the floor. As a minimum include the following:
  - 1.10.2.2.1 Location of centreline of all columns with respect to grids at each floor level;
  - 1.10.2.2.2 Elevation of tops of girders, joists, trusses and beams at ends, midspan and at cantilevered ends, at all floors and roof, before and after placing of concrete.

### 1.10.3 Calculations

- 1.10.3.1 Submit calculations bearing the seal and signature of the qualified Professional Engineer licensed in the Province having jurisdiction and such further proof as may be necessary to show that non-standard connections and steel joist systems and the like conform to the requirements set forth in this section.

- 1.10.4      Cambering Procedures
  - 1.10.4.1   Submit detailed cambering procedures for beams, girders, trusses, joists and the like for review prior to start of fabrication.
- 1.10.5      Erection Procedures
  - 1.10.5.1   Erection procedures and erection bracing are the sole responsibility of the Contractor.
- 1.10.6      Substitution
  - 1.10.6.1   It is the Contractor's responsibility to verify the availability of the steel sections shown on the structural Drawings at time of tender, and to immediately notify the Consultant if any of the sections are not readily available and need to be substituted. Substitutions after the time of tender will be at the cost of the Contractor.
  - 1.10.6.2   If the Contractor wishes to make other substitutions for steel materials or sizes indicated in the Contract Documents, submit proposals with the tender including calculations for review by the Consultant.
- 1.10.7      Mill Test Certificates
  - 1.10.7.1   Submit to the Consultant copies of mill test certificates covering chemical and physical properties of steel used in this Work, including mill test reports for all structural bolts, a minimum of 4 weeks prior to commencing fabrication.
- 1.10.8      Colour Code
  - 1.10.8.1   Submit colour code proposed or other agreed methods to identify various grades of structural elements.
- 1.10.9      Non-destructive Testing
  - 1.10.9.1   Submit all in-house non-destructive testing results of shop and field Work together with inspector/technician certification status and test procedures used.

## **PART 2 - PRODUCTS**

### **2.1            MATERIALS**

- 2.1.1      Provide only new material manufactured in North American mills or the following international mills Corus UK Ltd (UK), ArcelorMittal S.A. (Luxembourg). free from defects impairing strength and durability. New materials shall be in accordance with the Standards referenced in this Section. Where sections identified are not available from the mills noted or where the Contractor chooses to use sections produced by other mills, provide new materials of minimum strength and minimum quality as indicated in the Contract Documents. For sections that are not produced by North American mills, or additional mills listed above, the Contractor shall submit written requests for review of the alternate mill to the Consultant before proceeding with material procurement. The Consultant reserves the right to require physical test data (in addition to the mill test reports) proving that the steel from the proposed mill meets the requirements specified in the Contract Documents. Provide such data for each 100 tonnes of material supplied.



- 2.1.2 Structural Steel:
- 2.1.2.1 Structural wide flange shapes (W) to conform to CAN/CSA-G40.20/G40.21 grade 350W or ASTM A992/A992M grade 50 (ksi).
  - 2.1.2.2 Structural welded wide flange shapes (WWF) to conform to CAN/CSA-G40.20/G40.21 grade 350W.
  - 2.1.2.3 Angles, plates and channels (L, C) to conform to CAN/CSA-G40.20/G40.21 grade 300W.
  - 2.1.2.4 Hollow structural sections (HSS) to conform to ASTM A500/A500M GRADE C.
- 2.1.3 Anchor Rods: Conform to 300W threaded rod conforming to CSA G40.21-M, unless noted otherwise in the Contract Documents.
- 2.1.4 Bolts, Nuts and Washers: Conform to ASTM F3125. Galvanized A325 bolts over 22mm diameter shall have a dry lubricant on threads such as Johnson's Stick Wax #140 or approved equivalent before installation.
- 2.1.5 Welded Stud Shear Connectors: Headed studs shall be manufactured by Nelson Stud Welding, Inc. (or approved equivalent) and shall be made from mild steel conforming to ASTM A108 grade 1010 through 1020. Headed studs shall be welded per manufacturer's recommendations; mechanical properties of headed studs shall be in accordance with AWS D1.1.
- 2.1.6 Deformed Bar Anchors: Shall be Nelson, flux filled deformed bar anchors, type D2L, or approved equivalent.
- 2.1.7 Shop Paint/Primer:
- 2.1.7.1 The shop primer or paint shall be compatible with spray fireproofing, intumescent paint and/or the top coat paint system specified in the Contract Documents or elsewhere, where applicable.
  - 2.1.7.2 Steel not exposed to view or weather may be left unpainted, subject to the approval of the Consultant.
  - 2.1.7.3 Shop Paint: To CISC/CPMA 1-73a or SSPC Paint 15.
  - 2.1.7.4 Shop Primer: To CISC/CPMA Standard 2-75.
- 2.1.8 Inorganic Zinc-Rich Primer: Cathacoat 304V as supplied by Devoe Coatings, an Akzo Nobel N.V. brand (2 to 4 mils dry film thickness), Carbozinc 11 as supplied by Carboline Company (2 to 3 mils dry film thickness), Zinc Clad II as supplied by The Sherwin-Williams Company (2 to 4 mils dry film thickness), or approved equivalent.
- 2.1.9 Organic Zinc-Rich Primer: Cathacoat 302HA as supplied by Devoe Coatings, an Akzo Nobel N.V. brand (3 to 4 mils dry film thickness), Zinc Clad 200 as supplied by The Sherwin-Williams Company (3 to 5 mils dry film thickness), or approved equivalent.
- 2.1.10 Epoxy Paint: Devran 224HS as supplied by Devoe Coatings, an Akzo Nobel N.V. brand (4 to 6 mils dry film thickness) or Macropoxy 646 Fast Cure Epoxy as supplied by Sherwin-Williams Company (4 to 6 mils dry film thickness) or approved equivalent.

- 2.1.11 Zinc-Rich Touch-up Paint: Galvafrid as supplied by W. R. Meadows Limited or Zinc Clad 5 as supplied by The Sherwin-Williams Company) or approved equivalent.

### **PART 3 - EXECUTION**

#### **3.1 FABRICATION**

- 3.1.1 Provide holes up to 12 mm in diameter, as required, to permit the attachment of other materials. Ensure cross sectional area of section is not reduced by more than 10% at any point on its length.
- 3.1.2 Provide 20 mm ( $\frac{3}{4}$ " ) drain holes in closed sections to prevent water build-up during erection. Ensure drain holes remain free to drain throughout construction and are not plugged by subsequent construction activities.
- 3.1.3 Splices, other than those shown in the Contract Documents, shall not be permitted in members without the Consultant's approval. If approval is given to permit welded splices, they shall be non-destructively tested at no extra cost to the Owner.
- 3.1.4 Unless noted otherwise in the Contract Documents, provide a 10 mm cap plate for all hollow members. Provide continuous seal weld around cap plate.
- 3.1.5 Seal all hollow built-up members exposed to weather with continuous seal welds, incorporating structural welds where indicated in the Contract Documents or as required.
- 3.1.6 Where masonry walls are shown built into structural steel columns and beams in the Contract Documents, provide and install masonry anchors on columns at 600 mm on centres and anchors on beams at 1500mm on centres.
- 3.1.7 Thickness of baseplates 100 mm or greater is nominal and allows for a maximum reduction of 6 mm for milling to the requirements of CSA S16. Identify grade of steel for these plates which may not conform to clause 2.1.2.3
- 3.1.8 Cambers
- 3.1.8.1 Provide the camber indicated in the Contract Documents to trusses, joists, beams and girders in such a manner as to provide a uniform parabolic profile. Ensure that the method used to provide camber does not reduce the safe load carrying capacity or cause distortion of the members.
- 3.1.8.2 Camber stated on the Drawings is the required camber after erection.
- 3.1.9 Openings
- 3.1.9.1 Conform to the requirements indicated in the Contract Documents for location, size, and reinforcement of openings through structural steel.
- 3.1.9.2 No openings other than those indicated on the structural Drawings will be permitted without the Consultant's approval.
- 3.1.10 Holes & Cutting
- 3.1.10.1 All holes shall be accurately drilled or punched. Burning or drifting unfair holes will not be permitted. Holes that must be enlarged shall be reamed. Holes for the

attachment of Work by other Sections shall be provided as required. Drift pins shall be allowed only to bring together the several parts for connection.

3.1.10.2 Holes shall be provided in members to permit connections to the Work of other Sections or contracts.

3.1.10.3 The use of manual gas-cutting in the shop shall be used only if automatic or semi-automatic methods are not possible. Cope for pipes and ducts as indicated in the Contract Documents.

### 3.1.11 Bolting

3.1.11.1 Drive bolts accurately into the holes without damaging the threads and heads. Bolts heads and nuts shall rest squarely against metal surfaces.

3.1.11.2 Where bolts are to be used on beveled surfaces having slopes greater than 1 in 20 with a plane normal to the bolt axis, provide beveled washers to give full bearing to the thread or nut.

3.1.11.3 Bolt threads of unfinished bolts shall be upset to prevent the nuts from backing off.

3.1.11.4 Label and ship anchor rods and base plates in sets indicating size and locations of columns and deliver in ample time prior to the start of related concrete Work. Furnish templates together with instructions for setting of anchor rods. Ascertain that anchor rods and other embedded items are set properly during the progress of the Work. Provide 75 mm x 75 mm x 7 mm plate washers between top of base plate and bottom of anchor rod nuts.

### 3.1.12 Welding of Structural Steel

#### 3.1.12.1 Pre-weld Inspection

3.1.12.1.1 The surface to be welded and the filler material to be used shall be subject to inspection by quality control personnel before welding is performed.

#### 3.1.12.2 Method and Type

3.1.12.2.1 All welding shall be electric arc welding and shall comply in all respects with the codes and Specifications noted in this Section, incorporating the Specifications for design, fabrication, and inspection of welded structures and the qualifications of welders and supervisors. The heat, input, length of weld, and sequence weld and cooling process shall be controlled to prevent distortions.

3.1.12.2.2 For weldments comprised of plates in more than one plane and whose configuration could cause restraint to uniform cooling of the weldment, conform to detailed welding procedures prepared by the Contractor's Engineer.

3.1.12.2.3 For weldments comprised of plates thicker than 50 mm or of heavy shapes groups 4 & 5, take adequate precaution to control

welding and cooling processes in order to control thermal shrinkage stresses. Use stress relieving techniques where necessary. Each welder shall mark his identification symbol on this Work. Where such plates or shapes are spliced or connected using CJP groove welds, the steel shall be supplied with CVN testing.

## **3.2 ERECTION**

### **3.2.1 General**

- 3.2.1.1 Bracing members and anchor rods shown in the Contract Documents are for the finished structure and may not be adequate to resist forces present during construction.
- 3.2.1.2 Maintain erection bracing until completion of entire structure including floor and roof decks and slabs, masonry walls and/or other elements which are part of the lateral load resisting system.
- 3.2.1.3 Carry out erection operations, including installation of any temporary guying and shoring required, ensuring that the existing structure or members already erected are not loaded in excess of their safe load carrying capacity.
- 3.2.1.4 Erection bracing must be adequate to restrict lateral drift per storey to an appropriate amount to ensure the steel erection can be completed within the necessary tolerances.
- 3.2.1.5 During construction, forces or reactions in the steel frame members and their connections might exceed those on which the design is based. Determine the magnitude of such forces and reactions and take such measures as are necessary to ensure that the safety and stability of the structure is maintained until the entire structure, including floor and roof slabs is complete.
- 3.2.1.6 Nuts on bolts shall be prevented from working loose by use of lock washers, lock nuts, jam nuts, thread burring or other approved methods.
- 3.2.1.7 Runoff tabs shall be removed where required by the governing technical standard, or where they interfere with clearances required by other disciplines or would be exposed to view in the completed building.
- 3.2.1.8 Report to the Consultant where members cannot be erected within the specified tolerances without modification or special procedures. Take corrective measures to the Consultant's approval.

### **3.2.2 Bracing**

- 3.2.2.1 Install permanent bracing members by applying a nominal tension such that they will be initially under tension in the completed building.

### **3.2.3 Bearing on Concrete or Masonry**

- 3.2.3.1 Set steel baseplates and bearing assemblies true and level at the proper elevation so that upon grouting, they will have full bearing. Unless noted otherwise by the grout supplier, do not vibrate the formwork or baseplate during

grout placement. Grout shall be placed on one side only and pushed back under the baseplate with strapping.

- 3.2.3.2 When directed by the Consultant, lift at least 3 grouted bases so that the adequacy of grouting can be examined. If defects are found, more bases will have to be raised.

### 3.2.4 Joists

- 3.2.4.1 Anchor joists in accordance with CSA S16 and to safely resist net uplift forces.
- 3.2.4.2 Supply special shoes or steel shims as required to bring joists to required bearing level.
- 3.2.4.3 Provide suitable temporary anchorage until such time as the permanent anchorage system can maintain the joists in their correct position.
- 3.2.4.4 Where the Contract Documents call for electrical and mechanical services recessed between joists, space and arrange joists and bridging to permit installation of services.
- 3.2.4.5 Provide ceiling extensions for joist bottom chords as required.

### 3.2.5 Lintels

- 3.2.5.1 Unless a reinforced block or concrete lintel is noted, provide loose steel lintels, to the details shown in the Contract Documents, over openings and recesses including those for mechanical or electrical services in masonry walls or partitions.

## 3.3 PROTECTION

### 3.3.1 Cleaning Steel

- 3.3.1.1 Clean structural steel and joists in accordance with table below:
- 3.3.1.2 Clean surfaces within 50 mm (2") of any field weld location of materials that would prevent proper welding or produce objectionable fumes while welding Work is being performed.

### 3.3.2 Painting

- 3.3.2.1 Except where steel is to be galvanized, shop paint structural steel and joists in accordance with the table below:

Environment	Preparation	Primer/Paint	Remarks
Inside Vapour Barrier	SSPC-SP3 Power Tool Cleaning	CISC/CPMA 1-73a (or Leave unpainted if not exposed to view)	

Environment	Preparation	Primer/Paint	Remarks
Inside Vapour Barrier (joists not exposed to view)	SSPC-SP2 Hand Tool Cleaning	CISC/CPMA 1-73a or SSPC Paint 15	
Inside Vapour Barrier (steel exposed to view)	SSPC-SP6 Commercial Blast Cleaning	CISC/CPMA 2-75	Note additional requirements for AESS elsewhere in the Specification.
Inside Vapour Barrier (joists exposed to view)	SSPC-SP7 Brush-Off Blast Cleaning	CISC/CPMA 2-75	
Outside Vapour Barrier (joists)	SSPC-SP7 Brush-Off Blast Cleaning	Zinc-rich primer	
Outside Vapour Barrier – All remaining steel		Galvanize	Note additional requirements for galvanizing elsewhere in the Specification.

3.3.2.2 Do not paint steel items inside the vapour barrier that are to be encased in concrete and surfaces that are to have concrete placed against them or that are to be covered in cementitious fireproofing.

3.3.2.3 Where shear connectors are to be field welded through the low flute of the steel deck, the top surface of the top flange, which is to receive the shear studs, is to be unpainted and free of heavy rust, mill scale, sand, or other foreign materials which will interfere with the stud welding operation.

3.3.2.4 Joists shall have one coat of protective paint of a type standard with the manufacturer.

3.3.2.5 Upon completion of erection, clean with mechanical brush and apply primer to welds, bolts and at locations where original primer is damaged.

### 3.3.3 Galvanizing

3.3.3.1 In accordance with ASTM A123/A123M, fully galvanize cooling tower structural steel, structural steel lintels, masonry shelf angles, parking garage stairs and other steel materials exposed to weather including connection material and inserts.

3.3.3.2 Where the galvanizing process may distort the members, submit procedures for review by the Consultant and make good to tolerances noted in the Contract Documents.

3.3.3.3 Galvanize members after shop welding has been completed.

3.3.3.4 Do not weld to galvanized steel members. Where welding is necessary, remove galvanizing by grinding.

3.3.3.5 Identify at time of tender any splices that are required due to the size, length or weight constraints imposed by the galvanizing process.

3.3.3.6 High strength bolts grade A490M shall not be galvanized.

### 3.3.4 Cold Weather Protection

3.3.4.1 During cold weather, protect members from damage due to water freezing in confined areas.

### 3.3.5 Corrosion

3.3.5.1 Protect milled surfaces to prevent corrosion prior to erection.

## 3.4 QUALITY CONTROL

### 3.4.1 Visual Inspection

3.4.1.1 As a minimum, carry out visual inspection of all shop and field welds in accordance with CSA W59.

### 3.4.2 Non-Destructive Testing (NDT)

3.4.2.1 Non-destructive testing shall be carried out by radiography, magnetic particle or ultra sonic methods, whichever is more appropriate.

3.4.2.2 Any deficient welds identified by means of NDT, shall be repaired at the Contractor's expense.

3.4.2.3 Welds found deficient in dimensions, but not in quality may be enlarged by additional welding. Any weld found deficient in quality shall be removed by chipping or gouging and the weld shall be remade.

### 3.4.3 General

3.4.3.1 Bring to the attention of the Consultant any defects in the Work or departures from the Contract Documents which may occur during construction. The Consultant will decide upon corrective action and give recommendations in writing.

3.4.3.2 The Consultant's general review during construction and inspection and testing by Independent Inspection and Testing Companies reporting to the Consultant are both undertaken to inform the Owner of the Contractor's performance and shall in no way augment the Contractor's quality control or relieve the Contractor of contractual responsibility.

## 3.5 NOTIFICATION

3.5.1 Prior to commencing significant segments of the Work, give the Consultant and Independent Inspection and Testing Companies appropriate notification so as to afford them reasonable opportunity to review Work previously completed. Failure to meet this requirement may be cause for the Consultant to classify the Work as defective.

### **3.6 INSPECTION AND TESTING**

- 3.6.1 The Owner will appoint the Independent Inspection and Testing Companies to make inspections or perform tests as the Consultant directs. The Independent Inspection and Testing Company shall be responsible only to the Consultant, and shall make only such inspections or tests as the Consultant may direct.
- 3.6.2 When defects are revealed, the Consultant may request, at the Contractor's expense, additional inspection or testing to ascertain the full extent of the defect.

### **3.7 DEFECTIVE MATERIALS AND WORK**

- 3.7.1 Where evidence exists that defective Work has occurred or that Work has been carried out incorporating defective materials, the Consultant may have tests, inspections or surveys performed, analytical calculations of structural strength made and the like in order to help determine whether the Work must be replaced. Tests, inspections or surveys or calculations carried out under these circumstances will be made at the Contractor's expense, regardless of their results, which may be such that, in the Consultant's opinion, the Work may be acceptable.
- 3.7.2 All testing shall be conducted in accordance with the requirements of the Building Code, except where this would, in the Consultant's opinion, cause undue delay or give results not representative of the rejected material in place. In this case, the tests shall be conducted in accordance with the standards given by the Consultant.
- 3.7.3 Materials or Work which fail to meet specified requirements may be rejected by the Consultant whenever found at any time prior to the Total Performance of the Work regardless of previous inspection. If rejected, defective materials or Work shall be promptly removed and replaced or repaired to the satisfaction of the Consultant, at no expense to the Owner.

**END OF SECTION**



## **1 GENERAL**

### **1.01 RELATED REQUIREMENTS**

- .1 Refer to all drawings.

### **1.02 DEFINITIONS**

- .1 Application Specialist: An individual who performs surface preparation and application of protective coatings and linings to steel and concrete surfaces of complex industrial structures.

### **1.03 REFERENCE STANDARDS**

- .1 ASTM International (ASTM):
  - .1 [ASTM A 53/A 53M-\[12\]](#), Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
  - .2 [ASTM A 269M-\[15a\]](#), Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
  - .3 [ASTM A 307-\[14\]](#), Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
- .2 CSA Group (CSA):
  - .1 CSA G40.20-[13] /G40.21-[13], General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
  - .2 [CAN/CSA G164-\[M92\(R2003\)\]](#), Hot Dip Galvanizing of Irregularly Shaped Articles.
  - .3 [CSA S16-\[14\]](#), Design of Steel Structures.
  - .4 [CSA W48-\[14\]](#), Filler Metals and Allied Materials for Metal Arc Welding (Developed in co-operation with the Canadian Welding Bureau).
  - .5 [CSA W59-\[13\]](#), Welded Steel Construction (Metal Arc Welding)
- .3 Environmental Choice Program (ECP):
  - .1 CCD-048-[95(2006)], Surface Coatings - Recycled Water-borne.
- .4 Green Seal Environmental Standards (GS):
  - .1 GS-11-[2011], Paints and Coatings.
- .5 The Master Painters Institute (MPI):
  - .1 Architectural Painting Specification Manual.
- .6 Underwriters Laboratories (UL):
  - .1 UL 2768-[11], Architectural Surface Coatings.
- .7 NACE International:
  - .1 NACE International
    - .1 ANSI/NACE No. 13/SSPC-ACS-1-[2016] -SG, Industrial Coating and Lining Application Specialist Qualification and Certification.

### **1.04 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Division 1.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for all applicable components and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Submit WHMIS SDS in accordance with Division 1.
    - .3 For finishes, coatings, primers, and paints applied on site: indicate VOC concentration in g/L.

- .3 Shop Drawings:
  - .1 Submit drawings prepared, stamped and signed by professional engineer registered or licensed in Ontario, Canada.
  - .2 Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.
- .4 Sustainable Design Submittals:
  - .1 Reserved.
- .5 Certificates:
  - .1 Where used in Project, submit certifications for Application Specialists to demonstrate compliance with the requirements of ANSI/NACE No.13.
  - .2 Submit confirmation metal fabrications contractor is a member of the Canadian Institute of Steel Construction (CISC).
  - .3 Submit confirmation metal fabrications contractor is certified by the Canadian Welding Bureau (CWB).

#### **1.05 QUALITY ASSURANCE**

- .1 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.
- .2 Certifications: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .3 Qualifications:
  - .1 Ensure that a minimum of 50% of industrial coating and or lining applications specialists, who perform concrete and steel surfaces preparation and coating applications, are certified by a recognized Applicator Certification Agency, in accordance with NACE 13 /SSPC ACS-I, Applicator Certification Standard (ACS).
  - .2 Maintain a current and valid ACS certification during project period.
    - .1 Application specialists who perform surface preparation and coating application work on this project must have a current ACS.
  - .3 Notify Consultant of any change in application specialist certification status.
    - .1 Any delays to the completion of the Project due to invalid certifications will not be considered, and liquidated damages shall not be waived for any non-performance by Contractor.
  - .4 Ensure that metal fabricator is fully certified by the Canadian Welding Bureau and is a member of the Canadian Institute of Steel Construction and has a minimum of 5 years experience performing work of similar size and complexity.
- .4 Pre-installation Meeting: conduct pre-installation meeting on site with fabrication engineer to review project requirements and existing conditions.
- .5 Design & Fabrication: design, supply and install metal connections, members, other components that are not fully detailed on drawings but required for proper erection. For fully detailed connections, verify structural adequacy and accept responsibility for the successful fabrication and erection of the Work. Design and detail connections to not encroach upon architectural components.

#### **1.06 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

- .3 Storage and Handling Requirements:
  - .1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan and/or Waste Reduction Workplan related to Work of this Section and in accordance with Division 1.
- .5 Packaging Waste Management: remove as specified in Construction Waste Management Plan and/or Waste Reduction Workplan where applicable.

## **2 PRODUCTS**

### **2.01 MATERIALS**

- .1 Steel sections and plates: to [CSA G40.20/G40.21](#), Grade 300W or 350W.
- .2 Welding materials: to [CSA W59](#).
- .3 Welding electrodes: to [CSA W48](#) Series.
- .4 Bolts and anchor bolts: to [ASTM A 307](#)
- .5 Stainless steel tubing: to [ASTM A 269](#), Type 302 commercial grade seamless welded with AISI No. 4 finish.
- .6 Grout: non-shrink, non-metallic, flowable, 15 MPa at 24 hours.

### **2.02 FABRICATION**

- .1 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.
- .2 Use self-tapping shake-proof headed screws on items requiring assembly by screws or as indicated.
- .3 Where possible, fit and shop assemble work, ready for erection.
- .4 Exposed welds continuous for length of each joint. File or grind exposed welds smooth and flush.

### **2.03 FINISHES**

- .1 Galvanizing: hot dipped galvanizing with zinc coating 600 g/m<sup>2</sup> to [CAN/CSA-G164](#).
- .2 Shop coat primer: to MPI INT/ EXT 5.1A.
- .3 Zinc primer: zinc rich, ready mix to MPI -INT/EXT 5.2C.

### **2.04 ISOLATION COATING**

- .1 Isolate aluminum from following components, by means of bituminous paint:
  - .1 Dissimilar metals except stainless steel, zinc, or white bronze of small area.
  - .2 Concrete, mortar and masonry.
  - .3 Wood.

### **2.05 SHOP PAINTING**

- .1 Primer: MPI INT/EXT 5.1A unless otherwise noted on drawings.

- .2 Apply one shop coat of primer to metal items, with exception of galvanized or concrete encased items.
- .3 Use primer unadulterated, as prepared by manufacturer. Paint on dry surfaces, free from rust, scale, grease. Paint when temperature minimum 7 degrees C.
- .4 Clean surfaces to be field welded; do not paint.

## **2.06 ANGLE LINTELS**

- .1 Steel angles: sizes indicated for openings.
- .2 Weld or bolt back-to-back angles to profiles as indicated.
- .3 Finish:
  - .1 Primer: shop primed for interior applications.
  - .2 Hot-dip Galvanized: hot-dip galvanize steel where component is installed in or on exterior wall.

## **2.07 NOT USED**

- .1 Not used.

## **2.08 NOT USED**

- .1 Not used.

## **2.09 NOT USED**

- .1 Not used.

## **2.10 Not Used**

- .1 Not used.

## **2.11 CHANNEL FRAMES**

- .1 Fabricate frames from steel, sizes of channel and opening as indicated.
- .2 Weld channels together to form continuous frame for jambs and head of openings, sizes as indicated.
- .3 Finish:
  - .1 Primer: shop primed for interior applications.
  - .2 Hot-dip Galvanized: hot-dip galvanize steel where component is installed in or on exterior wall.

# **3 EXECUTION**

## **3.01 EXAMINATION**

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts acceptable for metal fabrications installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate.
  - .2 Correct unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions remedied.

### **3.02 ERECTION - GENERAL**

- .1 Do welding work in accordance with [CSA W59](#) unless specified otherwise
- .2 Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.
- .3 Provide suitable means of anchorage such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.
- .4 Exposed fastening devices to match finish and be compatible with material through which they pass.
- .5 Supply components for work by other trades in accordance with shop drawings and schedule.
- .6 Make field connections with bolts to [CSA S16](#) or Weld field connection], refer to drawings.
- .7 Deliver items over for casting into concrete and building into masonry together with setting templates to appropriate location and construction personnel.
- .8 Touch-up rivets, field welds, bolts and burnt or scratched surfaces with matching finish coating.
- .9 Touch-up galvanized surfaces with cold galvanizing compound where burned by field welding.

### **3.03 CLEANING**

- .1 Progress Cleaning: clean in accordance with Division 1.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section Division 1.
- .3 Waste Management: separate waste materials for reuse and/or recycling in accordance with Division 1.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

### **3.09 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by metal fabrications installation.

**END OF SECTION**

## **1 GENERAL**

### **1.01 RELATED REQUIREMENTS**

- .1 Refer to drawings and all applicable specifications indicating finish and hardware requirements for architectural millwork.

### **1.02 REFERENCE STANDARDS**

- .1 American National Standards Institute (ANSI):
  - .1 ANSI A208.1-[09], Particleboard.
  - .2 ANSI A208.2-[09], Medium Density Fibreboard (MDF) for Interior Applications.
  - .3 ANSI/HPVA HP-1- [10], American National Standard for Hardwood and Decorative Plywood.
  - .4 ANSI/BHMA A156.16 Auxiliary Hardware.
  - .5 ANSI/ASME 18.6.1 1981 (R2012) Wood Screws (Inch Series).
- .2 Architectural Woodwork Manufacturers Association of Canada (AWMAC) and Architectural Woodwork Institute (AWI):
  - .1 Architectural Woodwork Quality Standards, 2nd edition, 2014.
- .3 ASTM International:
  - .1 [ASTM A 153/A 153M-\[16\]](#), Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
  - .2 [ASTM E 1333-\[14\]](#) Standard Test Method for Determining Formaldehyde Concentrations in Air and Emission Rates from Wood Products Using a Large Chamber.
  - .3 [ASTM F 1667-\[13\]](#) Standard Specification for Driven Fasteners: Nails, Spikes and Staples.
- .4 Canadian General Standards Board (CGSB):
  - .1 [CAN/CGSB-11.3-\[M87\]](#), Hardboard.
- .5 CSA Group (CSA):
  - .1 [CSA O121-\[08\(R2013\)\]](#), Douglas Fir Plywood.
  - .2 [CSA O151-\[09\(R2014\)\]](#), Canadian Softwood Plywood.
  - .3 [CSA O153-\[M13\]](#), Poplar Plywood.
  - .4 [CAN/CSA-Z809-\[08\(R2013\)\]](#), Sustainable Forest Management.
- .6 Forest Stewardship Council (FSC):
  - .1 FSC-STD-01-001- [2004], FSC Principle and Criteria for Forest Stewardship.
- .7 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
  - .1 Safety Data Sheets (SDS).
- .8 Sustainable Forestry Initiative (SFI):
  - .1 SFI- [2015-2019] Standard.
- .9 Underwriters Laboratories of Canada (ULC):
  - .1 [CAN/ULC-S104-\[10\]](#), Standard Method for Fire Tests of Door Assemblies.
  - .2 CAN/ULC-S105-[09], Standard Specification for Fire Door Frames.

### **1.03 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Division 1.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature, data sheets and catalogue pages for specified products. Include product characteristics, performance criteria,

- dimensions and profiles, finish and limitations on use.
  - .2 Submit two copies of WHMIS SDS in accordance with Division 1.
- .3 Shop Drawings:
  - .1 Prepare and submit shop drawings in general accordance with AWMAC AWS manual.
  - .2 Indicate profiles and dimensions, assembly techniques, jointing, methods of fastening, terminations and other related details.
  - .3 Indicate materials, thicknesses, finishes and hardware.
  - .4 Include schedule or key plan.
  - .5 Show profiles, elevations and details at scales recommended by AWMAC AWS.
  - .6 Where necessary, show location and type of blocking and backing required within supporting assemblies.
- .4 Samples:
  - .1 Submit triplicate 300 mm long representative samples of each typical item of finish carpentry.
    - .1 Standing and running trim: 300 mm long.
    - .2 Panel materials: 300 mm x 300 mm.
  - .2 Shop applied coating samples:
    - .1 For transparent finish, submit samples of each species and cut of wood to be used, finished as specified or indicated on drawings.
    - .2 For opaque finish, submit samples for each colour selection, finished as specified or indicated on drawings.
  - .3 Decorative overlaid composite panels, complete with applied edge treatment and corner treatment, minimum 300 mm x 300 mm.
  - .4 Samples for site applied finish:
    - .1 Furnish samples of each finish carpentry item and composite panel material to Contractor for preparation of site applied finish samples.
  - .5 Submit samples of each hardware item to be left exposed in final construction. Samples will be returned for incorporation into the work.
- .5 Certifications: submit certificates signed by manufacturer certifying materials comply with specified performance characteristics, physical properties and requirements of referenced standards.
- .6 Test and Evaluation Reports: submit certified test reports for composite wood from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.

#### **1.04 SUSTAINABLE DESIGN SUBMITTALS**

- .1 Reserved.

#### **1.05 QUALITY ASSURANCE**

- .1 Perform Work of this Section by finish carpentry contractor with minimum 5 years of current experience and having completed minimum one project in the past 5 years with value within 20% of the cost of the work of this Section.
- .2 Mock-ups:
  - .1 Construct mock-ups in accordance with Division 1.
  - .2 Shop prepare one typical example of each specified item complete with shop applied finishes, and install where directed by Consultant.
  - .3 Allow 48 hours for inspection of mock-up by Consultant before proceeding with Work.
  - .4 When accepted, mock-up will demonstrate minimum standard for Work.
  - .5 Do not proceed with work before receipt of written acceptance of mock-up by Consultant.
  - .6 Accepted mock-up may remain as part of finished work.

## **1.06 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Division 1 and with AWS recommendations and as follows.
- .2 Deliver finish carpentry materials only when area of work is enclosed, plaster and concrete work is dry, area is broom clean and site environmental conditions are acceptable for installation.
- .3 Storage and Handling Requirements:
  - .1 Store materials indoors in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Maintain indoor temperature and humidity within range recommended by AWS for location of the Work.
  - .3 Store products on site as specified for minimum 72 hours before installation.
  - .4 Store and protect finish carpentry products from moisture, nicks, scratches, and blemishes.
  - .5 Replace defective or damaged materials with new.
- .4 Waste Management: for packaging and materials, in accordance with Division 1.

## **2 PRODUCTS**

### **2.01 REGULATORY REQUIREMENTS**

- .1 Wood fire rated frames and panels: labelled and listed by an organization accredited by Standards Council of Canada in conformance with CAN/ULC-S104 for ratings specified or indicated.
- .2 Provide fire labelled frames for openings requiring fire protection ratings. Test products in conformance with CAN/ULC-S104 and listed by nationally recognized agency having factory inspection services.

### **2.02 SUSTAINABILITY CHARACTERISTICS**

- .1 Reserved.

### **2.03 QUALITY GRADE**

- .1 Provide all materials and perform all work of this Section in accordance with AWMAC AWS Custom Grade.
- .2 In case of conflict between Contract Documents and AWMAC AWS grade requirements, Contract Documents govern.

### **2.04 MATERIALS**

- .1 Softwood and hardwood lumber: Sound lumber to specified AWS grade requirements, kiln-dried to moisture content recommended for location of the Work
  - .1 Machine stress-rated lumber is acceptable for all purposes.
- .2 MDF (medium density fibreboard) core: to ANSI A208.2, density 769 kg/m<sup>3</sup>, Grade 155, 19 mm thick unless indicated otherwise.
  - .1 Use moisture resistant MR grade at wet areas.
- .3 Interior mat-formed wood particleboard: to ANSI/NPA A208.1, industrial grade M-2 or M-3, medium density (640-800 kg/m<sup>3</sup>), thickness 19 mm unless indicated otherwise.
  - .1 Use moisture resistant grade 2-M-2 or 2-M-3 for countertops and splash-backs to receive



plumbing fixtures.

- .4 Douglas fir plywood (DFP): to [CSA O121](#), standard construction.
- .5 Canadian softwood plywood (CSP): to [CSA O151](#), standard construction.
- .6 Hardwood plywood: to ANSI/HPVA HP-1.
- .7 Poplar plywood (PP): to [CSA O153](#), standard construction.
- .8 Hardboard: to [CAN/CGSB-11.3](#).
- .9 Low density fibreboard: to CSA-A247M.

## **2.05 FASTENINGS**

- .1 Provide screws, bolts, expansion shields and other fastening devices required for satisfactory installation.
- .2 Exposed fasteners to match finish of hardware.
- .3 Nails and staples: to [ASTM F 1677](#), stainless steel for exterior work, interior humid areas; plain finish elsewhere.
- .4 Wood screws: to ANSI/ASME 18.6.1, countersunk flush type unless indicated otherwise, in sizes to suit application, galvanized to [ASTM A 153/A 153M](#) for exterior work, interior humid areas; plain finish elsewhere.
- .5 Splines: wood, as detailed.
- .6 Panel adhesive: Type to suit application.

## **2.06 HARDWARE**

- .1 Refer to Section 06 41 93 Cabinet and Miscellaneous Hardware.
- .2 Hardware Fastenings:
  - .1 Supply screws, bolts, expansion shields and other fastening devices required for satisfactory installation of hardware.
  - .2 Exposed fastening devices to match finish of hardware.
  - .3 Use fasteners compatible with material through which they pass.

## **3 EXECUTION**

### **3.01 EXAMINATION**

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contract are acceptable for wood products installation in accordance with AWS tolerances and requirements of Contract Documents.
  - .1 Visually inspect substrate.
  - .2 Correct unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied.

### **3.02 PREPARATION**

- .1 Back prime woodwork before installation, to AWMAC AWS.

### **3.03 INSTALLATION**

- .1 Install items of finish carpentry in accordance with AWMAC AWS grade specified for respective items.
- .2 In case of conflict between Contract Documents and AWS grade requirements, Contract Documents govern.
- .3 Install items of finish carpentry at locations shown on drawings.
  - .1 Position accurately, level, plumb straight.
  - .2 Fasten and anchor securely.
- .4 Scribe and cut as required, fit to abutting walls, and surfaces, fit properly into recesses and to accommodate piping, columns, fixtures, outlets, or other projecting, intersecting or penetrating objects.
- .5 Form joints to conceal shrinkage.

### **3.04 CONSTRUCTION**

- .1 Fastening:
  - .1 Position items of finished carpentry work accurately, level, plumb, true and fasten or anchor securely.
  - .2 Design and select fasteners to suit size and nature of components being joined. Use proprietary devices as recommended by manufacturer.
  - .3 Set finishing nails to receive filler. Where screws are used to secure members, countersink screw in round smooth cut hole and plug with wood plug to match material being secured.
  - .4 Replace items of finish carpentry with damage to wood surfaces including hammer and other bruises.
- .2 Standing and running trim:
  - .1 Butt and cope internal joints of baseboards to make snug, tight, joint. Cut right angle joints of casing and base with mitred joints.
  - .2 Fit backs of baseboards and casing snugly to wall surfaces to eliminate cracks at junction of base and casing with walls.
  - .3 Make joints in baseboard, where necessary using a 45 degree scarf type joint.
  - .4 Install door and window trim in single lengths without splicing.
- .3 Interior and exterior frames:
  - .1 Set frames with plumb sides and level heads and sills, and secure.
- .4 Panelling:
  - .1 Secure panelling and perimeter trim using adhesive recommended for purpose by manufacturer. Fill nail holes caused by temporary fixing with filler matching wood in colour.
  - .2 Secure panelling and perimeter trim using concealed fasteners.
  - .3 Secure panelling and perimeter trim using counter sunk screws plugged with matching wood plugs.
- .5 Stairs:
  - .1 Install stairs to location and details as indicated.
- .6 Handrails, wall rails and bumper rails.
  - .1 Install handrails, wall rails and bumper rails in locations indicated.
  - .2 Make joints hair line, dowelled and glued.
  - .3 Install support brackets as indicated.
  - .4 Install brackets at ends and at 1200 mm on centre minimum at intermediate spacings.

- .5 Secure using counter sunk screws plugged with matching wood plugs.
- .7 Shelving:
  - .1 Install shelving as indicated.
- .8 Hardware:
  - .1 Supply and install all required hardware to complete installation or make suitable for use.  
Refer to Section 06 41 93 Cabinet and Miscellaneous Hardware.

### **3.05 CLEANING**

- .1 Progress Cleaning: clean in accordance with Division 1.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Division 1.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Division 1.

### **3.06 TOUCHUP AND PROTECTION**

- .1 Fill and retouch all nicks, chips and scratches in factory finishes and substrate materials to AWS standards. Replace damaged items that cannot be repaired to AWS standards
- .2 Protect installed products and components from damage during construction.
- .3 Repair damage to adjacent materials caused by finish carpentry installation.
- .4 Leave work to be site finished ready for finishing by applicable Division 9 specifications.

**END OF SECTION**

## **1 GENERAL**

### **1.01 RELATED REQUIREMENTS**

- .1 Section 06 20 00 - Finish Carpentry: Plastic laminate finish for paneling.
- .2 Section 08 14 00 – Wood Doors: Plastic laminate finish for doors.

### **1.02 REFERENCE STANDARDS**

- .1 American National Standards Institute (ANSI):
  - .1 ANSI 208.1-[09], Particleboard.
  - .2 ANSI A208.2-[09], Medium Density Fiberboard (MDF) for Interior Applications.
- .2 Architectural Woodwork Manufacturers Association of Canada (AWMAC):
  - .1 Architectural Woodwork Standards (AWS), [2nd] edition, [2014].
- .3 ASTM International (ASTM):
  - .1 [ASTM E 1333-\[14\]](#), Standard Test Method for Determining Formaldehyde Concentrations in Air and Emission Rates From Wood Products Using a Large Chamber.
- .4 Canadian General Standards Board (CGSB):
  - .1 [CAN/CGSB-71.19-\[M88\]](#), Adhesive, Contact, Sprayable.
  - .2 [CAN/CGSB-71.20-\[M88\]](#), Adhesive, Contact, Brushable.
- .5 CSA Group (CSA):
  - .1 CSA O112-M Series 1977 [(R2006)] Standards for Wood Adhesives.
  - .2 [CSA O121-\[08\]](#), Douglas Fir Plywood.
  - .3 [CSA O151-\[09\]](#), Canadian Softwood Plywood.
  - .4 [CSA O153-\[M1980\(R2008\)\]](#), Poplar Plywood.
  - .5 [CAN/CSA-Z809-\[08\]](#), Sustainable Forest Management.
- .6 Forest Stewardship Council (FSC):
  - .1 FSC-STD-01-001-[2004], FSC Principle and Criteria for Forest Stewardship.
- .7 Green Seal Environmental Standards (GS):
  - .1 GS-36-[13], Commercial Adhesives.
- .8 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
  - .1 Safety Data Sheets (SDS).
- .9 National Electrical Manufacturers Association (NEMA):
  - .1 ANSI/NEMA LD-3-[05], High Pressure Decorative Laminates (HPDL).
- .10 Scientific Equipment and Furniture Association (SEFA):
  - .1 SEFA 8-[99], Laboratory Furniture.
- .11 Sustainable Forestry Initiative (SFI):
  - .1 SFI-[2015-2019] Standard.

### **1.03 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Division 1.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for laminate, adhesive, and core materials and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Submit two copies of WHMIS SDS in accordance with Division 1. Indicate VOC's for

adhesives in g/L.

- .3 Samples:
  - .1 Submit for review and acceptance of each unit.
  - .2 Samples will be returned for inclusion into work.
  - .3 Submit duplicate samples of joints, edging, cutouts and postformed profiles.
- .4 Shop Drawings
  - .1 Prepare and submit shop drawings in accordance with AWMAC AWS and as follows.
  - .2 Indicate AWMAC AWS quality grade where different from predominant grade specified.
  - .3 Include color schedule of all plastic laminate work, including all countertop, exposed, and semi-exposed cabinet finishes, finish material manufacturer, pattern, and color.
- .5 Certifications: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

#### **1.04 SUSTAINABLE DESIGN SUBMITTALS**

- .1 Reserved.

#### **1.05 CLOSEOUT SUBMITTALS**

- .1 Provide maintenance data for laminate work for incorporation into manual specified in Division 1.

#### **1.06 QUALITY ASSURANCE**

- .1 Perform Work of this Section by plastic laminate fabricator with minimum 5 years of current experience and having completed minimum one project in the past 5 years with value within 20% of the cost of the work of this Section.
- .2 Independent inspection/testing agency may be engaged by Owner for purpose of inspecting and/or testing Work of this Section.
  - .1 Cost of inspection and testing services will be borne by Owner.
- .3 Mock-ups:
  - .1 Construct mock-ups in accordance with Division 1.
  - .2 Prepare one typical plastic laminate finish installation where directed by Consultant.
  - .3 Allow 48 hours for inspection of mock-up by Consultant before proceeding with Work.
  - .4 When accepted, mock-up will demonstrate minimum standard for Work.
  - .5 Do not proceed with work before receipt of written acceptance of mock-up by Consultant.
  - .6 Accepted mock-up may remain as part of finished work.

#### **1.07 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Division 1 and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials indoors and in accordance with manufacturer's recommendations in a clean, dry, well-ventilated area.
  - .2 Maintain indoor temperature and humidity within range recommended by the AWMAC Quality Standards for location of the project.
  - .3 Store and protect laminate, adhesive, and core materials from nicks, scratches, and blemishes.
  - .4 Replace defective or damaged materials with new.

- .4 Packaging Waste Management: sort for reuse, return, recycling or disposal as specified in Construction Waste Management Plan and/or Waste Reduction Workplan in accordance with Division 1.

## 2 PRODUCTS

### 2.01 SUSTAINABILITY CHARACTERISTICS

- .1 Reserved.

### 2.02 QUALITY GRADE

- .1 Provide all materials and perform all fabrication in accordance with AWMAC AWS Custom Grade except where specified otherwise.
- .2 In case of conflict between Contract Documents and AWMAC AWS grade requirements, Contract Documents govern.

### 2.03 LAMINATED PLASTIC MATERIALS

- .1 Acceptable Manufacturers:
  - .1 Wilsonart.
  - .2 Tafisa.
  - .3 Panolam.
- .2 Laminated plastic for flatwork to NEMA LD3: **NOT USED**.
  - .1 Type: general purpose.
  - .2 Grade: [HGS][HGL][VDS][VGL].
  - .3 Thickness: [1.0][1.2] mm thick.
  - .4 Colour: [integral colour throughout], [multilayered].
  - .5 Pattern: [solid][woodgrain][printed pattern][metallic].
  - .6 Finish: [gloss][satin][furniture][matt][textured][embossed].
- .3 Laminated plastic for postforming work to NEMA LD3: **FINISH TYPE PL-1**.
  - .1 Manufacturer: Wilsonart.
  - .2 Product: Chemsurf HPL.
  - .3 Type: postforming, Type 390.
  - .4 Grade: HGP.
  - .5 Thickness: 0.86 mm thick.
  - .6 Colour: Graphite 10657.
  - .7 Pattern: solid.
  - .8 Finish: #60 matte.
- .4 Laminated plastic high wear to NEMA LD3: **NOT USED**.
  - .1 Type: high wear.
  - .2 Grade: [HGH][HDM][HDS].
  - .3 Size: [0.7][1.0][1.2] mm thick.
  - .4 Colour: [integral colour throughout], [multilayered].
  - .5 Pattern: [solid][woodgrain][printed pattern][metallic].
  - .6 Finish: [gloss][satin][furniture][matt][textured][embossed].
- .5 Laminated plastic for backing sheet to NEMA LD3: **NOT USED**.
  - .1 Type: backer.
  - .2 Grade: [BKH][BKM][BKV][BKL].
  - .3 Thickness: [same thickness as face laminate].
  - .4 Colour: [same colour as face laminate].

- .6 Laminated plastic for liner to NEMA LD3: **FINISH TYPE PL-2.**
  - .1 Type: cabinet liner.
  - .2 Grade: CLS.
  - .3 Thickness: 0.5 mm thick
  - .4 Colour: white.

## 2.04 CORE MATERIALS

- .1 Interior mat-formed wood particleboard: to ANSI/NPA A208.1, industrial grade M-2 or M-3, medium density (640-800 kg/m<sup>3</sup>), thickness 19 mm unless indicated otherwise.
  - .1 Use moisture resistant grade 2-M-2 or 2-M-3 for countertops and splash-backs to receive plumbing fixtures.
- .2 Douglas fir plywood (DFP): to [CSA O121](#), standard construction.
- .3 Canadian softwood plywood (CSP): to [CSA O151](#), standard construction.

## 2.05 ADHESIVES, SEALERS AND ACCESSORIES

- .1 Laminated plastic adhesive: contact adhesive to [CAN/CGSB-71.20](#).
  - .1 VOC limit 80 g/L maximum to GS-36.
- .2 Sealer: water resistant sealer or glue acceptable to laminate manufacturer.
  - .1 VOC limit: 200 g/L maximum.
- .3 Sealants: as recommended by fabricator.
- .4 Draw bolts and splines: as recommended by fabricator.
- .5 Edge finishing:
  - .1 HPDL to match face.

## 2.06 FABRICATION

- .1 Fabricate plastic laminate finished items in accordance with NEMA LD3, Annex A and specified AWMAC AWS quality grade requirements
- .2 Obtain governing dimensions before fabricating items which are to accommodate or abut appliances, equipment and other materials.
- .3 Ensure adjacent parts of continuous laminate work match in colour and pattern.
- .4 Veneer laminated plastic to core material in accordance with adhesive manufacturer's instructions. Ensure core and laminate profiles coincide to provide continuous support and bond over entire surface. Use continuous lengths up to 3000 mm. Keep joints 600 mm from sink cutouts.
- .5 Form shaped profiles and bends as indicated, using postforming grade laminate to manufacturer's instructions.
- .6 Apply laminate backing sheet to reverse side of core of plastic laminate work.
- .7 Apply laminated plastic liner sheet to interior of cabinetry where indicated.
- .8 Edge treatment:
  - .1 For HPDL edge treatment use straight self-edging laminate strip for flatwork to cover exposed edge of core material. Chamfer exposed edges uniformly at approximately 20 degrees. Do not mitre laminate edges.

### **3 EXECUTION**

#### **3.01 EXAMINATION**

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for laminate, adhesive, and core materials installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Consultant.
  - .2 Inform Consultant of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

#### **3.02 MANUFACTURER'S INSTRUCTIONS**

- .1 Compliance: comply with manufacturer's written recommendations, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

#### **3.03 INSTALLATION**

- .1 Install laminated plastic work in accordance with AWMAC AWS Custom Grade, except where specified otherwise.
- .2 In case of conflict between Contract Documents and AWMAC AWS grade requirements, Contract Documents govern.
- .3 Install work plumb, true and square, neatly scribed to adjoining surfaces.
- .4 Make allowances around perimeter where fixed objects pass through or project into laminated plastic work to permit normal movement without restriction.
- .5 Use draw bolts and splines in counter top joints. Maximum spacing 450 mm on centre, 75 mm from edge. Make flush hairline joints.
- .6 Provide cutouts for inserts, grilles, appliances, outlet boxes and other penetrations. Round internal corners, chamfer edges and seal exposed core.
- .7 At junction of laminated plastic counter back splash and adjacent wall finish, apply small bead of sealant in accordance with Section 07 92 00 - Joint Sealants.

#### **3.04 SITE APPLIED PLASTIC LAMINATE**

- .1 Site apply laminated plastic to units as indicated.
- .2 Adhere laminated plastic over entire surface.
- .3 Make corners with hairline joints.
- .4 Use full sized laminate sheets.
- .5 Make joints only where indicated or approved by Consultant.
- .6 Slightly bevel arises.
- .7 Offset joints in plastic laminate facing from joints in core.

#### **3.05 CLEANING**

- .1 Progress Cleaning: clean in accordance with Division 1.



- .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.
  - .1 Clean to NEMA LD3, Annex B
  - .2 Remove traces of primer, caulking, epoxy and filler materials and clean doors and frames.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Division 1.

### **3.06 PROTECTION**

- .1 Cover finished laminated surfaces with heavy kraft paper or put in cartons during shipment.
- .2 Protect installed laminated surfaces in accordance with manufacturer's written recommendations.
  - .1 Remove protection only immediately before final inspection.
- .3 Protect installed products and components from damage during construction.
- .4 Repair damage to adjacent materials caused by laminate, adhesive, and core materials installation.

**END OF SECTION**

## **1 GENERAL**

### **1.01 RELATED REQUIREMENTS**

- .1 Reserved.

### **1.02 REFERENCE STANDARDS**

- .1 American National Standards Institute (ANSI) / Builders Hardware Manufacturers Association (BHMA):
  - .1 ANSI/BHMA A156.9-[2003], Cabinet Hardware.
  - .2 ANSI/BHMA A156.11-[2004], Cabinet Locks.
  - .3 ANSI/BHMA A156.16-[2008], Auxiliary Hardware.
  - .4 ANSI/BHMA A156.18-[2006], Materials and Finishes.
  - .5 ANSI/BHMA A156.20-[2006], Strap and Tee Hinges and Hasps.
- .2 Canada Green Building Council (CaGBC):
  - .1 LEED Canada-NC Version 1.0-[2004], LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For New Construction and Major Renovations (including Addendum [2007]).
  - .2 LEED Canada-CI Version 1.0-[2007], LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide For Commercial Interiors.

### **1.03 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Division 1.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for cabinet hardware and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Samples:
  - .1 Reserved.
- .4 Hardware List:
  - .1 Submit contract hardware list.
  - .2 Indicate specified hardware, including make, model, material, function, finish and other pertinent information.
- .5 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
- .6 Manufacturer's Instructions: submit manufacturer's installation instructions.
- .7 Sustainable Design Submittals:
  - .1 Reserved.

### **1.04 CLOSEOUT SUBMITTALS**

- .1 Submit in accordance with Division 1.
- .2 Operation and Maintenance Data: submit operation and maintenance data for cabinet hardware for incorporation into manual.

### **1.05 QUALITY ASSURANCE**

- .1 Certificates: product certificates signed by manufacturer certifying materials comply with specified

performance characteristics and criteria and physical requirements.

## **1.06 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Division 1 and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Package items of hardware including fastenings, separately or in like groups of hardware, label each package as to item definition and location.
- .4 Storage and Handling Requirements:
  - .1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect cabinet hardware from nicks, scratches, and blemishes.
  - .3 Protect prefinished surfaces with wrapping or strippable coating.
  - .4 Replace defective or damaged materials with new.
- .5 Develop Construction Waste Management Plan and/or Waste Reduction Workplan related to Work of this Section and in accordance with Division 1.
- .6 Reserved.

## **2 PRODUCTS**

### **2.01 HARDWARE ITEMS**

- .1 Use one manufacturer's product for all similar items.

### **2.02 CABINET HARDWARE**

- .1 Cabinet hardware: to ANSI/BHMA A156.9, designated by letter B and numeral identifiers [listed in Hardware Schedule][s listed below].
  - .1 Hinges: Hettich Intermat 9956 full overlay wide-angle concealed hinge. Finish: satin nickel.
  - .2 Pulls: Richelieu 4" surface mounted D pull, Finish: stainless steel.
  - .3 Knobs: reserved.
  - .4 Latches: reserved.
  - .5 Catches: Hafele Deluxe Model spring-loaded type, solid brass construction, Finish: chrome.
  - .6 Shelf rests and standards: reserved.
  - .7 Shelf brackets and standards: Richelieu Kolossus Pilaster installed flush with cabinet surface, complete with pilaster clips, Finish: stainless steel.
  - .8 Drawer slides: Hettich KA-5632 Full Extension, side mounted ball bearing drawer slides with Silent System (35 kg capacity), Finish: passivated galvanized steel.
  - .9 Rotating shelves: reserved.
  - .10 Pull up shelf supports: reserved.
  - .11 Track and guides for sliding panels: reserved.
- .2 Cabinet locks: to ANSI/BHMA A156.11, as listed in Millwork Hardware Schedule and below.
  - .1 Door or drawer locks: surface mounted, zinc alloy construction; Finish: Chrome. Model: Richelieu 1403 Series Lock #BP140301140.
  - .2 Sliding door locks: reserved.
  - .3 Cylinders: key into keying system as directed by Owner.
  - .4 Finish: stainless steel.

## **2.03 MISCELLANEOUS HARDWARE**

- .1 Auxiliary hardware: to ANSI/BHMA A156.16, [designated by letter and numeral identifiers][listed in Hardware Schedule][as listed below], finished to [\_\_\_\_\_].
  - .1 Handrail brackets: N/A.
  - .2 Garment hooks: N/A.
  - .3 Garment rods and shelf brackets: N/A.
  - .4 Window bolts or catches: N/A.
  - .5 Window lifts: N/A.
  - .6 Roller latch: N/A.
- .2 Strap and tee hinges and hasps: to ANSI/BHMA A156.20.
- .3 Closet shelf supports: reserved.
- .4 Closet hanger bar and supports: reserved.
- .5 Padlock: reserved.

## **2.04 FASTENINGS**

- .1 Supply screws, bolts, expansion shields and other fastening devices required for satisfactory installation and operation of hardware.
- .2 Exposed fastening devices to match finish of hardware.
- .3 Use fasteners compatible with material through which they pass.

## **2.05 KEYING**

- .1 Padlocks and cabinet locks to be keyed alike in groups or as directed by Owner. Submit keying schedule for approval.
- .2 Supply keys in duplicate for every lock in this Contract.
- .3 Supply 3 master keys for each master key or grand master key group.
- .4 Stamp keying code numbers on keys and cylinders.
- .5 Install key cabinet where indicated.

# **3 EXECUTION**

## **3.01 INSTALLATION**

- .1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.
- .2 Install hardware to standard hardware location dimensions in accordance with manufacturer's recommendations and to project design requirements.
- .3 Install key control cabinet and establish key control set-up.

## **3.02 ADJUSTING**

- .1 Adjust cabinet hardware for optimum, smooth operating condition.

- .2 Lubricate hardware and other moving parts.
- .3 Adjust cabinet door hardware to ensure tight fit at contact points with frames.

### **3.03 CLEANING**

- .1 Progress Cleaning: clean in accordance with Division 1.
  - .1 Leave Work area clean at end of each day.
  - .2 Clean hardware with damp rag and approved non-abrasive cleaner, and polish hardware in accordance with manufacturer's instructions.
  - .3 Remove protective material from hardware items where present.
  - .4 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Division 1.
- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Division 1.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

### **3.04 DEMONSTRATION**

- .1 Keying System Setup and Cabinet:
  - .1 Set up key control system with file key tags, duplicate key tags, numerical index, alphabetical index and key change index, label shields, control book and key receipt cards.
  - .2 Place file keys and duplicate keys in key cabinet on their respective hooks.
  - .3 Lock key cabinet and turn over key to Consultant.
- .2 Maintenance Staff Briefing:
  - .1 Brief maintenance staff regarding:
    - .1 Proper care, cleaning, and general maintenance of projects complete hardware.
    - .2 Description, use, handling, and storage of keys.
- .3 Demonstrate operation, operating components, adjustment features, and lubrication requirements.

### **3.05 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by cabinet and miscellaneous hardware installation.

### **3.06 SCHEDULE**

- .1 Cabinet Hardware: Refer to Millwork Hardware Schedule on Drawings.
- .2 Miscellaneous Hardware: Refer to Millwork Fixtures & Accessories Schedule on Drawings.

**END OF SECTION**

## **1 GENERAL**

### **1.01 REFERENCE STANDARDS**

- .1 American National Standards Institute (ANSI):
  - .1 ANSI A208.2-2022, Medium Density Fibreboard (MDF) for Interior Applications.
- .2 American Society for Testing and Materials International, (ASTM):
  - .1 ASTM C 920-18 [R2024], Standard Specification for Elastomeric Joint Sealants.
  - .2 ASTM D 638-22, Standard Test Method for Tensile Properties of Plastics.
  - .3 ASTM D 785-08 [R2015], Standard Test Method for Rockwell Hardness of Plastics and Electrical Insulation Materials.
  - .4 ASTM D 790-17, Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
  - .5 ASTM D 5420-21, Standard Test Method for Impact Resistance of Flat, Rigid Plastic Specimen by Means of a Striker Impacted by a Falling Weight (Gardner Impact).
  - .6 ASTM E 84-24, Standard Test Method for Surface Burning Characteristics of Building Materials.
  - .7 ASTM E 228-22, Standard Test Method for Linear Thermal Expansion of Solid Materials with a Push-Rod Dilatometer.
  - .8 ASTM G 21-15 [R2021], Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
  - .9 ASTM G 22-23, Standard Practice for Determining Resistance of Plastics to Bacteria.
  - .10 ASTM G 155-21, Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials.
- .3 Canadian General Standards Board (CGSB):
  - .1 CAN/CGSB-71.20, Adhesive, Contact, Brushable.
- .4 Canadian Standards Association (CSA International):
  - .1 CSA B45.5:22, Standards for Plastic Plumbing Fixtures.
  - .2 CSA O115-M1982 [R2001], Hardwood and Decorative Plywood.

### **1.02 SUBMITTALS**

- .1 Product Data:
  - .1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Division 1.
  - .2 Submit WHMIS MSDS in accordance with Division 1.
- .2 Samples:
  - .1 Submit samples in accordance with Division 1.
  - .2 Submit duplicate 150 mm x 150 mm samples of each type and colour indicated.
- .3 Shop Drawings:
  - .1 Submit shop drawings for work of this Section in accordance with Division 1. Indicate plans, sections, dimensions, component sizes, edge details, thermosetting requirements, fabrication details, attachment provisions, sizes of furring, blocking, including concealed blocking and coordination requirements with adjacent work. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers, waste receptacles and other items installed in solid surface.
- .4 Coordination Drawings:
  - .1 Submit coordination drawings indicating plumbing and miscellaneous steel work indicating locations of wall rated or non-rated, blocking requirements, locations and recessed wall items and similar items.
- .5 Operation and Maintenance Data:

- .1 Submit manufacturer's care and maintenance data, including repair and cleaning instructions for inclusion in project Operations and Maintenance Manual.

### **1.03 QUALITY ASSURANCE**

- .1 Installers: provide work in this Section executed by competent installers with minimum 5 years' experience in the application of products, systems and assemblies specified and with approval and training of the product manufacturer.
- .2 Pre-installation Meetings: Conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

### **1.04 DELIVERY, STORAGE AND HANDLING**

- .1 Delivery, Storage and Protection:
  - .1 Delivery and Acceptance Requirements: Deliver no components to site until areas are ready for installation.
  - .2 Store components indoors prior to installation.
  - .3 Handle materials to prevent damage to finished surfaces.

### **1.05 WASTE MANAGEMENT AND DISPOSAL**

- .1 In accordance with Section 01 74 19 – Waste Management and Disposal.

### **1.06 WARRANTY**

- .1 Manufacturer Warranty: provide manufacturer's standard warranty for material only for period of 10 years against defects and/or deficiencies in accordance with General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of Consultant and at no expense to Owner.

## **2 PRODUCTS**

### **2.01 MATERIALS**

- .1 Acceptable Manufacturers: Corian, Wilsonart, Formica.
- .2 **Counter Top Finish CT-1: Corian Solid Surface 'Antarctica'.**
- .3 Solid Surface Based Products Performance/Design Criteria:
  - .1 Tensile Strength: 6,000 psi min., to ASTM D638.
  - .2 Tensile Modulus:  $1.5 \times 10^6$  psi min., to ASTM D638.
  - .3 Tensile Elongation: 0.4% min., to ASTM D638.
  - .4 Flexural Strength: 10,000 psi min., to ASTM D790.
  - .5 Flexural Modulus:  $1.2 \times 10^6$  psi min., to ASTM D790.
  - .6 Hardness: >85-Rockwell "M" scale min., to ASTM D785.
  - .7 Thermal Expansion:  $3.90 \times 10^{-5}$  in./in./°C, to ASTM E228.
  - .8 Fungi and Bacteria: Does not support microbial growth, to ASTM G21 & G22.
  - .9 Microbial Resistance: Highly resistant to mould growth, to UL 2824.
  - .10 Ball Impact: No fracture – 1/2 lb. Ball; 1/4" slab – 36" drop; 1/2" slab (approx. weight per sq ft) – 144" drop; to NEMA LD 3, Method 3.8.
  - .11 Weatherability:  $\Delta E^*_{94} < 5$  in 1,000 hrs, to ASTM G155.
  - .12 Flammability: to ASTM E84, NFPA 255, UL 723.
  - .13 Flame Spread: 1/4" = <25; 1/2" = <25.
  - .14 Smoke Developed: 1/4" = <25; 1/2" = <25.
  - .15 Class: A, to NFPA 101.

- .4 Solid Surface Material:
  - .1 Non-porous, homogeneous material maintaining the same composition throughout the part with a composition of acrylic polymer, aluminum trihydrate filler and pigment; not coated, laminated or of composite construction; meeting the following criteria:
  - .2 Flammability: Flame Spread Index: 0 and Smoke Developed Index: 5 when tested to CAN/ULC-S102.
  - .3 Food Equipment Material Compliance: Food Zone to NSF/ANSI 51.
  - .4 Ensure superficial damage to a depth of 0.25 mm (0.010") is repairable by sanding and polishing.
- .5 Adhesive for Bonding to Other Products: one component silicone to ASTM C920.
- .6 Sealant: a standard mildew-resistant clear silicone suitable for food preparation areas.
- .7 Sink/Bowl Mounting Hardware: manufacturer's approved bowl clips, brass inserts and fasteners for attachment of undermount sinks/bowls.
- .8 Heat Reflecting Tape: manufacturer's standard aluminum foil tape, with required thickness, for use with cutouts near heat sources.
- .9 Insulating Fabric: manufacturer's standard for use with conductive tape in insulating solid surface material from adjacent heat source.

## **2.02 MANUFACTURED UNITS**

- .1 Window Sills: 12 mm (1/2") thick solid surface material, adhesively joined with inconspicuous seams, edge details as indicated on Drawings. Colour selected later by Consultant from manufacturer's full colour range.
- .2 Counter Perimeter Frame: 12 mm (1/2") thick, moisture resistant MDF core conforming to ANSI/NPA A208.2 balanced design, manufactured from recycled materials, meeting ANSI Standards for emissions, of minimum density of 770 kg/m<sup>3</sup>, (48 lb/cu ft). Cores for counter tops in wet areas having sinks or lavatories shall have 19 mm (3/4") thick exterior grade plywood with waterproof adhesive, CSA O115-M (G/SO) Fir or Poplar plywood, veneer core only.
- .3 Lavatory Tops with Hard Seamed Bowls: 12 mm (1/2") thick countertop of solid surfacing material with a bowl made from solid surfacing material, cast to desired profiles and sizes having edge details as indicated on Drawings conforming to CSA B45.5/IAPMO Z124, complete with seamed "S" undermount bowl. Provide countertops complete with backsplashes of size shown on Drawings. Colours and profiles as indicated on Drawings. Bowl models as indicated on Drawings.
- .4 Lavatory Tops with Undermount Bowls: 12 mm (1/2") thick countertop of solid surfacing material with a bowl made from solid surfacing material, cast to desired profiles and sizes having edge details as indicated on Drawings conforming to CSA B45.5/IAPMO Z124, complete with undermount bowl(s) as indicated on Drawings. Provide countertops complete with backsplashes of size shown on Drawings. Use undermount hardware according to manufacturer's instructions. Provide countertops complete with backsplashes of size shown on Drawings. Colours and profiles as indicated on Drawings. Bowl models as indicated on Drawings.
- .5 Lavatory Tops with Integral Bowls: Moulded countertop of solid surfacing material, complete with integrally molded bowl(s) of 100% acrylic solid surface material; edge details as indicated on Drawings. Provide countertops complete with backsplashes of size shown on Drawings. Colours and profiles as indicated on Drawings. Bowl models as indicated on Drawings.

## **2.03 FABRICATION**

- .1 Fabricate components in shop to greatest extent practical to sizes and shapes indicated, in accordance with approved Shop Drawings and solid surface manufacturer requirements. Form



- joints between components to create inconspicuous seams, using manufacturer's standard joint adhesive. Provide factory cutouts for plumbing fittings and bath accessories as indicated on Drawings.
- .2 Where indicated, thermoform corners and edges or other objects to shapes and sizes indicated on Drawings, prior to seaming and joining. Cut components larger than finished dimensions and sand edges to remove nicks and scratches. Heat entire component uniformly prior to forming.
  - .3 Ensure no blistering, whitening and cracking of components during forming.
  - .4 Fabricate backsplashes from solid surfacing material with optional radius cove where counter and backsplashes meet as indicated on Drawings.
  - .5 Fabricate joints between components using manufacturer's standard joint adhesive. Ensure joints are inconspicuous in appearance and without voids. Attach 50 mm (2") wide reinforcing strip of solid surface material under each joint.
  - .6 Provide holes and cutouts for plumbing and bath accessories as required or as indicated on Drawings.
  - .7 Rout and finish component edges to a smooth, uniform finish. Rout cutouts, then sand edges smooth. Repair or reject defective or inaccurate work.
  - .8 Finish: Ensure surfaces have uniform finish.
    - .1 Matte: with a 60° gloss rating of 5 - 20.
    - .2 Semi-gloss: with a 60° gloss rating of 25 - 50.
    - .3 Polished: with a 60° gloss rating of 55 - 80.
  - .9 Fabrication Tolerances:
    - .1 Variation in Component Size: +/-3 mm (+/-1/8").
    - .2 Location of Openings: +/-3 mm (+/-1/8") from indicated location.

### **3 EXECUTION**

#### **3.01 MANUFACTURER'S INSTRUCTIONS**

- .1 Compliance: Comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

#### **3.02 EXAMINATION**

- .1 Examine substrates and conditions, with fabricator present for compliance with requirements for installation tolerances and other conditions affecting performance of work. Proceed with installation only after unsatisfactory conditions have been corrected.
- .2 Verify actual site dimensions and location of adjacent materials prior to commencing work.
- .3 Examine cabinets upon which counter tops are to be installed. Verify cabinets are level to within 3 mm in 3 m (1/8" in 10' - 0").
- .4 Notify Consultant in writing of any conditions which would be detrimental to installation.
- .5 Evaluation and Assessment: Commencement of work implies acceptance of previously completed work.

### **3.03 INSTALLATION**

- .1 Install components plumb, level, rigid, scribed to adjacent finishes in accordance with reviewed Shop Drawings and Product installation details.
- .2 Fabricate field joints using manufacturer's recommended adhesive, with joints being inconspicuous in finished work. Exposed joints/seams are not permitted. Keep components and hands clean when making joints. Reinforce field joints as specified herein. Cut and finish component edges with clean, sharp returns.
- .3 Route radii and contours to template. Anchor securely to base component or other supports. Align adjacent components and form seams to comply with manufacturer's written recommendations using adhesive in colour to match work. Carefully dress joints smooth, remove surface scratches and clean entire surface.
- .4 Install countertops with no more than 3 mm (1/8") sag, bow or other variation from a straight line.
- .5 Adhere undermount/submount/bevel mount sinks/bowls to countertops using manufacturer's recommended adhesive and mounting hardware.
- .6 Adhere topmount sinks/bowls to countertops using manufacturer recommended adhesives and colour-coordinated silicone sealant. Secure seam mount bowls and sinks to counter tops using colour-coordinated joint adhesive.
- .7 Seal between wall and components with joint sealant as specified herein and in Section 07 92 00 – Joint Sealants, as applicable.
- .8 Provide backsplashes and endsplashes as indicated on Drawings. Adhere to countertops using a standard colour-coordinated silicone sealant. Adhere applied sidesplashes to countertops using a standard colour-coordinated silicone sealant. Provide coved backsplashes and sidesplashes at walls and adjacent millwork. Fabricate radius cove at intersection of counters with backsplashes to dimensions shown on reviewed Shop Drawings. Adhere to countertops using manufacturer's standard colour-coordinated joint adhesive.
- .9 Keep components and hands clean during installation. Remove adhesives, sealants and other stains. Ensure components are clean on date of Substantial Performance of the Work.
- .10 Coordinate connections of plumbing fixtures with Mechanical requirements. Make plumbing connections to sinks in accordance with Mechanical requirements.

### **3.04 REPAIR**

- .1 Repair minor imperfections and cracked seams and replace areas of severely damaged surfaces in accordance with manufacturer's "Technical Bulletins".

### **3.05 SITE QUALITY CONTROL**

- .1 Non-Conforming Work: Replace damaged work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of Consultant at no cost to Owner.

### **3.06 CLEANING**

- .1 Perform cleaning after installation to remove construction and accumulated environmental dirt.
- .2 Remove excess adhesive and sealant from visible surfaces.
- .3 Clean surfaces in accordance with manufacturer's "Care and Maintenance Instructions".

**3.07 PROTECTION**

- .1 Provide protective coverings to prevent physical damage or staining following installation for duration of Project.
- .2 Protect surfaces from damage until date of Substantial Performance of the Work.

**END OF SECTION**

## **1 GENERAL**

### **1.01 RESERVED**

- .1 Reserved.

### **1.02 DEFINITIONS**

- .1 Environmental Product Declaration (EPD): Third-party verified documentation with the supporting Product Category Rule (PCR) and Life cycle assessment information. Prepared in accordance with ISO 14025, 14040, 14044, and EN 15804 or ISO 21930 and have at least a cradle to gate scope.
  - .1 Industry-wide (generic) EPD with third-party certification (Type III), including external verification in which the manufacturer is explicitly recognized as the participant by the program operator.
  - .2 Product-specific Type III EPD -- Products with third-party certification (Type III), including external verification in which the manufacturer is explicitly recognized as the participant by the program operator.

### **1.03 REFERENCE STANDARDS**

- .1 ASTM International (ASTM):
  - .1 [ASTM C 167-\[18\]](#), Standard Test Methods for Thickness and Density of Blanket or Batt Thermal Insulations.
  - .2 [ASTM C 423-17](#) Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
  - .3 [ASTM C 553-\[19\]](#), Standard Specification for Mineral Fibre Blanket Thermal Insulation for Commercial and Industrial Applications.
  - .4 [ASTM C 665-\[17\]](#), Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
  - .5 [ASTM C 1320-\[20\]](#), Standard Practice for Installation of Mineral Fiber Batt and Blanket Thermal Insulation for Light Frame Construction.
  - .6 [ASTM E 90-\[09\]](#), Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
  - .7 [ASTM E 413-\[16\]](#), Classification for Rating Sound Insulation.
  - .8 [ASTM F 1667-\[18a\]](#), Standard Specification for Driven Fasteners: Nails, Spikes, and Staples.
- .2 CSA Group (CSA):
  - .1 [CSA B111-\[1974\]](#), Wire Nails, Spikes and Staples.
  - .2 [CSA B149](#) PACKAGE-[20], Consists of B149.1, Natural Gas and Propane Installation Code and B149.2, Propane Storage and Handling Code.
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
  - .1 Safety Data Sheets (SDS).
- .4 Underwriters Laboratories of Canada (ULC):
  - .1 ULC 102- [18], Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies (CAN/ULC S102).
  - .2 ULC 114-[18], Standard Method of Test for Determination of Non-Combustibility in Building Materials.
  - .3 ULC 604, Standard for Factory-Built Type A Chimneys (CAN/ULC-S604-[16]).
  - .4 ULC 702, Standard for Mineral Fibre Insulation for Buildings (CAN/ULC-S702-[15]).

### **1.04 ADMINISTRATIVE REQUIREMENTS**

- .1 Coordination: Coordinate building envelope commissioning with Division 1.

## **1.05 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Division 1.
- .2 Product Data: Submit manufacturer's instructions, product literature and data sheets for blanket insulation. Include product characteristics, performance criteria, physical sizes, and limitations.
- .3 Certificates: When requested, submit manufacturer's product certificates certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .4 Test Reports: When requested, submit certified test reports showing compliance with specified performance characteristics and physical properties.
- .5 Sustainable Design Submittals: Submit in accordance with Division 1 where applicable to project requirements.

## **1.06 DELIVERY, STORAGE, AND HANDLING**

- .1 Perform in accordance with Division 1.
- .2 Storage and Handling Requirements:
  - .1 Store materials in accordance with manufacturer's recommendations.
  - .2 Store and protect blanket insulation from weather exposure and water.
- .3 Develop Construction Waste Management Plan and/or Waste Reduction Workplan as related to Work of this Section in accordance with Division 1.
- .4 Packaging Waste Management: Perform in accordance with Division 1.

## **2 PRODUCTS**

### **2.01 INSULATION**

- .1 Batt and blanket mineral fibre: Non-combustible, stone wool batt insulation to [ASTM C 553](#), [ASTM C 665](#), CAN/ULC-S702.
  - .1 Type: 1.
  - .2 Fire performance:
    - .1 Non-combustibility: To [CAN/ULC S114](#).
      - .1 Flame spread: 0.
      - .2 Smoke developed: 5.
    - .2 Surface Burning Characteristics: To CAN/ULC S102.
      - .1 Flame spread: 0.
      - .2 Smoke developed: 0.
  - .3 Density: to [ASTM C 167](#)
  - .4 Thermal Resistance: Not applicable.
  - .5 Thickness: as indicated on Drawings.

### **2.02 ACCESSORIES**

- .1 Insulation clips:
  - .1 Impale type, perforated 50 x 50 mm cold rolled carbon steel 0.8 mm thick, adhesive back, spindle of 2.5 mm diameter annealed steel, length to suit insulation, 25 mm diameter washers of self locking type.
- .2 Nails: galvanized steel, length to suit insulation.

- .3 Staples: in accordance with manufacturer's recommendations.
- .4 Tape: as recommended by manufacturer.

### **3 EXECUTION**

#### **3.01 EXAMINATION**

- .1 Verification of Conditions: Verify that conditions of substrate previously installed are acceptable for blanket insulation application in accordance with manufacturer's instructions.
  - .1 Verify all in wall construction is complete.
  - .2 Verify building substrates are dry.
  - .3 Correct unacceptable conditions immediately upon discovery.
  - .4 Proceed with installation only after unacceptable conditions have been remedied.

#### **3.02 INSULATION INSTALLATION**

- .1 Install insulation to maintain continuity of thermal protection to building elements and spaces.
- .2 Install insulation with factory applied vapour barrier facing warm side of building spaces and vapour permeable membrane facing cold side. Lap ends and side flanges of membrane over framing members. Install as per manufacturer's instructions. Do not tear or cut vapour barrier.
- .3 Fit insulation closely around electrical boxes, pipes, ducts, frames and other objects in or passing through insulation.
- .4 Fill stud space of exterior framed walls with insulation full depth of stud only where no insulation/vapour retardant indicated on exterior face of stud walls.
- .5 Do not compress insulation to fit into spaces.
- .6 Keep insulation minimum 75 mm from heat emitting devices such as recessed light fixtures, and minimum 50 mm from sidewalls of CAN/ULC-S604 Type A chimneys and [CSA B149.1](#) and CSA B149.2 Type B and L vents.
- .7 Do not enclose insulation until it has been reviewed and is acceptable by AHJ.

**END OF SECTION**

## **1 GENERAL**

### **1.01 SUMMARY**

- .1 This Section specifies fire stop and smoke seal systems and materials intended to fill gaps between fire separations, between fire separations and other construction assemblies, or used in or around items which fully or partially penetrate a fire separation, to restrict the spread of fire and smoke thus maintaining the integrity of a fire separation.
- .2 This Section includes fire stopping and smoke seal work for the entire Project including selection, installation and inspection of all required fire stops by the Contractor's designated firestop subcontractor and or trade. Upon review of all drawings, Contractor will submit firestop systems that are suitable for the proposed Work.

### **1.02 RELATED REQUIREMENTS**

- .1 Section 07 21 16 – Blanket Insulation.

### **1.03 DEFINITIONS**

- .1 Fire Blocking: materials, components or system installed in a concealed space in the building to restrict the spread of fire and smoke in that concealed space or from that concealed space to an adjacent space.
- .2 Fire Stop System: a specific site erected construction consisting of the assembly, fire stop materials, any penetrating items and their means of support which have met the requirements for an F, FT, FH, FTH and/or L rating when tested in a fire-resistance rated assembly in accordance with [CAN/ULC-S115](#).
  - .1 F-Rating: the amount of time a fire stop system can remain in place without the passage of flame through the opening or the occurrence of flaming on the unexposed face of the fire stop.
  - .2 FT-Rating: a fire stop system with an F-Rating for the required time period which can also resist the transmission of heat through the fire stop during the same period and limit the rise in temperature on the unexposed face and/or penetrating item of the fire stop.
  - .3 FH-Rating: a fire stop system with an F-Rating for the required time period which can also resist the force of a hose stream without developing openings for a prescribed period.
  - .4 FTH-Rating: a fire stop system with an FT-Rating for the required time period which also passes the hose stream test for a prescribed period.
  - .5 L-Rating: largest test sample leakage rate, determined in accordance with the optional air leakage test in [CAN/ULC-S115](#).
- .3 System Design Listing: document providing proof of testing with technical details, specifications and requirements that leads to the application of a specific listed fire stop system.

### **1.04 REFERENCE STANDARDS**

- .1 ASTM International (ASTM):
  - .1 [ASTM A 1008/A 1008M-\[13\]](#) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable.
  - .2 [ASTM C 719-\[14\]](#), Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle).
  - .3 [ASTM C 920-\[14\]](#), Standard Specification for Elastomeric Joint Sealants.
  - .4 [ASTM E 84-\[21\]](#), Standard Test Method for Surface Burning Characteristics of Building Materials.
  - .5 [ASTM E 119-\[20\]](#), Standard Test Methods for Fire Tests of Building Construction and

- Materials.
  - .6 [ASTM E 136-\[19A\]](#), Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 degrees.
  - .7 [ASTM E 595-\[15\]](#), Standard Test Method for Total Mass Loss and Collected Volatile Condensable Materials from Outgassing in a Vacuum Environment.
  - .8 [ASTM E 814-\[13a\]](#), Standard Test Method for Fire Tests of Penetration Firestop Systems.
  - .9 [ASTM E 1966](#) [15], Standard Test Method for Fire Resistive Joint Systems.
  - .10 [ASTM E 2032-\[09\]](#), Standard Guide for Extension of Data From Fire Resistance Tests Conducted in Accordance with [ASTM E 119](#).
  - .11 [ASTM E 2174-\[20A\]](#), Standard Practice for On-Site Inspection of Installed Firestops.
  - .12 [ASTM E 2393-\[20A\]](#), Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers.
- .2 Firestop Contractors International Association (FCIA):
  - .1 FCIA Firestop Manual of Practice.
- .3 Factory Mutual Approvals (FM):
  - .1 FM 4990, Approval Standard for Fire stopping.
  - .2 FM 4991, Approval Standard for Firestop Contractors.
- .4 International Accreditation Service (IAS):
  - .1 IAS AC291, Accreditation Criteria for Special Inspection Agencies.
- .5 International Firestop Council (IFC):
  - .1 IFC Guidelines for Evaluating Engineering Judgments.
  - .2 IFC Guidelines for Evaluating Engineering Judgments - Perimeter Fire Barrier Systems.
  - .3 IFC Inspection Guidelines for Penetration Firestop Systems and Fire Resistive Joint Systems in Fire Resistance Rated Construction.
- .6 National Fire Protection Agency (NFPA):
  - .1 [NFPA 251-\[2006\]](#), Standard Methods of Tests of Fire Endurance of Building Construction and Materials.
- .7 National Research Council Canada (NRC):
  - .1 National Building Code of Canada (NBC).
  - .2 Best Practice Guide on Fire Stops and Fire Blocks and Their Impact on Sound Transmission.
- .8 ULC Standards (ULC):
  - .1 [CAN/ULC-S101-\[14\]](#), Standard Method of Fire Endurance Tests of Building Construction and Materials.
  - .2 CAN/ULC-S102-[10], Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
  - .3 [CAN/ULC-S114-\[05\]](#), Standard Method of Test for Determination of Non-Combustibility in Building Materials.
  - .4 [CAN/ULC-S115-\[11\]](#), Standard Method of Fire Tests of Firestop Systems.
- .9 Underwriters Laboratories Inc. (UL):
  - .1 UL 1479-[2015], Fire Tests of Penetration Firestops.
  - .2 UL Qualified Firestop Contractor Program.

## 1.05 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-Installation Meetings:
  - .1 Hold pre-installation meeting before beginning Work with Contractor, Subcontractor to:
    - .1 Verify Project requirements.



- .2 Review sustainable requirements.
    - .3 Review installation and substrate conditions.
    - .4 Discuss coordination with other Subcontractors.
    - .5 Review system design listings, manufacturer's installation instructions and warranty requirements.
    - .6 Review quantity and location of mock-ups.
  - .2 Hold pre-installation meetings with other trades to review:
    - .1 Installation procedures and precautions.
    - .2 Location, scheduling and sequencing of other work around fire stops that can affect the outcome of the installation.
    - .3 Requirements for annular opening sizes.
    - .4 Requirements and preparations for wall/floor single and multi-penetrations.
    - .5 Requirements for construction and perimeter joints.
    - .6 Mock-up requirements.
  - .3 Submit copies of applicable listed fire stop system details to each trade for opening preparation. Include installation details required for the listed system.
  - .4 Meeting minutes: Contractor to take minutes of pre-installation meetings and distribute to Owner and Consultant and each affected trade.
- .2 Sequencing:
- .1 Proceed with installation only when submittals have been reviewed by Consultant.
  - .2 Install fire stops located in floor assemblies before interior partition erections.
  - .3 Metal deck bonding: Unless otherwise noted on system design listing and manufacturer's installation instructions, fire stopping to precede spray-applied fireproofing to ensure required bonding.
  - .4 Pipe and duct insulation: Certified fire stop system component.
    - .1 Ensure pipe and duct insulation installation precedes fire stopping.

## **1.06 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Division 1.
- .2 Qualification Statement:
  - .1 Submit contractor qualification statements and certificates demonstrating compliance with the qualification requirements of this Section, as described in PART 1 - QUALITY ASSURANCE, after award of contract and before starting Work.
- .3 Product Data:
  - .1 Submit manufacturer's product data for each type of fire stopping and smoke seal. Submit complete product data for each individual component and include:
    - .1 Product name and product number.
    - .2 Product characteristics and performance criteria.
    - .3 Physical size, finish and limitations.
    - .4 Technical data on out-gassing, off-gassing and age testing.
    - .5 Curing time.
    - .6 Chemical compatibility with other construction materials.
    - .7 Shelf life.
    - .8 Life expectancy.
    - .9 Temperature range for installation.
    - .10 Humidity range for installation.
    - .11 Sound attenuation STC-Rating.
  - .2 Manufacture Product Certification:
    - .1 Submit manufacturer certification certifying products supplied comply with local regulations controlling use of Volatile Organic Compounds (VOC's) and are non-toxic to building occupants.
    - .2 Submit test reports showing compliance to [ASTM E 595](#).

- .3 Submit one copy of WHMIS Safety Data Sheets (SDS) for each individual component.
- .4 Submit a comprehensive list of all products and components included in submittal.
- .4 Shop Drawings:
  - .1 Submit shop drawings showing system design listings for Project including proposed materials, reinforcement, anchorage, fastenings and method of installation for all proposed firestop systems.
  - .2 Construction details to accurately reflect actual job conditions for each product and assembly.
  - .3 Submit details for materials and prefabricated devices.
  - .4 Submit electronic copy of shop drawings and include:
    - .1 Title page, labelled "Fire and Smoke Stop System Listings". Include project name, date and the names of the installation company and the manufacturer of proposed products.
    - .2 Table of Contents.
    - .3 List of each proposed listed fire stop system and corresponding service penetration type or joint type in a matrix spreadsheet schedule, indicating floor and wall system, including rating for each.
    - .4 Location of penetrations:
      - .1 Schedules listing each penetration with a unique identification number, their associated listing number, organized by floor, wall and ceiling area and indicating each room number.
    - .5 System Design Listings:
      - .1 Submit design listings for each listed fire stop system and each application identified in accordance with [CAN/ULC-S115](#).
      - .2 When more than one product is specified for the listed fire stop system or more than one packing/damming material is indicated, identify the item that will be used on this Project.
    - .6 Certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .5 Manufacturer's Instructions: Submit manufacturer's installation instructions and special handling criteria, installation sequence, cleaning procedures.
- .6 Reserved.
- .7 Quality Assurance Submittals: Submit the following in accordance with Section 01 43 00 - Quality Assurance:
  - .1 Test reports in accordance with [CAN/ULC-S101](#), [CAN/ULC-S102](#), and [CAN/ULC-S115](#).
    - .1 Submit certified test reports from approved independent testing laboratories, indicating compliance of applied fire stopping with specifications for specified performance characteristics and physical properties.
  - .2 Document from Engineer of Record showing compliance of alternative fire stopping solution with [CAN/ULC-S115](#) and the EJ guidelines provided by the National Research Council, Best Practice Guide on Fire Stops and Fire Blocks and Their Impact on Sound Transmission.
  - .3 Certificates: Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
  - .4 Manufacturer's Instructions: Submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.
  - .5 Manufacturer's Site Reports: Submit manufacturer's reports verifying compliance of Work, as described in SITE QUALITY CONTROL in Part 3 of this Section.
  - .6 Third-party Inspection: Where firestop manufacturer cannot provide field services, retain third-party inspection agency to review firestopping installation and provide report verifying firestop systems have been properly installed. Pay for costs for third-party inspection where required.

- .8 Engineering Judgments (EJ):
  - .1 Reserved.
- .9 Sustainable Design Submittals:
  - .1 Reserved.
- .10 Closeout Submittals:
  - .1 Submit in accordance with Division 1.
- .11 Operation and Maintenance Data: Submit maintenance data for incorporation into manual, including:
  - .1 WHMIS Safety Data Sheets (SDS),
  - .2 product data and manufacturer's installation and maintenance instructions for each product/system used on this project,
  - .3 approved system design listings and EJs, and
  - .4 matrix schedule listing all system design listings and EJs with a description of their penetration or joint type.
  - .5 Certifications:
    - .1 Provide proof of training for each worker that performed installation on the Project.
    - .2 Provide proof of company installing fire stopping and smoke seals is a Member in Good Standing with FCIA.
    - .3 Certification of company as a ULC Qualified and or FM 4991 Approved Firestop Contractor, including the Designated Responsible Individual (DRI) certificate.
    - .4 Accreditation of third-party inspection firm.
  - .6 Manufacturer's field reports.
  - .7 Warranty information on fire stop installations.
  - .8 Life expectancy of each product installed as part of Project. For each system, list the installation date of products and the expected expiration date (month/year).
- .12 Record Documentation:
  - .1 Maintain a daily log of all activities on site during the course of construction. Submit a copy of all daily logs after completion of fire stopping work.
  - .2 As-built Drawings:
    - .1 Submit a marked-up set of Drawings to provide referencing system identifying the location of each fire stop.
    - .2 Identify each penetration type fire stop with their penetration identification number.
  - .3 Provide detailed Drawings of system design listings for each type of fire stop (i.e., through-penetration, membrane penetration, blank opening, construction joint, building perimeter).
  - .4 Fire Stop Schedules:
    - .1 Submit complete fire stop schedules for floors, walls and ceilings.
    - .2 Indicate all penetration fire stops and joint fire stops through each reference wall, floor and ceiling in the schedules.
    - .3 Cross-reference firestop schedules with as-built drawings and indicate design listing numbers associated with each penetration fire stop and joint fire stop.

## 1.07 QUALITY ASSURANCE

- .1 Regulatory Requirements: Use materials and methods of determining required thickness of application that have the full acceptance of AHJ and that are tested in accordance with [CAN/ULC-S115](#), and form a part of a ULC or cUL listed system, Engineered Judgement or Equivalent Fire Resistance Rated Assembly.
- .2 Provide systems selection and analysis, installation and inspection of fire stop systems in accordance with the recommended practices detailed in the following guides:

- .1 FCIA Firestop Manual of Practice (MOP).
- .3 Qualifications:
  - .1 Contractor specializing in selection and installation of fire stops with five years documented experience
  - .2 The installers are recognized as a Member in Good Standing with the Firestop Contractors International Association (FCIA). Submit proof of current membership.
  - .3 Training: Workers, including site supervisor, to complete:
    - .1 Manufacturer training on the products/systems installed as part of this Section.
    - .2 Training under the FCIA Firestop Containment Worker Education Program.
  - .4 Certified Firestop Contractor: company certified with the following programs:
    - .1 ULC Qualified Firestop Contractor Program. Submit signed copy of certificate.
    - .2 FM 4991 Approved Firestop Contractor. Submit signed copy of FM Approval certificate.
  - .5 Third-Party Inspection Firm: IAS AC291 Accredited inspection agency with inspectors who have passed the ULC Firestop Exam and/or FM Firestop Exam.
- .4 Mock-ups:
  - .1 Where requested, construct mock-up of fire stop systems in accordance with Division 1.
- .5 Manufacturer Site Visits:
  - .1 Conducted after delivery and storage of products, and when preparatory Work is complete, but before installation begins.
  - .2 During progress of work.
  - .3 Conducted again upon completion of Work and after final cleaning is complete.

#### **1.08 DELIVERY, STORAGE AND HANDLING**

- .1 Packing, shipping, handling and unloading:
  - .1 Perform in accordance with Division 1.
  - .2 Deliver materials to the site in undamaged condition and in original unopened containers.
- .2 Storage and Protection:
  - .1 Store materials in accordance with manufacturer's instructions.
  - .2 Coordinate delivery of materials with scheduled installation dates to allow minimum storage time on site.
  - .3 Comply with recommended procedures, precautions and measures described in WHMIS Safety Data Sheets (SDS).
- .3 Waste Management and Disposal:
  - .1 Perform in accordance with Division 1.

#### **1.09 AMBIENT CONDITIONS**

- .1 Ambient Conditions:
  - .1 Install fire stops and smoke seals when ambient and substrate temperatures are within the limits prescribed by the manufacturer and when the substrate is dry and without risk of condensation.
  - .2 Maintain manufacturer's recommended ambient and substrate temperatures for installation.
- .2 Ventilate fire stops and smoke seals in accordance with manufacturers' instructions by natural means or, where this is inadequate or not available, use forced air circulation.

#### **1.10 WARRANTY**

- .1 Extend 12 month warranty period to 24 months for Work of this Section.

- .2 Manufacturers shall warrant work of this Section against defects and deficiencies in the product material for a period of 24 months. Promptly correct any defects or deficiencies which become apparent within warranty period at no expense.
- .3 Contractor warrants workmanship on materials and installation for a period of 24 months. Promptly correct any defects or deficiencies which become apparent within warranty period at no expense.

## **2 PRODUCTS**

### **2.01 MANUFACTURERS**

- .1 Provide products from a single manufacturer, to the greatest extent possible for each firestop system.
- .2 Acceptable Manufacturers: 3M, Hilti, STI (Specified Technologies Inc.)

### **2.02 SUSTAINABILITY CHARACTERISTICS**

- .1 Reserved.

### **2.03 PERFORMANCE/DESIGN CRITERIA**

- .1 Fire stop and smoke seal systems consisting of a material or combination of materials installed to maintain the integrity of the fire-resistance rating of a fire separation in accordance with the requirements of the Ontario Building Code (OBC).
- .2 Performance Requirements: Manufacturer shall design proprietary assemblies to withstand the listed ratings in accordance with the OBC, ULC Standards, and AHJ, and as follows:
  - .1 Non-rated fire separations: Provide L-Rated smoke protection fire stop system for application on both sides of separation.
  - .2 Provide through-penetration fire stop and joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of penetrated assembly, such as:
    - .1 Fire-resistance rated loadbearing walls, including partitions, with fire protection rated openings.
    - .2 Fire-resistance rated non-loadbearing walls, including partitions with fire protection rated openings.
    - .3 Fire-resistance rated floor assemblies.
  - .3 "F" Rated Systems: Provide through-penetration fire stop systems with F-ratings indicated, as determined by [CAN/ULC-S115](#) or [ASTM E 814](#), and equal to or exceeding the fire-resistance rating of the penetrations created during construction.
  - .4 "T" Rated Systems: Where fire stop systems protect penetrating items from potential contact with adjacent materials, provide through-penetration fire stop systems with T-ratings and F-ratings indicated, as determined by [CAN/ULC-S115](#) or [ASTM E 814](#), for the following conditions:
    - .1 Penetrations located outside wall cavities.
    - .2 Penetrations located outside fire resistive shaft enclosures.
    - .3 Penetrations located in a construction containing fire protection rated openings.
    - .4 Penetrating items larger than a 100-mm-diameter nominal pipe or 100 cm<sup>2</sup> in overall cross-sectional area.
  - .5 Fire stopping and Smoke Seal Systems Exposed to View: Provide products that after curing do not deteriorate when exposed to view, traffic, moisture, and physical damage both during and after construction, and as follows:
    - .1 Provide moisture resistant through-penetration fire stop systems for piping

- penetrations for plumbing and wet pipe sprinkler systems.
- .2 Provide fire stopping and smoke seal systems capable of supporting anticipated floor loads either by installing floor plates or by other means for floor penetrations with annular spaces exceeding 100 mm in width and exposed to possible loading and traffic.
- .3 Provide fire stopping and smoke seal systems not requiring removal of insulation for penetrations involving insulated piping.
- .4 Provide products with flame-spread ratings of less than 25 and smoke-developed ratings of less than 50 for fire stopping, smoke seal, and joint systems exposed to view.
- .5 Architectural considerations: When fire stop system is exposed to view, consider architectural finish, potential traffic, and exposure to moisture and heat.
- .6 Fire Resistance of Joint Systems: Assembly ratings and movement capabilities shall be as indicated with assembly ratings equal to or exceeding the fire-resistance rating of constructions in which joints are located.
- .3 Acoustic insulation properties as per system design listing.
- .4 Dynamic Joints: Where required, design fire stop and smoke seal systems to accommodate a defined amount of movement in structural elements, construction joints and mechanical piping caused by expansion or contraction. Systems should also accommodate movement and sound and vibration control in mechanical installations.
- .5 Insulated Pipes and Ducts: Design and test listed fire stop system with the actual insulation materials penetrating the fire separation, as indicated on the system design listing.
- .6 Use in Wet Areas: water-based products are unacceptable in wet areas or areas that may be subject to occasional water exposure or flooding during and after construction.
- .7 Environment Considerations: Select materials taking into consideration the environment in which they will be used during and after curing, as well as the intended use of the space. Confirm compatibility of the proposed materials/products with fire stop manufacturer for the following situations:
  - .1 Spaces requiring resistance to infection and biological spread through assemblies.
  - .2 Spaces containing sensitive electronic equipment.
  - .3 Preventing contamination of laboratory and manufacturing environments.

## 2.04 MATERIALS

- .1 Compatibility: Under conditions of service and application, provide fire stopping and smoke seal systems that are compatible with one another, with the substrates forming openings, and with the items, if any, penetrating the systems, as demonstrated by fire stopping and smoke seal system manufacturer based on testing and site experience, and as follows:
  - .1 Asbestos-free materials and systems capable of maintaining an effective barrier against the passage of flame, smoke and water and the transmission of heat in compliance with requirements of CAN-ULC-S115 and not to exceed opening sizes for which they are intended, as indicated on System Design Listing.
  - .2 Fire Stop System Rating: To match fire-resistance rating of fire separation as indicated on Drawings.
  - .3 Service penetration assemblies and fire stop components: Certified by testing laboratory to [CAN/ULC-S115](#) and FM Global Approval.
  - .4 Provide elastomeric seal or non-shrink foam cement mortar for fire and smoke stop systems at openings intended for re-entry, such as cables. Do not use cementitious or rigid seal at such locations.
  - .5 Provide elastomeric protection for fire and smoke stop systems at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control. Do not use a cementitious or rigid seal at such locations. Exemption for

- fire dampers.
- .6 Provide elastomeric seal for fire and smoke seals behind and around mechanical and electrical boxes within wall, floor, and ceiling assemblies.

## 2.05 FILL MATERIALS

- .1 General:
  - .1 Provide fire stopping and smoke seal systems containing the types of fill materials indicated in SCHEDULE in Part 3 of this Section by reference to the types of materials described in this Article. Fill materials are those referred to in directories of the referenced testing and inspecting agencies as fill, void, or cavity materials.
  - .2 Fire stopping and smoke seal systems shall be tested in accordance with [CAN/ULC-S115](#) and be comprised of asbestos free materials and systems capable of maintaining an effective barrier against flame, smoke and gases. Fire stopping and smoke seal systems not to exceed opening sizes for which they are intended for the ratings as indicated on Drawings.
- .2 Cast-in-Place Fire Stopping and Smoke Seal Devices: Factory assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.
- .3 Latex Sealants: Single component latex formulations that after curing do not re-emulsify during exposure to moisture.
- .4 Fire Stopping and Smoke Seal Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrating item.
- .5 Cable Penetration Devices:
  - .1 Pre-manufactured intumescent blocks
  - .2 Pre-manufactured sleeves, consisting of an adjustable core
  - .3 Pre-manufactured cable management system, consisting of a system of intumescent inserts and adjustable cores
- .6 Intumescent Composite Sheets: Rigid panels consisting of aluminum foil faced elastomeric sheet bonded to galvanized steel sheet.
- .7 Intumescent Putties: Non-hardening dielectric, water resistant putties containing no solvents, inorganic fibres, or silicone compounds.
- .8 Intumescent Spray Foam: Expanding spray-in-place intumescent foam sealant.
- .9 Intumescent Wrap Strips: Single component intumescent elastomeric sheets with aluminum foil on one side.
- .10 Intumescent, Latex Sealant: Single-component, intumescent, latex formulation.
- .11 Job-Mixed Vinyl Compound: Prepackaged vinyl-based powder product for mixing with water at Project site to produce a paintable compound, passing [ASTM E 136](#), with flame-spread and smoke-developed ratings of zero per [ASTM E 84](#).
- .12 Solvent-Release-Curing Intumescent Sealant: Solvent-release-curing, single-component, synthetic-polymer-based sealant of grade indicated below:
  - .1 Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces. Non-sag formulation for openings in vertical and other surfaces requiring a non-slumping/gunnable sealant, unless indicated fire stop system limits use non-sag grade.



- .13 Mortars: Pre-packaged, dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a non-shrinking, homogeneous mortar.
- .14 Pillows/Bags: Reusable, heat-expanding pillows/bags consisting of glass fibre cloth cases filled with a combination of mineral fibre, water insoluble expansion agents and fire-retardant additives.
- .15 Silicone Foams: Multi-component, silicone based liquid elastomers that, when mixed, expand and cure in-place to produce a flexible, non-shrinking foam.
- .16 Silicone Sealants: Moisture curing, single component, silicone based, neutral curing elastomeric sealants of grade indicated below:
  - .1 Grade for Horizontal Surfaces: Pourable (self-levelling) formulation for openings in floors and other horizontal surfaces.
  - .2 Grade for Vertical Surfaces: Non-sag formulation for openings in vertical and other surfaces.
- .17 Ceramic-Fibre and Mastic Coating: Ceramic fibres in bulk form formulated for use with mastic coating, and ceramic fibre manufacturer's mastic coating.
- .18 Ceramic-Fibre Sealant: Single-component formulation of ceramic fibres and inorganic binders.

## **2.06 MIXING**

- .1 For those products requiring mixing before application, comply with fire stopping and smoke seal system manufacturer's instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

## **2.07 FIRE-RESISTIVE ELASTOMERIC JOINT**

- .1 Elastomeric Sealant Standard: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer that comply with [ASTM C 920](#) requirements, including those referenced for Type, Grade, Class, and Uses, and requirements specified in this Section applicable to fire-resistive joint sealants.
- .2 Single-Component, Neutral-Curing Silicone Sealant: Type S; Grade NS; Class 25; exposure-related Use NT, and joint-substrate-related Uses M, G, A, and (as applicable to joint substrates indicated) O.
  - .1 Additional Movement Capability: When tested for adhesion and cohesion under maximum cyclic movement per [ASTM C 719](#), provide sealant with the capability to withstand the changes in joint width existing at the time of installation, and remain in compliance with other requirements of [ASTM C 920](#).
- .3 Multicomponent, Non-sag, Urethane Sealant: Type M; Grade NS; Class 25; exposure-related Use NT, and joint-substrate-related Uses M, A, and (as applicable to joint substrates indicated) O.
  - .1 Additional Movement Capability: When tested for adhesion and cohesion under maximum cyclic movement per [ASTM C 719](#), provide sealant with the capability to withstand the change in joint width existing at the time of installation, and remain in compliance with other requirements of [ASTM C 920](#).
- .4 Single-Component, Non-sag, Urethane Sealant: Type S; Grade NS; Class 25; and Uses NT, M, A, and (as applicable to joint substrates indicated) O.



## **2.08 FIRE STOP IDENTIFICATION**

- .1 Identification Labels and Markings: Permanent for the expected service life of the installation.
- .2 Fire Stopped Penetrations:
  - .1 Provide identification labels at each penetration Where directed.
- .3 Fire Separation (Barrier) Markings:
  - .1 Reserved.

## **2.09 ACCESSORIES**

- .1 Provide components for each fire stopping and smoke seal system needed to install fill materials. Use only components specified by fire stopping and smoke seal system manufacturer and approved by the qualified testing and inspecting agency for fire stopping and smoke seal systems indicated on Drawings.
- .2 Primers: To manufacturer's recommendation for specific material, substrate, and end use.
- .3 Water (if applicable): Potable, clean and free from harmful amounts of deleterious substances.
- .4 Metal Fire Stop: Commercial galvanized steel, to [ASTM A 1008/A 1008M](#), zinc coating 260 g/m<sup>2</sup>, minimum metal core thickness 0.912 mm.
- .5 Steel Deck Moulded Flute Inserts: One-piece moulded mineral fibre flute inserts, sized for steel deck profiles, for placement at top of fire-rated wall assemblies
- .6 Packing/Damming Materials, Supports and Anchoring Devices: To manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to AHJ.
- .7 Fire Stop Insulation: Pre-formed, semi-rigid, non-combustible mineral wool And other products required by firestop system design listing.
- .8 Junction Box/Outlet Sealing Putty: Intumescent putty, pre-formed in pads.
- .9 Sealants: Good adhesion without use of primer, high visibility safety colours.
  - .1 Flame-spread rating: Maximum 25.
  - .2 Smoke development classification: Maximum 50.
  - .3 For vertical joints: Non-sagging
  - .4 For horizontal joints: Single component, self-levelling

## **3 EXECUTION**

### **3.01 EXAMINATION**

- .1 Verify that conditions of substrates previously installed are acceptable for product installation in accordance with manufacturer's instructions and approved system design listings for each condition.
- .2 Verify each opening/annular space to ensure it does not exceed the maximum and minimum dimensions indicated on the approved system design listing.
- .3 Verify that all joints, service penetrating elements and supporting devices/hangers have been properly installed as indicated on approved system design listings. Remove all temporary lines and markings to meet the approved system design listings.
- .4 Verify that proposed fire stop system consists of components that are compatible with each other,

with substrates forming the openings, and with items, if any, penetrating the fire stop under conditions of application and service, as demonstrated by the fire stop manufacturer based on testing and site experience.

- .5 Pipe and Duct Insulation: Confirm that proposed fire stop system has been tested with the actual insulation penetrating the fire separation on site, as indicated in the approved system design listing. Maintain insulation around pipes and ducts penetrating the fire separation.
- .6 Ensure no additional items have been installed through opening that does not appear on the approved system design listing.
- .7 Ensure fire stopped areas are accessible for proper application and that conditions are suitable for installation of the fire stop system. Areas to remain accessible for inspection.
- .8 Correct any defective surfaces or conditions affecting the fire stop system installation immediately and before commencing any installations.
- .9 Proceed only once defected surfaces or conditions have been corrected.
- .10 Proceed with installation only after unacceptable conditions have been remedied.

### **3.02 PREPARATION**

- .1 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials.
  - .1 Ensure that substrates and surfaces are clean, dry and frost free.
  - .2 Ensure substrates and surfaces are free of dirt, grease, oil, rust, laitance, release agents, water repellents, and any other substances that may affect proper adhesion.
- .2 Prepare surfaces in contact with fire stop and smoke stop materials to manufacturer's instructions.
- .3 Maintain insulation around pipes and ducts penetrating fire separation.
- .4 Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.
- .5 Protect adjacent work areas and finish surfaces from damage during product installation.
- .6 Prime surfaces as required.
- .7 Ensure multi-penetration openings have been framed and boarded out around annular openings, as indicated in the system design listing before prepping the opening.

### **3.03 INSTALLATION**

- .1 Install fire stop and smoke seal materials and components in accordance with manufacturer's certified tested system listing.
- .2 Coordinate with other sub-trades to ensure that all pipes, conduits, cables, and other items, which penetrate fire separations, have been permanently installed before installation of fire stop systems.
- .3 Schedule work to ensure that fire separations and all other construction that conceals penetrations are not erected before installation of fire and smoke seal systems
- .4 Seal holes or voids made by through-penetrations, poke-through termination devices, and un-penetrated openings or joints to ensure that both continuity and integrity of fire separation are

maintained.

- .5 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing per manufacturer's instructions.
- .6 Tool or trowel exposed surfaces to neat finish.
- .7 Remove excess compound promptly as work progresses and upon completion.
- .8 Protect gaps around recessed components (e.g., panels, electrical boxes, outlets) with sealing putty in accordance with manufacturer's instructions.
- .9 Do not use damaged or expired material.

### **3.04 INSTALLATION - JOINT FIRE STOPS**

- .1 For sealant applications, install joint fillers to support fire stop materials during application. Position joint fillers to ensure fire stop material cross-sectional shape and thickness relative to the joint width allows for optimum sealant movement, while developing the required fire-resistance rating.
- .2 Install fire stops using techniques recommended by the manufacturer:
  - .1 Fully wetting joint substrates to optimize adhesion.
  - .2 Completely filling recesses provided for each joint configuration.
  - .3 Tool non-sag fire stop materials immediately after their application and before the time skinning begins. Form smooth, uniform beads of configuration indicated or required to
    - .1 provide required fire-resistance rating,
    - .2 eliminate air pockets, and
    - .3 ensure contact and adhesion with sides of joint.
  - .4 Joint Systems and Perimeter Fire Containment Systems:
    - .1 For systems with dynamic joints, ensure movement capabilities of the installation meet or exceed the movement expectations of the system design listing and manufacturer's installation instructions.

### **3.05 INSTALLATION - THROUGH PENETRATION JOINT SEALANTS**

- .1 Install forming/damming materials and other accessories of types required to support fill materials during their application and in the position required to achieve fire ratings of designated through-penetration fire stop systems.
- .2 Install fill materials for through-penetration fire stop systems by techniques recommended by the manufacturer to produce the following results:
  - .1 Completely fill voids and cavities formed by openings, forming materials, accessories, and penetrating items.
  - .2 Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
  - .3 For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.
- .3 Remove combustible forming materials and other accessories not indicated as permanent components of fire stop systems.

### **3.06 IDENTIFICATION**

- .1 General:
  - .1 Clean substrate before applying identification.
  - .2 Determine final location of identification on site.

- .3 Identification is not required on both sides of the fire separation.
- .4 Refer to Drawings for locations of fire separations and rating required.
- .2 Fire Stopped Penetrations:
  - .1 Install identification label adjacent to each fire stopped wall/floor service penetration. Provide one identification label per single opening or per grouping cluster.
  - .2 Securely apply identification to substrate by providing adequate adhesive
  - .3 Secure tags with metal fasteners or hang with metal chain or wire.
  - .4 Identification shall be completely filled out and installed before requesting substantial performance.
- .3 Fire Separations (Barriers):
  - .1 Reserved.

### **3.07 REPAIRS AND MODIFICATIONS**

- .1 Identify damaged or re-entered seals requiring repair or modification.
- .2 Remove loose or damaged materials. If adding penetrating items, remove sufficient material to insert new elements and to avoid damaging the balance of the seal.
- .3 Ensure sealed surfaces are clean and dry.
- .4 Use only materials that are suitable for repair of original seal, as approved by manufacturer. Do not mix products from different manufacturers.

### **3.08 SITE QUALITY CONTROL**

- .1 Inspections: Notify Consultant and Manufacturer (Third-party Inspection Agency where applicable) when ready for inspection and before concealing or enclosing fire stop materials and service penetration assemblies.
- .2 Manufacturer's Field Services:
  - .1 Obtain report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Site Reports as described in SUBMITTALS in Part 1 of this Section.
  - .2 Provide manufacturer's site services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
- .3 Third-party Inspections:
  - .1 Where firestop manufacturer(s) field review services are not available. Retain Third-party Inspection agency to review firestop installation and submit report confirming firestop systems have been properly installed.

### **3.09 INSPECTIONS**

- .1 Third-Party Inspection Firm: Provide the services of a third-party inspection firm to conduct random inspections and direct exploratory review (i.e., destructive testing) during the course of construction and before closing off any concealed areas. Perform inspections and destructive testing in compliance with [ASTM E 2174](#) and [ASTM E 2393](#).
- .2 Upon completion of construction and before requesting substantial performance review, fire stop contractor and manufacturer's representative shall inspect all fire stopping work and prepare a

deficiency list. Submit deficiency list to Consultant for review. Repair any deficiencies and re-inspect work to ensure that all deficiencies have been completed.

- .3 Submit formal request for substantial performance review of work once all work is completed, quality control has been performed and all fire stop installations have been inspected and identified with the approved fire stop identification labels.

### **3.10 CLEANING**

- .1 Perform cleaning in accordance with Division 1.
- .2 Remove equipment, excess materials and debris and clean adjacent surfaces immediately after application. Use methods and cleaning materials approved by manufacturer.
- .3 Protect fire stops during and after curing period from contact with contaminating substances
- .4 Remove temporary dams after initial set of fire stop and smoke seal materials.

### **3.11 SCHEDULE**

- .1 Provide fire stop and L-Rated smoke-resistant fire stop systems in accordance with drawings.
- .2 Design and provide through-penetration fire stopping and smoke seals as follows:
  - .1 Systems with no penetrating items, select one or more of the following fill materials:
    - .1 latex sealant.
    - .2 silicone sealant.
    - .3 intumescent putty.
    - .4 intumescent foam blocks or boards.
    - .5 intumescent spray foam.
  - .2 Systems for metallic pipes, conduit, or tubing, select one or more of the following fill materials:
    - .1 latex sealant.
    - .2 silicone sealant.
    - .3 intumescent putty.
    - .4 intumescent foam blocks or boards.
    - .5 intumescent spray foam.
  - .3 Systems for non-metallic pipe, conduit, or tubing, select one or more of the following fill materials:
    - .1 latex sealant.
    - .2 silicone sealant.
    - .3 intumescent putty.
    - .4 intumescent foam blocks or boards.
    - .5 intumescent spray foam.
  - .4 Re-enterable and cable managed systems for electrical, and data and communications cables:
    - .1 prefabricated fire stop sleeve cp653 (hilti).
    - .2 preformed intumescent blocks cfs-bl (hilti).
    - .3 preformed intumescent blocks (3M).
    - .4 prefabricated cable pathways (ez-path).
  - .5 Systems for electrical, and data and communications cables, select one or more of the following fill materials:
    - .1 latex sealant.
    - .2 silicone sealant.
    - .3 intumescent putty.
    - .4 silicone foam.
    - .5 prefabricated fire stop sleeve cp 653 (hilti).
    - .6 preformed intumescent blocks cfs-bl (hilti).

- .7 preformed intumescent blocks (3M).
    - .8 prefabricated cable pathways (ez-path).
    - .9 intumescent foam blocks or boards.
    - .10 intumescent spray foam.
  - .6 Systems for cable trays, select one or more of the following fill materials:
    - .1 latex sealant.
    - .2 intumescent putty.
    - .3 silicone foam.
    - .4 pillows/bags.
    - .5 intumescent foam blocks or boards.
  - .7 Systems for insulated pipes, select one or more of the following fill materials:
    - .1 latex sealant.
    - .2 intumescent putty.
    - .3 silicone foam.
    - .4 intumescent wrap strips.
    - .5 intumescent foam blocks or boards.
    - .6 intumescent spray foam.
  - .8 Systems for miscellaneous electrical penetrations, select one or more of the following fill materials:
    - .1 latex sealant.
    - .2 intumescent putty.
    - .3 intumescent foam blocks or boards.
    - .4 intumescent spray foam.
  - .9 Systems for miscellaneous mechanical penetrations, select one or more of the following fill materials:
    - .1 latex sealant.
    - .2 intumescent foam blocks or boards.
    - .3 intumescent spray foam.
  - .10 Systems for groupings of penetrations, select one or more of the following fill materials:
    - .1 latex sealant.
    - .2 intumescent wrap strips.
    - .3 fire stopping and smoke seal device.
    - .4 intumescent composite sheet.
    - .5 intumescent foam blocks or boards.
    - .6 intumescent spray foam.
- .3 Design and provide joint fire stopping and smoke seals as follows for:
  - .1 Floor-to-Floor, Fire-Resistive Joint System: Provide materials to meet the following criteria:
    - .1 assembly rating: as indicated.
    - .2 nominal joint width: as indicated.
    - .3 movement capabilities: compression and extension.
  - .2 Floor-to-Wall, Fire-Resistive Joint System: Provide materials to meet the following criteria:
    - .1 assembly rating: as indicated.
    - .2 nominal joint width: as indicated.
    - .3 movement capabilities: to be confirmed, compression, extension, or horizontal shear.
  - .3 Head-of-Wall, Fire-Resistive Joint System: Provide materials to meet the following criteria:
    - .1 assembly rating: as indicated.
    - .2 nominal joint width: as indicated.
    - .3 movement capabilities: compression and extension.
  - .4 Wall-to-Wall, Fire-Resistive Joint System: Provide materials to meet the following criteria:
    - .1 assembly rating: as indicated.
    - .2 nominal joint width: as indicated.

- .3 movement capabilities: compression and extension.
- .4 Design and provide perimeter fire containment fire stopping and smoke seals as follows for:
  - .1 Perimeter Fire Containment System: Provide materials to meet the following criteria:
    - .1 integrity rating: as indicated.
    - .2 insulation rating: as indicated.
    - .3 linear opening width: as indicated.

**END OF SECTION**

## **1 GENERAL**

### **1.01 RELATED REQUIREMENTS**

- .1 Section 07 84 00 - Fire Stopping.

### **1.02 RESERVED**

- .1 Reserved.

### **1.03 REFERENCE STANDARDS**

- .1 ASTM International (ASTM):
  - .1 [ASTM C 834-\[17\]](#), Standard Specification for Latex Sealants
  - .2 [ASTM C 919-\[19\]](#), Standard Practice for Use of Sealants in Acoustical Applications
  - .3 [ASTM C 920-\[18\]](#), Standard Specification for Elastomeric Joint Sealants
  - .4 [ASTM C 1193-\[16\]](#), Standard Guide for Use of Joint Sealants
  - .5 [ASTM C 1330-\[18\]](#), Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants
  - .6 [ASTM C 1481-\[12\]](#), Standard Guide for Use of Joint Sealants with Exterior Insulation and Finish Systems (EIFS)
  - .7 [ASTM D 1056-\[20\]](#), Standard Specification for Flexible Cellular Materials-Sponge or Expanded Rubber
  - .8 [ASTM D 2240-\[15e1\]](#), Standard Test Methods for Rubber Property, Durometer Hardness
  - .9 [ASTM D 2628-\[91\]](#), Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements
- .2 Canadian General Standards Board (CGSB) 1330:
  - .1 [CAN/CGSB-19.24-\[M90\]](#), Multi-component, Chemical Curing Sealing Compound.
- .3 Department of Justice Canada (Jus):
  - .1 Canadian Environmental Protection Act, 1999 (2018) (CEPA).
- .4 General Services Administration (GSA) - Federal Specifications (FS):
  - .1 FS-SS-S-200-[E(2)1993], Sealants, Joint, Two-Component, Jet-Blast-Resistant, Cold Applied, for Portland Cement Concrete Pavement.
- .5 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
  - .1 Safety Data Sheets (SDS).
  - .2 Sealant, Waterproofing, and Restoration Institute (SWRI): Sealants: The Professionals' Guide 2013.
- .6 Transport Canada (TC):
  - .1 Transportation of Dangerous Goods Act, 1992 (2019 amended.) (TDGA).
- .7 ULC Standards/ UL Canada (ULC):
  - .1 CAN/ULC 115-[2018], Standard Method of Fire Tests of Firestop Systems.

### **1.04 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Division 1.
- .2 Product Data:
  - .1 Submit manufacturer's product data for each type of primer, backer rod, and sealants and include product characteristics, performance criteria, available colours, compatibility warnings, compliance standards and limitations.
  - .2 Submit one electronic copy of WHMIS SDS.



- .3 Reserved.
- .4 Certificates: Where requested, submit manufacturer's product certificates indicating proposed sealant is appropriate for each application on this Project.
- .5 Manufacturer's Instructions:
  - .1 Submit instructions for each type of product.
- .6 Reserved.

#### **1.05 CLOSEOUT SUBMITTALS**

- .1 Submit in accordance with Division 1.
- .2 Operation and Maintenance Data: Submit maintenance data for incorporation into manual.

#### **1.06 QUALITY ASSURANCE**

- .1 Qualifications:
  - .1 Manufacturer: Obtain each type of joint sealant from a single manufacturer.
  - .2 Minimum 5 years successful experience in Work of similar size and complexity.
- .2 Compatibility: Ensure sealants are compatible with adjacent materials and are approved by manufacturer for use with adjacent materials.
- .3 Mock-Ups:
  - .1 Construct mock up in accordance with Division 1.
  - .2 Before performing sealant work do sample applications of each type of sealant for review.
  - .3 Site locations for sample applications shall be designated by Consultant.
  - .4 Construct joint sealant mock-ups in assemblies of other Sections with joint sealants, which are referenced in this Section.
- .4 Comply with requirements of WHMIS regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and provision of Safety Data Sheets (SDS) acceptable to Health Canada.

#### **1.07 DELIVERY, STORAGE AND HANDLING**

- .1 Perform in accordance with Division 1.
- .2 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging, with manufacturer's label.
- .3 Storage and Handling Requirements:
  - .1 Store materials in accordance with manufacturer's recommendations.
  - .2 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.
  - .3 Do not dispose of unused sealant material into sewer system, streams, lakes, onto ground or in other location where it will pose health or environmental hazard.
  - .4 Divert unused joint sealing material from landfill to official hazardous material collections site approved by manufacturer.

#### **1.08 AMBIENT CONDITIONS**

- .1 Proceed with installation of joint sealants only when:
  - .1 Ambient and substrate temperature conditions are within limits permitted by joint sealant manufacturer or are above 4.4 degrees C.
  - .2 Joint substrates are dry.

- .3 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.
- .2 Ventilate area of work as required to comply with health & safety requirements.

## **1.09 WARRANTY**

- .1 Manufacturer's warranty: Provide manufacturer's standard warranty documentation.
- .2 Warrant that sealant work will not leak, crack, crumble, melt, shrink, run, lose adhesion or stain adjacent surfaces in accordance with General Conditions.
- .3 Installer's Warranty: Provide an installation warranty, installer agrees to repair or replace joint sealants that do not comply with requirements of this Section for 2 years from Substantial Performance.

## **2 PRODUCTS**

### **2.01 SUSTAINABILITY CHARACTERISTICS**

- .1 When low toxicity sealants are not possible, confine usage to areas which off gas to exterior, are contained behind air barriers, or are applied several months before occupancy to maximize off gas time.
- .2 Reserved.

### **2.02 PERFORMANCE REQUIREMENTS**

- .1 Each sealant system shall meet the following requirements for warranty period:
  - .1 Waterproof, flexible, and compatible with substrate under applicable service conditions.
  - .2 Provide a weather-tight seal that does not allow moisture penetration.
  - .3 Shall not de-bond, crack, or craze.
  - .4 Shall not leak.

### **2.03 SEALANT MATERIALS**

- .1 In air handling units and supply air system, use sealants without strong odours, without toxic chemicals, and are mould-resistant. When low toxicity sealants are not possible, confine usage to areas which off gas to exterior, are contained behind air barriers, or are applied several months before occupancy to maximize off gas time.
- .2 Provide primers in accordance with manufacturer recommendation.

### **2.04 SEALANT MATERIAL DESIGNATIONS**

- .1 Type S-1: Acrylic Latex One Part, Shore A Hardness 20.
- .2 Type S-2: Silicone Sealant; mould and mildew resistant.
  - .1 To [ASTM C 920](#), [CAN/CGSB-19.13](#); Type S; Grade NS; Class 50; Use NT, G, and A.
  - .2 To [ASTM C 920](#), [CAN/CGSB-19.13](#); Type S; Grade NS; Class 25; Use NT, G, and A.
- .3 Type S-3: Silicone Sealant; general construction and air-seal sealant.
  - .1 To [ASTM C 920](#); Type S; Grade NS; Class 25; Use NT, M, G, A, O.
- .4 Type S-4: Silicone Sealant; structural glazing.
  - .1 To [ASTM C 920](#), [CAN/CGSB-19.13](#); Type S; Grade NS; Class 25; Use NT, A, G, O.

- .5 Type S-5: Acoustical Sealant; interior, non-skimming, non-hardening, simple component synthetic rubber sealant, to [ASTM C 919](#).
- .6 Type S-6: Multi-component polyurethane sealant; chemical curing, exterior wall sealant.
  - .1 To [ASTM C 920](#), [CAN/CGSB-19.24](#): Type M; Grade NS; Class 50; Use T, NT, M, A, O.
- .7 Type S-7: One-component polyurethane sealant; non-sag, for general construction.
  - .1 To [ASTM C 920](#), [CAN/CGSB-19.24](#): Type S; Grade NS; Class 25; Use NT, M, A, O.
- .8 Type S-8: Horizontal joint sealant; two component, self-levelling.
  - .1 To [ASTM C 920](#), [CAN/CGSB-19.13](#): Type M; Grade P; Class 25; Use T, M, O.
- .9 Type S-9: One part moisture curing, low modulus polyurethane sealant for sealing joints in level and slightly slope surfaces conforming to [ASTM C 920](#), [CAN/CGSB-19.24](#), Type S, Grade P, Class 50, Use T, M, A,O, MC-1-25-B-N.
- .10 Type S-10: Control joint sealant: two-component, epoxy-urethane, self-levelling, load bearing saw cut or preformed control joints.
- .11 Type S-11 Control Joint Sealant: Two component, polyurea based, load bearing, self levelling sealant.
- .12 Type S-12 Control Joint Sealant: Two component, semi-rigid epoxy, load bearing, self levelling sealant.
- .13 Type S-13: One-component polyurethane sealant; medium-modulus, non-sag, low-VOC, UV stable, to [CAN/CGSB-19.24](#).

## **2.05 SEALANT SELECTION**

- .1 Where no specific type of sealant is scheduled, provide one of the sealants indicated in this Section appropriate for its application and consistent with manufacturer's recommendations and the recommendations of SWRI, Sealants: The Professionals' Guide.
- .2 Make sealant selections consistent with manufacturer's recommendations.
- .3 Use acrylic sealant Type S-1 only on the interior and only in situations where little or no movement can occur.
- .4 Use mould & mildew resistant silicone sealant Type S-2 for nonmoving joints in washrooms and kitchens. Do not use on floors.
- .5 Use silicone general construction sealant Type S-3 or Type S-6 and S-7 for all joints, interior and exterior, where no other specific sealant type specified.
- .6 Use structural glazing silicone Type S-4 for sealing glass, interior and exterior.
- .7 Use acoustical sealant Type S-5 and air seal sealant Type S-3 only where they will be fully concealed and only where no constant or consistent air pressure difference will exist across the joint.
- .8 Use multi component sealant type S-6, primed penetration element surfaces other than concrete, for mechanical and electrical service penetrations in concrete foundation walls.
- .9 Use multi component sealant Type S-8 for horizontal joint sealant of plaza, floors and decks, exterior areas only, subject to pedestrian and vehicular traffic.
- .10 Use polyurethane, semi-self levelling sealant Type S-9 for in expansion joints in sidewalks, plazas, floors and other pedestrian and vehicular horizontal surfaces with slopes up to 6%.

- .11 Use control joint sealant S-10 as filler for interior, horizontal saw cut or preformed control joints where joints are subject to load bearing conditions.
- .12 Use control joint sealant S-10 as filler for interior only, horizontal saw cut or preformed control joints where joints are subject to load bearing conditions.
- .13 Use control joint sealant S-11 as filler for interior, horizontal saw cut or preformed control joints, where joints are subject to low temperatures (freezer floors) and where joints require nosing support.
- .14 Use control joint sealant S-12 as filler for interior, horizontal saw cut or preformed control joints where joints are subject to thermal shock conditions, traffic loops, and where a high bond strength is required.
- .15 Use sealant S-13 for sealing exterior holes and penetrations around pipes and other services passing through concrete foundations and requiring greater movement capability.

## 2.06 ACCESSORIES

- .1 Preformed compressible and non-compressible back-up materials that are non-staining, compatible with joint substrate, sealants, primers, and other joint fillers, and are approved for applications indicated by sealant manufacturer based on site experience and laboratory testing:
  - .1 Rod Type Sealant Backings:
    - .1 [ASTM C 1330](#), Type C (closed cell material with a surface skin), Type O (open cell material) or Type B (bi cellular material with a surface skin).
    - .2 Provide any of the preceding types, as approved in writing by joint sealant manufacturer for joint application indicated.
    - .3 Size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
    - .4 Non adhering to sealant, to maintain two sided adhesion across joint.
  - .2 High Density Foam:
    - .1 Extruded closed cell polyvinyl chloride (PVC), extruded polyethylene, closed cell, Shore A hardness 20, tensile strength 140 to 200 kPa, extruded polyolefin foam, 32 kg/m<sup>3</sup> density, or neoprene foam backer, size as recommended by manufacturer.
  - .3 Elastomeric Tubing Joint Fillers: Neoprene, butyl, EPDM, or silicone tubing complying with [ASTM D 1056](#), non absorbent to water and gas, capable of remaining resilient at temperatures down to 15 deg C. Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth and otherwise contribute to optimum sealant performance.
  - .4 Bond Breaker Tape:
    - .1 Polyethylene bond breaker tape or other tape recommended by sealant manufacturer which will not bond to sealant.
- .2 Preformed Sealants:
  - .1 Preformed Silicone Sealant System: Manufacturer's standard system consisting of pre-cured low modulus silicone extrusion, in sizes to fit joint widths indicated, combined with a neutral curing silicone sealant for bonding extrusions to substrates.
  - .2 Preformed Hollow Neoprene Gasket: Manufacturer's standard preformed polychloroprene elastomeric joint seal of the open cell compression type complying with [ASTM D 2628](#) and with requirements for size, profile and cross sectional design.
- .3 Bond Breaker: Pressure-sensitive plastic tape that will not bond to sealants.
- .4 Joint Cleaner: Provide a non-corrosive and non-staining type, compatible with joint forming materials and sealant in accordance with sealant manufacturer's recommendations
- .5 Primer: Provide in accordance with sealant manufacturer's recommendations.

- .6 Masking Tape: Non-absorbent type, non-staining, compatible with joint sealant and joint substrates.

## **2.07 COLOURS**

- .1 Sealant Colours: Match colour of adjacent materials where visible, as selected by Consultant, from manufacturer's standard colour range.

## **3 EXECUTION**

### **3.01 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed are acceptable for joint sealants installation in accordance with manufacturer's instructions.
  - .1 Visually inspect substrate.
  - .2 Verify joint surfaces are dry and frost free.
  - .3 Verify substrates are without contaminants capable of interfering with sealant adhesion. Remove contaminants where occurring.
  - .4 Examine joint sizes and conditions to establish acceptable depth to width ratio for installation of backup materials and application of sealants.
  - .5 Verify joint widths are within the limits recommended by joint sealant manufacturer for applications indicated.
  - .6 Correct unacceptable conditions immediately upon discovery.
  - .7 Proceed with installation only after unacceptable conditions have been remedied.

### **3.02 SURFACE PREPARATION**

- .1 Clean bonding joint surfaces of harmful contaminants including dust, rust, oil grease, and other matter which may impair adhesion.
- .2 Do not apply sealants to joint substrates treated with sealer, curing compound, water repellent, or other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required.
- .3 Prepare surfaces in accordance with manufacturer's directions.

### **3.03 PRIMING**

- .1 Mask adjacent surfaces prior to priming and sealing where necessary to prevent staining.
- .2 Prime sides of joints in accordance with sealant manufacturer's instructions immediately applying sealant, except when manufacturer's instructions explicitly state priming is not required.
- .3 Prime all porous material (e.g. wood, masonry, concrete, ceramic or paver tile, etc).

### **3.04 BACKUP MATERIAL**

- .1 Provide backer rod as specified, to limit depth of sealant and to act as bond breaker at back of joint.
- .2 Install joint filler to achieve correct joint depth and shape, with approximately 30% compression.
- .3 Apply paper masking tape to back of joint to act as bond break where depth of joint does not permit the use of backer rod.
- .4 Ensure that no joints are formed which are bonded on adjacent sides where there is any possibility of movement.

### **3.05 MIXING**

- .1 Mix materials in strict accordance with sealant manufacturer's instructions.

### **3.06 APPLICATION**

- .1 Sealant: Application: Apply sealants to recommendations of [ASTM C 1193](#), and of [ASTM C 1481](#) for EIFS systems, and in accordance with manufacturer's instructions, and as follows:
  - .1 Apply sealant within recommended temperature ranges. Consult manufacturer when sealant cannot be applied within recommended temperature range.
  - .2 Mask edges of joint where irregular surface or sensitive joint border exists to provide neat joint.
  - .3 For joints where movement is possible, apply backer rod to achieve a joint depth of one half the joint width but not less than 9 mm; for joints larger than 25 mm use a depth of 13 mm.
  - .4 Apply sealant in a continuous beads.
  - .5 Apply sealant using gun with proper size nozzle.
  - .6 Fill voids and joints solid.
  - .7 Form sealant surface with a smooth full bead, without from ridges, wrinkles, sags, air pockets, embedded impurities.
  - .8 Tool exposed surfaces before skinning begins to give slightly concave shape.
  - .9 Ensure bead is solid, filling entire space between sides and bedding material, exerting sufficient pressure to obtain maximum bond, by allowing sealant to bulge out in advance of nozzle.
  - .10 Apply sealant within recommended temperature ranges. Consult manufacturer when sealant cannot be applied within recommended temperature range.
  - .11 Seal at all locations where dissimilar material meet.
- .2 Sealant Curing:
  - .1 Cure sealants in accordance with sealant manufacturer's instructions.
  - .2 Do not cover up sealants until after curing has completed.

### **3.07 CLEANING**

- .1 Progress Cleaning: Clean in accordance with Division 1.
  - .1 Clean adjacent surfaces immediately of excess primers and sealants.
  - .2 Remove excess and droppings, using recommended cleaners as work progresses.
  - .3 Remove masking tape after initial set of sealant.
- .2 Final Cleaning: Perform in accordance with Division 1 upon completion.
- .3 Waste Management: Perform in accordance with Division 1.
  - .1 Do not dispose of unused sealant materials into sewer system, streams, lakes, onto ground, or other location where it might pose a health or environmental hazard.
  - .2 Divert unused sealants from landfill to a hazardous material collection site.
  - .3 Place materials defined as hazardous or toxic in designated containers.
  - .4 Dispose of hazardous materials in accordance with the CEPA, TDGA, regional and municipal regulations.

### **3.08 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by joint sealants installation.

### **3.09 SCHEDULE**

- .1 Use acrylic sealant Type S-1 only on the interior and only where little or no movement can occur.

- .2 Use mould and mildew-resistant silicone sealant Type S-2 for non-moving joints in washrooms and kitchens. Do not use on floors.
- .3 Use silicone general construction sealant Type S-3 or Type S-6 and S-7 for all joints, interior and exterior, where no other specific sealant type is specified.
- .4 Use structural glazing silicone Type S-4 for sealing structural glass and sealing butt-to glazing joints, interior and exterior.
- .5 Use acoustical sealant Type S-5 only where they will be fully concealed and only where no constant or consistent air pressure difference will exist across the joint.
- .6 Use multicomponent sealant type S-6, primed penetration element surfaces other than concrete, for mechanical and electrical service penetrations in concrete foundation walls.
- .7 Use multicomponent sealant type S-6, at perimeters of exterior openings where frames meet exterior facade of building (e.g., brick, block, precast masonry).
- .8 Use multicomponent sealant Type S-8 for horizontal joint sealant of plaza, floors and decks, exterior areas only, subject to pedestrian and vehicular traffic.
- .9 Use sealant Type S-8 for exterior joints in horizontal wearing surfaces.
- .10 Use polyurethane, semi-self-levelling sealant Type S-9 for in expansion joints in sidewalks, plazas, floors and other pedestrian and vehicular horizontal surfaces with slopes up to 6%.
- .11 Use control joint sealant S-10 as filler for interior, horizontal saw cut or preformed control joints where joints are subject to load bearing conditions.
- .12 Use control joint sealant S-11 as filler for interior, horizontal saw cut or preformed control joints, where joints are subject to low temperatures (freezer room floors) and where joints require nosing support.
- .13 Use control joint sealant S-12 as filler for interior, horizontal saw cut, or preformed control joints where joints are subject to thermal shock conditions, traffic loops, and where a high bond strength is required.
- .14 Use sealant S-13 for exterior holes and penetrations around pipes and other services passing through concrete foundations and requiring greater movement capability.
- .15 Reserved.
- .16 In addition, provide joint sealants at the following conditions:
- .17 Seal perimeters of hollow metal door frames on both sides and at floor.
- .18 Seal control joints in gypsum board, except where prefabricated control joints are specified.
- .19 Seal control joints in EIFS and stucco unless otherwise indicated by Drawings.
- .20 Seal junctures between interior partitions with exterior walls.
- .21 Seal window and door frames around the inside perimeter, so that an airtight seal is obtained.
- .22 Seal joints in floors and walls and around service and mechanical and electrical fixture penetrations.
- .23 Perimeter of bath fixtures (e.g., sinks, tubs, urinals, water closets, basins, vanities).
- .24 Expansion and control joints in exterior surfaces of poured-in-place concrete walls.

- .25 Expansion and control joints in exterior surfaces of precast architectural wall panels.
- .26 Movement, control and expansion joints in exterior surfaces of unit masonry walls.
- .27 Coping joints and coping-to facade joints.
- .28 Cornice and wash (or horizontal surface joints).
- .29 Seal interior perimeters of exterior openings.
- .30 Control and expansion joints on the interior of exterior cast-in place concrete walls.
- .31 Expansion and control joints on the interior of exterior precast, architectural wall panels.
- .32 Joints of underside of precast beams or planks.
- .33 Movement, control and expansion joints on the interior of exterior surfaces of unit masonry walls.
- .34 Interior control and expansion joints in floor surfaces.
- .35 Perimeters of interior frames.
- .36 Movement, control and expansion joints in exterior surfaces of unit masonry walls.
- .37 Joints at tops of non-load bearing masonry walls at the underside of poured concrete.
- .38 Exposed interior control joints in gypsum board.
- .39 Seal at all locations where dissimilar material meet.

**END OF SECTION**



## **1 GENERAL**

### **1.01 RELATED REQUIREMENTS**

- .1 Section 07 92 00 - Joint Sealants.
- .2 Section 08 71 00 - Door Hardware.
- .3 Section 08 80 00 – Glazing.
- .4 Section 08 90 00 - Louvres and Vents.

### **1.02 REFERENCE STANDARDS**

- .1 American National Standards Institute/Steel Door Institute (ANSI/SDI):
  - .1 ANSI/SDI A250.7-[1997], Nomenclature for Standard Steel Doors and Steel Frames.
  - .2 ANSI/SDI A250.11-[12], Recommended Erection Instructions for Steel Frames.
- .2 ASTM International (ASTM):
  - .1 [ASTM A 167-\[99\]](#), Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip (Withdrawn).
  - .2 [ASTM A 653/A 653M-\[18\]](#), Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - .3 [ASTM A 780/A 780M-\[20\]](#), Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
  - .4 [ASTM A 879/A 879M-\[12\]](#), Standard Specification for Steel Sheet, Zinc Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass on Each Surface.
  - .5 [ASTM A 924/A 924M-\[20\]](#), Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
  - .6 [ASTM B 29-\[19\]](#), Standard Specification for Refined Lead.
  - .7 [ASTM B 749-\[20\]](#), Standard Specification for Lead and Lead Alloy Strip, Sheet, and Plate Products.
  - .8 [ASTM D 4726-\[18\]](#), Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Exterior-Profile Extrusions Used for Assembled Windows and Doors.
  - .9 [ASTM E 90-\[09\]](#), Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
  - .10 [ASTM E 413-\[16\]](#), Classification for Rating Sound Insulation.
  - .11 [ASTM E 1425-\[14\]](#), Standard Practice for Determining the Acoustical Performance of Windows, Doors, Skylight, and Glazed Wall Systems.
  - .12 [ASTM F 2247-\[18\]](#), Standard Test Method for Metal Doors Used in Blast Resistant Applications (Equivalent Static Load Method).
- .3 Canadian General Standards Board (CGSB):
  - .1 [CAN/CGSB-1.132-M90](#), Zinc Chromate Primer, Low Moisture Sensitivity.
  - .2 [CAN/CGSB-1.181-99](#), Ready-Mixed Organic Zinc-Rich Coating.
  - .3 [CGSB 41-GP-19Ma-84](#), Rigid Vinyl Extrusions for Windows and Doors.
  - .4 [CAN/CGSB 82.5-M88](#), Insulated Steel Doors.
- .4 CSA Group (CSA):
  - .1 CSA G40.20-[13] /G40.21-[13], General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
  - .2 [CSA W59-\[18\]](#), Welded Steel Construction [Includes Errata (2020)].
- .5 Canadian Steel Door Manufacturers Association (CSDMA):
  - .1 Recommended Dimensional Standards for Commercial Steel Doors and Frames, [2000].
  - .2 Recommended Specifications for Commercial Steel Doors and Frames, [2006].
  - .3 Recommended Selection and Usage Guide for Commercial Steel Door and Frame

- Products, [2009].
- .4 Storage and Installation Guide, [2012].
- .6 Fenestration & Glazing Industry Alliance (FGIA) (formerly American Architectural Manufacturers Association (AAMA)):
  - .1 AAMA 812-[19], Voluntary Practice for Assessment of Frame Deflection When Using One Component Polyurethane Foams for Air-Sealing Rough Openings of Fenestration Installations.
- .7 National Council on Radiation Protection and Measurements (NCRP):
  - .1 Report No. 049, Structural Shielding Design and Evaluation for Medical Use of X-Rays and Gamma Rays of Energies up to 10 MeV [(1976)].
- .8 National Fire Protection Association (NFPA):
  - .1 [NFPA 80-\[2013\]](#), Standard for Fire Doors and Other Opening Protectives.
  - .2 [NFPA 252-\[2022\]](#), Standard Methods of Fire Tests of Door Assemblies.
- .9 Steel Door Institute (SDI):
  - .1 SDI-108-[18], Recommended Selection and Usage Guide for Standard Steel Doors.
  - .2 SDI-111-[09], Recommended Details for Standard Steel Doors, Frames, Accessories and Related Components.
  - .3 SDI-122-[15], Installation Troubleshooting Guide for Standard Steel Doors and Frames.
- .10 Underwriters Laboratories (UL):
  - .1 UL 2985-[2015], Sustainability Standard for Thermal Insulation.
- .11 ULC Standards (ULC):
  - .1 [CAN/ULC-S104-\[15\]](#), Standard Method for Fire Tests of Door Assemblies.
  - .2 CAN/ULC-S105:[2016], Standard Specification for Fire Door Frames Meeting the Performance Required by [CAN/ULC-S104](#).
  - .3 [CAN/ULC S106-\[15\]](#), Standard Method for Fire Tests of Window and Glass Block Assemblies.
  - .4 [CAN/ULC-S701.1](#):[2017], Standard for Thermal Insulation, Polystyrene Boards.
  - .5 CAN/ULC-S702-[14], Standard for Mineral Fibre Thermal Insulation for Buildings.
  - .6 [CAN/ULC-S704-\[11\]](#), Standard for Thermal Insulation, Polyurethane and Polyisocyanurate, Boards, Faced.

### 1.03 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination:
  - .1 Coordinate primers for doors and frames with site-applied paint as indicated in drawings and applicable specifications related to painting.
  - .2 Coordinate throat dimensions based on actual material used for wall and partition construction assemblies.

### 1.04 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Division 1 specifications.
- .2 Product Data:
  - .1 Submit manufacturer's product data for each type of door and frame. Indicate door designation, type and model, product characteristics, core description, fabrication details, dimensions, fire-protection rating and sound transmission class rating, finishes, and limitations.
  - .2 Submit WHMIS Safety Data Sheet (SDS).
- .3 Shop Drawings:
  - .1 For each type of door, indicate material, steel core thicknesses, mortises, reinforcements,

- location of exposed fasteners, openings, arrangement of hardware, fire-protection rating, sound transmission classification rating, and finishes.
- .2 For each type of frame, indicate material, core metal thickness, reinforcements, glazing stops, location of anchors and exposed fastenings, reinforcing, fire-protection rating, sound transmission classification rating, and finishes.
- .3 Include a schedule identifying each unit with door marks and numbers matching numbering on Drawings and door schedule.
- .4 Samples:
  - .1 Submit Samples where requested by Consultant.
- .5 Certificates:
  - .1 Where fire-protection rated door and frame exceeds size limitations of fire labelled assemblies, submit evidence indicating compliance with fire labelling for door and frame assembly.
  - .2 Radiation Protection Compliance: For radiation protection assemblies, submit evidence of compliance in accordance with the requirements of the Cancer Agency, the provincial Occupational Health and Safety, Radiation Safety and Protection Branch, and the National Council on Radiation Protection and Measurement.
- .6 Test and Evaluation Reports: Submit certified test reports showing compliance with specified performance characteristics and physical properties, as follows:
  - .1 Submit test and engineering data, and installation instructions for radiation shielding doors and frames.
  - .2 Submit test data indicating compliance with Sound Transmission Class (STC) requirements. Include laboratory name, test report number, and date of test.
- .7 Sustainable Design Submittals:
  - .1 Reserved.

#### **1.05 CLOSEOUT SUBMITTALS**

- .1 Submit in accordance with Division 1.
- .2 Warranty Documentation: Submit manufacturer's material and fabrication warranty.

#### **1.06 QUALITY ASSURANCE**

- .1 Qualifications:
  - .1 Manufacturer: A member in good standing of the Canadian Steel Door Manufacturers Association.
  - .2 Installers: Experienced with installation of hollow metal doors and frames of similar complexity and scope to that required for the Project.
  - .3 Testing Agencies: Provide doors and frames under label service program of a testing agency acceptable to authorities having jurisdiction (AHJ).
- .2 Manufacturer: Obtain doors and frames from a single manufacturer.
- .3 Mock-Ups:
  - .1 When requested by Consultant, provide site mock-up for work of this Section indicating methods and materials, and proposed procedures to achieve design intent in accordance with Division 1, and to comply with the following requirements, using materials indicated for completed work:
    - .1 Build mock-ups in location and size as directed by Consultant.
    - .2 Obtain Consultant's acceptance of mock-ups before starting construction.
    - .3 Use mock-up throughout construction period as a standard of acceptance for work of this Section.
    - .4 Accepted mock-up may form part of Work.

## **1.07 DELIVERY, STORAGE, AND HANDLING**

- .1 Perform in accordance with and CSDMA Guide Specification for Installation and Storage of Hollow Metal Doors and Frames and manufacturer's requirements.
- .2 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging with manufacturer's labels.
  - .1 Provide temporary protection during delivery and site storage to prevent distortion, surface damage, and rust.
  - .2 After arrival on site, remove wet wrapping materials, inspect doors and frames for damage, and notify delivery company and supplier if damage is found.
  - .3 Minor damage may be repaired if refinished products match new work, and are acceptable to Consultant.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground, in a dry, well-ventilated indoor location, in a manner that prevents sagging, bowing, or twisting, and in accordance with manufacturer's recommendations, and CSDMA Guide Specification for Installation and Storage of Hollow Metal Doors and Frames.
  - .2 Store with space between stacked doors to allow air circulation.
  - .3 Store and protect steel doors and frames from [nicks, scratches, and distortion.

## **1.08 SITE CONDITIONS**

- .1 Site Measurements: Before fabrication, verify actual dimensions of openings by measuring on site, and indicate actual measurements on shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- .2 Established Dimensions: When site measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating doors and frames without site measurements. Coordinate site construction to ensure that actual site dimensions correspond to established dimensions.

## **1.09 WARRANTY**

- .1 Manufacturer's Warranty: Submit manufacturer's standard warranty.

## **2 PRODUCTS**

### **2.01 REGULATORY REQUIREMENTS**

- .1 Steel Fire-Protection Rated Doors, Frames, and Screens: Labelled and listed by an organization accredited by Standards Council of Canada in conformance with [CAN/ULC-S104](#) and **CAN/ULC-S105** for ratings indicated.
- .2 Affix appropriate label to each opening indicating the labelling requirement, as follows:
  - .1 Fire endurance rating; radiation protection where specified.

### **2.02 RESERVED**

- .1 Reserved.

### **2.03 PERFORMANCE REQUIREMENTS**

- .1 Design exterior frame assembly to accommodate expansion and contraction when subjected to a minimum and maximum surface temperature of -35°C to 35°C.

- .2 Maximum deflection for exterior steel entrance screens under wind load of 1.2 kPa not to exceed 1/175th of span.
- .3 Steel Fire-Rated Doors and Frames: Labelled and listed by an organization accredited by Standards Council of Canada in conformance with [CAN/ULC-S104](#) for ratings specified or indicated.
- .4 Provide fire labelled frames for openings requiring fire protection ratings. Test products in conformance with [CAN/ULC-S104](#), [CAN/ULC-S106](#) and listed by a nationally recognized agency having factory inspection services.
- .5 Provide lab-tested door and frame assemblies with acoustic performance and a minimum Sound Transmission Class (STC) tested to [ASTM E 90](#). Refer to drawings for STC requirements.

## **2.04 MATERIALS**

- .1 Exterior Doors and Frames and Interior High Humidity Areas: Metallic coated steel sheets in accordance with [ASTM A 924/A 924M](#), coated to [ASTM A 653/A 653M](#), Commercial Steel (CS), Type B, ZF120 (A40) galvanized, stretcher levelled standard of flatness where used for face sheets.
- .2 Interior Doors and Frames: Metallic coated steel sheets in accordance with [ASTM A 924/A 924M](#), coated to [ASTM A 653/A 653M](#), Commercial Steel (CS), Type B, ZF75 (A25) galvanized, stretcher levelled standard of flatness where used for face sheets.
- .3 Metallic Coated Steel Sheet Thickness: Minimum thickness in accordance with CSDMA, Recommended Specifications for Commercial Steel Door and Frame Products, Table 1 and Appendix 1 and as indicated in this specification.
- .4 Reinforcement: To [CSA G40.20/G40.21](#), Type 44W, coating designation to ASTM A 653/6 53M, ZF75.
- .5 Cast or Rolled Pure Sheet Lead: To [ASTM B 29](#), [ASTM B 749](#), refer to drawings for doors requiring lead lining and sheet lead thicknesses.
- .6 Composites: Balance of core materials used in conjunction with lead, in accordance with manufacturer's proprietary design.

## **2.05 DOOR CORE MATERIALS**

- .1 Honeycomb: Structural small cell, maximum 25 mm kraft paper, minimum 36 kg weight per ream, minimum 16.5 kg/m<sup>3</sup> density, and sanded to required thickness unless otherwise noted.
- .2 Fibreglass with Vertical Steel Stiffeners: To CAN/ULC-S702, loose batt type, density 24 kg/m<sup>3</sup>, face sheets welded to each face sheet at 150 mm on centre.
- .3 Expanded Polystyrene: To [CAN/ULC-S701.1](#) type 4, rigid extruded board, closed cell, fire retardant treated, density 16 to 32 kg/m<sup>3</sup>, RSI 0.6 /25 mm minimum, to UL 2985: Thermal Insulation Materials.
- .4 Temperature Rise Rated (TRR): Core composition to limit temperature rise on unexposed side of door to 250°C at 30 minutes. Core tested as part of complete door assembly, in accordance with [CAN/ULC-S104](#), and listed by nationally recognized testing agency having factory inspection service.
- .5 Acoustic Composite Core: Tested as part of a fully operable assembly to [ASTM E 90](#) and [ASTM E 413](#) to provide Sound Transmission Classification (STC) specified.
- .6 Lead Radiation Shielding Core: Pure lead sheet meeting [ASTM B 29](#) and [ASTM B 749](#), pure

virgin Grade C. Acoustic rated lead is not acceptable. Weight or thickness as specified to shield against radiation types and levels determined by Consultant.

- .1 Composites: Balance of core materials used in conjunction with lead shall be in accordance with manufacturer's proprietary design.

## **2.06 ADHESIVES**

- .1 Honeycomb Core and Steel Component Adhesive: in accordance with manufacturer's standards and recommendations.
- .2 Polystyrene and Polyurethane Core Adhesive: Heat resistant, epoxy resin based, low viscosity, contact cement.
- .3 Lock-Seam Edge Adhesive: Fire resistant, resin reinforced polychloroprene, high viscosity, sealant/adhesive.

## **2.07 ACCESSORIES**

- .1 Touch-up Primer: In accordance with manufacturer's recommendations.
- .2 Isolation Coating: As per manufacturer's recommendation.
- .3 Exterior Top Caps: To [ASTM D 4726](#) stainless steel channel inserts.
- .4 Interior Top Caps: Steel.
- .5 Frame Thermal Breaks: Rigid polyvinylchloride extrusion conforming to [ASTM D 4726](#).
- .6 Door Bottom Seal: Refer to door hardware schedule.
- .7 Door Silencers/Bumpers: Single stud neoprene type, black colour. Self-adhesive type silencers are not acceptable.
- .8 Metallic Paste Filler: To manufacturer's standard.
- .9 Fire Labels: Metal riveted.
- .10 Site-Applied Sealant at Frame Perimeter: In accordance with manufacturer's requirements.
- .11 Glazing Stops: Formed steel having 1.0 mm metal core thickness, screw attached. Accurately fit and butt at corners, glazing trim and stops, locate on secure side of door or facing interior of room.
- .12 Glazing: Refer to drawings and applicable specifications indicating glazing requirements.
- .13 Floor Anchors and Channel Spreaders: 1.60-mm nominal tee anchors, 1.19-mm wall stud anchors, and provide anchors appropriate to site conditions, as follows:
  - .1 Exterior Locations: Hot-dipped, zinc-coated.
  - .2 Interior Locations: Wipe coat galvanized.
  - .3 At Masonry: Corrugated, galvanized tee anchors or heavy gauge galvanized wire ties.
  - .4 Drilled stud anchors for wire tie to studs.
  - .5 At Existing Concrete Openings: Lag bolts, shields and bushing.

## **2.08 FABRICATION - FRAMES**

- .1 Fabricate frames in accordance with CSDMA Recommended Dimensional Standards for Commercial Steel Doors and Frames.
- .2 Fabricate frames to profiles and maximum face sizes as indicated.

- .3 Exterior Frames: 1.6 mm (16 gauge) welded, thermally broken type construction.
- .4 Interior Frames: 1.6 mm (16 gauge) welded type construction.
  - .1 Provide minimum 16mm stop height for factory-sealed double-glazed units.
- .5 Blank, reinforce, drill, and tap frames for mortised, templated hardware, and electronic hardware using templates provided by finish hardware supplier. Reinforce frames for surface-mounted hardware.
- .6 Protect mortised cut-outs with steel guard boxes.
- .7 Reinforce frames for surface-mounted hardware.
- .8 Prepare door openings for door silencers:
  - .1 Three silencers on strike jamb for single door openings.
  - .2 Two silencers on heads for double door openings.
- .9 Manufacturer's nameplates on frames and screens are not permitted.
- .10 Conceal fastenings except where exposed fastenings are indicated.
- .11 Provide factory-applied touch-up primer at areas where zinc coating has been removed during fabrication.
- .12 Insulate exterior frame components with polyurethane insulation.
- .13 Provide fire labelled frame products for openings requiring fire protection ratings, as scheduled. Test products in conformance with [CAN/ULC-S104](#), [CAN/ULC-S106](#) and list by a nationally recognized agency having factory inspection services and construct as detailed in Follow-Up Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.
- .14 Fire-rated lead-lined frames shall be provided for those openings requiring fire protection as determined and scheduled by Consultant. Lead-lined frames shall be listed for conformance with [CAN/ULC-S104](#). All fire-rated lead-lined frames shall bear the label of, and be listed by a nationally recognized testing agency having factory inspection services. Labelling shall be in accordance with [NFPA 80](#), the listing authority's policies and label materials, and shall identify the manufacturer. Fire-rated lead-lined frames shall be constructed as listed for labelling in the Follow-Up Service Procedures/Factory Inspection Manuals issued by the listing agency to individual manufacturers.

## **2.09 FRAME ANCHORAGE**

- .1 Provide anchorage to floor and wall construction suitable to each type of construction.
- .2 Locate each wall anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb.
- .3 Provide 2 anchors for rebate opening heights up to 1520 mm, and one additional anchor for each additional 760 mm of height or fraction thereof.
- .4 Locate anchors for frames in previously placed concrete, masonry or structural steel a maximum 150 mm from top and bottom of each jamb and intermediate anchors at a maximum 660 mm on centre.

## **2.10 FRAMES - WELDED TYPE**

- .1 Lead radiation lined doors shall be a welded type frame accurately mitre jointed.



- .2 Perform welding to [CSA W59](#).
- .3 Accurately mitre or mechanically joint frame product and securely weld on inside of profile.
- .4 Cope accurately and securely weld butt joints of mullions, transom bars, centre rails, and sills.
- .5 Grind welded joints and corners to flat plane, fill with metallic paste, and sand to uniform smooth finish.
- .6 Securely attach floor anchors to inside of each jamb profile.
- .7 Weld in two temporary jamb spreaders per frame to maintain proper alignment during shipment.
- .8 Securely attach lead to inside of frame profile from return to jamb soffit inclusive on door side of frame only.

**2.11 RESERVED.**

- .1 Reserved.

**2.12 RESERVED.**

- .1 Reserved.

**2.13 FABRICATION - DOORS, GENERAL**

- .1 Doors: Swing type, flush, with provision for glass and louvred openings as indicated.
- .2 Exterior Doors: Insulated steel stiffened core construction unless otherwise noted.
- .3 Interior doors: Laminated honeycomb core construction unless otherwise noted.
- .4 Interior Laminated Core Doors:
  - .1 Form both face sheets from a sheet of 18 gauge steel.
  - .2 Core shall be a composite of sheet lead, laminated under pressure to face sheets. Refer to drawings for doors requiring lead lining and lead thicknesses.
- .5 Fabricate doors with longitudinal edges mechanically interlocked full height of seam with epoxy adhesive:
  - .1 Seams: Visible.
- .6 Blast-Resistant Doors: Tested and engineered as part of a fully operable assembly, including door, frame, gaskets, and hardware in accordance with [ASTM F 2247](#). Refer to drawings for blast resistance requirements.
- .7 Blank, reinforce, drill, and tap doors for mortised, templated hardware and electronic hardware.
- .8 Factory-prepare holes and larger on-site at time of hardware installation, except for mounting and through-bolt holes. Coordinate with door hardware requirements.
- .9 Reinforce doors for surface-mounted hardware where required. Provide flush stainless steel top caps to exterior doors. Provide inverted top and bottom channels to interior doors.
- .10 Prepare doors for mounting of automatic door bottoms. Refer to drawings and door hardware schedule for door bottom types.
- .11 Provide factory-applied touch-up primer at areas where zinc coating has been removed during fabrication.



- .12 Provide fire labelled doors for openings requiring fire protection ratings, as scheduled. Test such products in conformance with [CAN/ULC-S104](#), listed by a nationally recognized agency having factory inspection services, and construct as detailed in Follow-Up Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.
- .13 Manufacturer's nameplates on doors are not permitted.

#### **2.14 FABRICATION - DOORS, HONEYCOMB AND INSULATED CORE**

- .1 Form face sheets for exterior doors from 1.2 mm (18 gauge) sheet steel with polystyrene core laminated under pressure to face sheets.
- .2 Form face sheets for interior doors from 1.2 mm (18 gauge) sheet steel with honeycomb core laminated under pressure to face sheets.

#### **2.15 FABRICATION - DOORS, STEEL STIFFENED CORE**

- .1 Form face sheets for exterior doors from 1.6 mm (16 gauge) sheet steel.
- .2 Form face sheets for interior doors from 1.6 mm (16 gauge) sheet steel.
- .3 Reinforce doors with vertical stiffeners made from minimum 20 gauge thick sheet steel, securely welded to face sheets at a maximum 150 mm on centre.
- .4 Fill voids between stiffeners of exterior doors with fibreglass core.
- .5 Fill voids between stiffeners of interior doors with fibreglass core.

#### **2.16 FABRICATION - THERMALLY BROKEN DOORS AND FRAMES**

- .1 Fabricate thermally broken doors by using insulated core and separating exterior parts from interior parts with a continuous interlocking thermal break.
- .2 Thermal Break: Rigid polyvinylchloride extrusion conforming to [CGSB 41-GP-19Ma, ASTM D 4726](#).
- .3 Fabricate thermally broken frames separating exterior parts from interior parts with a continuous interlocking thermal break.
- .4 Fill frame cavity with low pressure spray-applied polyurethane foam to AAMA 812.

#### **2.17 FABRICATION - GLAZING STOPS FOR DOORS AND FRAMES**

- .1 Make provisions for louvres and glazing as indicated and provide necessary glazing stops.
  - .1 Provide steel glazing stops for use with glazing tapes and compounds and secured with countersunk stainless steel screws.
- .2 Fabricate glazing stops as a formed channel that is a minimum 16 mm high, accurately fitted, butted at corners and fastened to frame sections with countersunk stainless steel screws.

### **3 EXECUTION**

#### **3.01 EXAMINATION**

- .1 Verification of Conditions: Verify conditions of substrates previously installed under other Sections or Contracts are acceptable for steel doors and frames installation in accordance with manufacturer's written instructions.

- .1 Visually inspect substrate.
- .2 Correct unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied.

### **3.02 INSTALLATION - GENERAL**

- .1 Install doors and frames to CSDMA Guide Specification for Installation and Storage of Hollow Metal Doors and Frames.
- .2 Install fire-rated doors and frames in accordance with [NFPA 80](#).
- .3 Isolate steel from direct contact with dissimilar metals, concrete, and masonry with manufacturer's recommended isolation coating.

### **3.03 INSTALLATION - FRAMES**

- .1 Set frames plumb, square, level, and at correct elevation.
- .2 Secure anchorages and connections to adjacent construction.
- .3 Brace frames rigidly in position until built-in:
  - .1 Remove temporary jamb spreaders.
  - .2 Provide temporary wood spreaders at third points of frame rebate height to maintain frame width until adjacent building-in work completed.
  - .3 Provide vertical support at centre of head for openings exceeding 1200 mm in width.
  - .4 Remove wood spreaders after frames have been built-in.
- .4 Make allowances for deflection of structure to ensure structural loads are not transmitted to frames.
- .5 Fill rough opening with low pressure spray-applied polyurethane foam to AAMA 812.
- .6 Apply sealant at perimeter of frames between frame and adjacent material.
- .7 Maintain continuity of air barrier and vapour retarder by sealing membrane to frame.
- .8 Install door silencers.
- .9 Install louvres in accordance with manufacturer's instructions.

### **3.04 INSTALLATION - DOOR HARDWARE**

- .1 Install hardware in accordance with manufacturer's instructions and using manufacturer's door hardware templates.

### **3.05 INSTALLATION - GLAZING**

- .1 Install glazing in accordance with glazing manufacturer's requirements.

### **3.06 SITE QUALITY CONTROL**

- .1 Tolerances: Provide even margins between doors and jambs, and doors and finished floor and thresholds as follows:
  - .1 Hinge Side: 1.0 mm.
  - .2 Latch Side and Head: 1.5 mm.
  - .3 Finished floor: Maximum 19 mm.
  - .4 Refer to Division 1 for commissioning requirements.

### **3.07 ADJUSTING**

- .1 Use primer to touch-up finishes damaged during installation.
- .2 Fill exposed frame anchors and surfaces with imperfections with metallic paste filler and sand to uniform, smooth finish.
- .3 Repair damage to zinc coatings in accordance with [ASTM A 780/A 780M](#).
- .4 Repair damage to adjacent materials caused by metal doors and frames installation.
- .5 Adjust operable parts for correct function.

### **3.08 CLEANING**

- .1 Progress Cleaning: Perform in accordance with Division 1 specifications, and as follows:
  - .1 Remove traces of primer, sealants, epoxy, and filler materials. Clean doors and frames.
  - .2 Clean glass and glazing materials with approved non-abrasive cleaner.
- .2 Final Cleaning: Perform in accordance with Division 1.
- .3 Waste Management: Perform in accordance with Division 1.

### **3.09 PROTECTION**

- .1 Protect installed products and components from damage during construction. Install temporary protective covering to exposed components.
- .2 Protect thresholds, hardware, frames, doors, and glass from damage. Lock operative door bottom in up position.

**END OF SECTION**

## **1 GENERAL**

### **1.01 RELATED REQUIREMENTS**

- .1 Refer to applicable Division 8 specifications regarding door requirements.
- .2 Refer to applicable Division 28 specifications regarding security and fire alarm requirements.

### **1.02 REFERENCE STANDARDS**

- .1 American National Standards Institute (ANSI) / Builders Hardware Manufacturers Association (BHMA):
  - .1 ANSI/BHMA A156.1-[2016], Butts and Hinges.
  - .2 ANSI/BHMA A156.2-[2017], Bored and Preassembled Locks and Latches.
  - .3 ANSI/BHMA A156.3-[2020], Exit Devices.
  - .4 ANSI/BHMA A156.4-[2019], Door Controls – Closers.
  - .5 ANSI/BHMA A156.5-[2020], Cylinders and Input Devices for Locks.
  - .6 ANSI/BHMA A156.6-[2015], Architectural Door Trim.
  - .7 ANSI/BHMA A156.8-[2015], Door Controls - Overhead Stops and Holders.
  - .8 ANSI/BHMA A156.10-[2017], Power Operated Pedestrian Doors.
  - .9 ANSI/BHMA A156.12-[2018], Interconnected Locks.
  - .10 ANSI/BHMA A156.13-[2017], Mortise Locks and Latches.
  - .11 ANSI/BHMA A156.14-[2019], Sliding and Folding Door Hardware.
  - .12 ANSI/BHMA A156.15-[2015], Release Devices - Closer Holder, Electromagnetic and Electromechanical.
  - .13 ANSI/BHMA A156.16-[2018], Auxiliary Hardware.
  - .14 ANSI/BHMA A156.17-[2019], Self Closing Hinges and Pivots.
  - .15 ANSI/BHMA A156.18-[2020], Materials and Finishes.
  - .16 ANSI/BHMA A156.19-[2019], Power Assist and Low Energy Power Operated Doors.
  - .17 ANSI/BHMA A156.20-[2021], Strap and Tee Hinges and Hasps.
  - .18 ANSI/BHMA A156.21-[2019], Thresholds.
  - .19 ANSI/BHMA A156.22-[2021], Gasketing.
  - .20 ANSI/BHMA A156.26-[2021], Continuous Hinges.
  - .21 ANSI/BHMA A156.28-[2018], Recommended Practices for Mechanical Keying Systems.
  - .22 ANSI/BHMA A156.29-[2017], Exit Locks, Exit Alarms, Alarms for Exit Devices.
  - .23 ANSI/BHMA A156.30-[2020], High Security Cylinders.
  - .24 ANSI/BHMA A156.34-[2019], Bored Locks and Mortise Locks with Ligature Resistant Trim.
  - .25 ANSI/BHMA A156.36-[2020], Auxiliary Locks.
- .2 Canadian Steel Door Manufacturers' Association (CSDMA):
  - .1 Recommended Dimensional Standards for Commercial Steel Doors and Frames, [2000].
- .3 CSA Group (CSA):
  - .1 [CSA B651-\[18\]](#), Accessible Design for the Built Environment.
- .4 Door and Hardware Institute (DHI):
  - .1 Sequence and Format for the Hardware Schedule, [2019].
- .5 National Fire Protection Association (NFPA):
  - .1 [NFPA 80-\[2013\]](#), Standard for Fire Doors and Other Opening Protectives.

### **1.03 ADMINISTRATIVE REQUIREMENTS**

- .1 Coordination: Obtain and distribute templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Coordinate with shop drawings or other Sections. Confirm that adequate provisions are made for locating and installing door hardware in accordance with indicated requirements, and as follows:

- .1 Coordinate with Division 26 specifications for type of wire required for electrified hardware, schedule for installation, and connection to electrified door hardware.
- .2 Coordinate layout and installation of recessed pivots and closers, and cast-in anchoring inserts into floor construction with applicable Division 3 specifications.
- .3 Coordinate layout and installation of electrified door hardware with connections to power supplies, fire alarm system and detection devices, access control system, security system and building management system with applicable Division 26 and 28 specifications.
- .4 Coordinate with electrical Subcontractor for provision of service to each electrical door operator.
- .5 Coordinate with electrical Subcontractor for electrical conduit and wiring from specified electrical door controls to door operators.
- .6 Coordinate door hardware and electrified operators with applicable Division 8 specifications.

#### **1.04 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Division 1 specifications.
- .2 Product Data:
  - .1 Submit manufacturer's product data for each type of door hardware. Include product characteristics, performance criteria, profiles, dimensions, finishes, and limitations.
- .3 Shop Drawings: Submit shop drawings indicating details of electrified door hardware including the following:
  - .1 Detailed interface between electrified door hardware and fire alarm, access control, security, building management system.
  - .2 Theory of operation for electrified door hardware groups.
  - .3 Wiring diagrams for power, signal, and control systems. Identify manufacturer-installed wiring and site-installed wiring.
    - .1 System schematic.
    - .2 Point-to-point wiring diagram.
    - .3 Riser diagram.
    - .4 Elevation of each electrified door.
- .4 Samples:
  - .1 Reserved.
- .5 Source Quality Control Submittals: When requested, submit proof of door hardware schedule consultant's participation in Door and Hardware Institute (DHI) Continuing Education Program.
- .6 Contract Door Hardware Schedule: Submit schedule prepared by a qualified hardware consultant detailing door hardware information and verifying compatibility.
  - .1 Comply with DHI Sequence and Format for the Hardware Schedule.
  - .2 Organize the door hardware schedule into door hardware groups indicating a complete description of every item required for each door (or opening).
  - .3 Indicate hardware make, model, material, function, handing, size, fastening, and finish using codes in BHMA A156.18, and other pertinent information.
  - .4 Include keying schedule describing how each locking device is keyed in accordance with ANSI/BHMA A156.28. Index each key type to a specific door number.
  - .5 Indicate location of each door hardware set, cross-referencing door numbers indicated in the Contract Documents.
  - .6 Include an explanation of abbreviations, symbols, and alphanumeric codes in contract hardware schedule, where applicable.
  - .7 Include description of each electrified door hardware function, sequence of operation, and coordinating interface with other systems (e.g., fire alarm).
  - .8 Include DHI certification stamp on contract door hardware schedule.
  - .9 Include recommendations for alternate hardware (of similar cost and performance) that

- may improve functionality and/or compatibility with other specified hardware listed in door hardware schedule.
- .10 Include all required door hardware and miscellaneous components that may not be indicated on door hardware schedule but required for proper operation of door with specified hardware.
- .7 Test Reports: When requested, submit certified test reports showing a product's compliance with a specified referenced standard.
- .8 Manufacturer's Instructions: Submit manufacturer's installation instructions.
- .9 Sustainable Design Submittals:
  - .1 Reserved.

#### **1.05 CLOSEOUT SUBMITTALS**

- .1 Submit in accordance with Division 1.
- .2 Operation and Maintenance Data: Submit operation and maintenance data for door hardware and incorporate into manual.
- .3 Warranty Documentation: Submit manufacturer's material and fabrication warranty.

#### **1.06 MAINTENANCE MATERIAL SUBMITTALS**

- .1 Extra Stock Materials: Supply maintenance materials in accordance with Division 1.
  - .1 Tools: Supply one set of wrenches for door closers, locksets and fire exit hardware.

#### **1.07 QUALITY ASSURANCE**

- .1 Qualifications:
  - .1 Door Hardware Consultant: DHI-certified, including any of the following: Door + Hardware Consultant (DHC), Door + Hardware Specification Consultant (DHSC), or Access Control System Consultant (ACSC), or an Architectural Hardware Consultant, or a Door + Hardware Technician (DHT).
  - .2 Installer: Installer shall be from the same company as the door hardware consultant and have completed door hardware projects similar in scope to this Project with a record of successful in-service performance in the past five years.
- .2 Regulatory Requirements:
  - .1 Hardware for doors in fire separations and exit doors: To ANSI/BHMA A156.29, certified by a Canadian Certification Organization accredited by the Standards Council of Canada.
  - .2 Fire-Rated Door Assemblies: Where fire-rated doors are indicated, provide door hardware complying with [NFPA 80](#) that is listed and labelled by a qualified testing agency for fire-protection ratings indicated.
  - .3 Lead-Lined Door Assemblies: Where lead-lined doors are indicated, provide lead-lined door hardware selections suitable for the lead-lining thickness indicated.

#### **1.08 DELIVERY, STORAGE, AND HANDLING**

- .1 Perform in accordance with Division 1.
- .2 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging and with manufacturer's labels.
- .3 Package hardware items, including fasteners, separately or in groups of related hardware. Protect prefinished surfaces with wrapping, strippable coating, or other protective packaging. Label each package with their contents and location in building.

- .4 Storage and Handling Requirements:
  - .1 Store materials in a dry, well-ventilated indoor location, and in accordance with manufacturer's recommendations.
  - .2 Store and protect door hardware from scratches and other damages.

## **1.09 WARRANTY**

- .1 Provide written warranties as indicated below:
  - .1 Locksets: 2 years minimum.
  - .2 Exit Devices: 2 years minimum.
  - .3 Door Closers: 10 years minimum.
  - .4 Door Operators: 5 years minimum.
  - .5 Door Pull: 5 years minimum.
  - .6 Electric Strikes: 5 years minimum.
  - .7 Electric Locksets: 5 years minimum.
  - .8 Electric Panic Devices: 5 year minimum.
  - .9 Hinges Full Mortise: 10 years minimum.
  - .10 Hinges Continuous: 10 years minimum.
  - .11 Door Seals: 5 years minimum.

## **2 PRODUCTS**

### **2.01 DOOR HARDWARE**

- .1 Use products from only one manufacturer for similar items.
- .2 Locks and Latches:
  - .1 Refer to door hardware schedule.
- .3 Butts and hinges:
  - .1 Butts and Hinges: Refer to door hardware schedule.
- .4 Exit Devices:
  - .1 Refer to door hardware schedule.
- .5 Door Closers and Accessories:
  - .1 Door controls (closers): Refer to door hardware schedule.
- .6 Door Operators:
  - .1 Power-operated pedestrian doors: To ANSI/BHMA A156.10. Refer to door hardware schedule.
  - .2 Power assist and low energy power-operated doors: To ANSI/BHMA A156.19. Refer to door hardware schedule.
- .7 Auxiliary locks and associated products:
  - .1 Dead bolt: Refer to door hardware schedule.
  - .2 Cylinders: Refer to door hardware schedule.
- .8 Architectural Door Trim:
  - .1 Door Protection Plates/ Push Plates/ Pulls: Refer to door hardware schedule.
- .9 Sliding and Folding Door Hardware: Refer to drawings and door hardware schedule.
- .10 Auxiliary hardware:
  - .1 Door stops: Refer to door hardware schedule.
  - .2 Flush/Surface Bolts: Refer to door hardware schedule.
  - .3 Door silencer: Refer to door hardware schedule.

- .11 Door bottom seal: Refer to door hardware schedule.
- .12 Thresholds: Refer to door hardware schedule.
- .13 Weatherstripping: To ANSI/BHMA A156.22, and as follows:
  - .1 Head and jamb seal:
    - .1 Refer to door hardware schedule.
  - .2 Door bottom seal:
    - .1 Refer to door hardware schedule.
- .14 Astragal / Latch guard: Refer to door hardware schedule.
- .15 Barrier-Free Pneumatic Door Operator:
  - .1 Refer to door hardware schedule.

## **2.02 MISCELLANEOUS HARDWARE**

- .1 Refer to door hardware schedule.

## **2.03 FASTENINGS**

- .1 Use only fasteners provided by the manufacturer. Failure to comply may void warranties and applicable licensed labels.
- .2 Supply screws, bolts, expansion shields and other fastening devices required for satisfactory installation and operation of hardware.
- .3 Match exposed fastening devices to finish of hardware.
- .4 Where pull is positioned on one side of the door and push plate on the other side, supply fastening devices, and install to secure pull through the door from the reverse side. Install push plate to cover fasteners.
- .5 Use fasteners compatible with the material they are used in.

## **2.04 KEYING**

- .1 Doors, padlocks and cabinet locks to be keyed as indicated in door hardware schedule. Submit keying information for Consultant's review.
- .2 Provide and install construction cores during construction.
- .3 Unless otherwise indicated by door hardware schedule, supply and install permanent cores and deliver keys to Owner.

# **3 EXECUTION**

## **3.01 INSTALLATION**

- .1 Manufacturer's Instructions: Comply with manufacturer's recommendations, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.
- .2 Provide metal door and frame manufacturers with complete instructions and templates for preparation of their work to receive hardware.
- .3 Provide manufacturers' instructions for proper installation of each hardware component.



- .4 Install hardware to standard hardware location dimensions in accordance with CSDMA Recommended Dimensional Standards for Commercial Steel Doors and Frames and [CSA B651](#).
- .5 Where door stop comes into contact with door pull, mount stop to strike bottom of pull.
- .6 Install key control cabinet.
- .7 Use only manufacturer's supplied fasteners.
  - .1 Use of "quick" type fasteners, unless specifically supplied by manufacturer, is unacceptable.
- .8 Remove construction cores when directed by Owner.
  - .1 Install permanent cores and confirm locks operate correctly. Refer to door hardware schedule for cylinder and core provision requirements.

### **3.02 ADJUSTING**

- .1 Adjust door hardware, operators, closures and controls for optimum, smooth operating condition, safety and for weather tight closure.
- .2 Lubricate hardware, operating equipment and other moving parts.
- .3 Adjust door hardware to ensure tight fit at contact points with frames.

### **3.03 CLEANING**

- .1 Progress Cleaning: Perform in accordance with Division 1 and as follows:
  - .1 Remove protective coatings and wrappings from hardware items.
  - .2 Final Cleaning: Perform in accordance with Division 1.

### **3.04 DEMONSTRATION**

- .1 Keying System Setup and Cabinet:
  - .1 Set up key control system with file key tags, duplicate key tags, numerical index, alphabetical index, key change index, label shields, control book and key receipt cards.
  - .2 Place file keys and duplicate keys in key cabinet on their respective hooks.
  - .3 Lock key cabinet and provide key to Owner.
- .2 Maintenance Staff Briefing: Brief maintenance staff regarding the following:
  - .1 Proper care, cleaning, disinfecting, and general maintenance of hardware.
  - .2 Description, use, handling, and storage of keys.
  - .3 Use, application and storage of wrenches for installed door hardware.
- .3 Demonstrate operation, operating components, adjustment features, and lubrication requirements.

### **3.05 PROTECTION**

- .1 Protect installed products and components from damage during construction.

### **3.06 DOOR HARDWARE SCHEDULE**

- .1 Refer to drawings for door hardware schedule.

**END OF SECTION**

## **1 GENERAL**

### **1.01 RELATED REQUIREMENTS**

.1 Refer to the following specification sections where applicable:

- .1 Section 07 92 00 - Joint Sealants.
- .2 Section 08 87 23.16 - Security Films.

### **1.02 REFERENCE STANDARDS**

- .1 American National Standards Institute (ANSI):
  - .1 [ANSI Z97.1-\[2015\]](#), Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test.
- .2 ASTM International (ASTM):
  - .1 [ASTM C 542-\[05\]](#), Standard Specification for Lock-Strip Gaskets.
  - .2 [ASTM C 1503-\[18\]](#), Standard Specification for Silvered Flat Glass Mirror.
  - .3 [ASTM D 790-\[17\]](#), Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
  - .4 [ASTM D 1003-\[13\]](#), Standard Test Method for Haze and Luminous Transmittance of Plastics.
  - .5 [ASTM D 1929-\[20\]](#), Standard Test Method for Determining Ignition Temperature of Plastics.
  - .6 [ASTM D 2240-\[15e1\]](#), Standard Test Method for Rubber Property - Durometer Hardness.
  - .7 [ASTM E 84-\[20\]](#), Standard Test Method for Surface Burning Characteristics of Building Materials.
  - .8 [ASTM E 330-\[02\]](#), Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
  - .9 [ASTM F 1233-\[08\]](#), Standard Test Method for Security Glazing Materials and Systems.
- .3 Canadian General Standards Board (CGSB):
  - .1 [CAN/CGSB-12.1-\[2017\]](#), Safety Glazing.
  - .2 [CAN/CGSB-12.2-M\[91\]](#), Flat, Clear Sheet Glass.
  - .3 [CAN/CGSB-12.3-M\[91\]](#), Flat, Clear Float Glass.
  - .4 [CAN/CGSB-12.4-M\[91\]](#), Heat Absorbing Glass.
  - .5 [CAN/CGSB-12.6-M\[91\]](#), Transparent (One-Way) Mirrors.
  - .6 [CAN/CGSB-12.8-\[2017\]](#), Insulating Glass Units.
  - .7 [CAN/CGSB-12.9-M\[91\]](#), Spandrel Glass.
  - .8 [CAN/CGSB-12.10-M\[76\]](#), Glass, Light and Heat Reflecting.
  - .9 [CAN/CGSB-12.12-M\[90\]](#), Plastic Safety Glazing Sheets.
  - .10 [CAN/CGSB-12.13-M\[91\]](#), Patterned Glass.
- .4 CSA Group (CSA):
  - .1 [CSA A460-\[19\]](#), Bird-Friendly Building Design.
- .5 National Glass Association with GANA (NGA):
  - .1 GANA Glazing Manual - [2008].
  - .2 Laminated Glazing Reference Manual - [2019].
- .6 UL Canada (UL):
  - .1 [UL 752-\[2015\]](#), Standard for Bullet-Resisting Equipment.
  - .2 [UL 2761-\[2011\]](#), Sealants and Caulking Compounds.
- .7 ULC Standards (ULC):
  - .1 [CAN/ULC S102-\[10\]](#), Test for Surface Burning Characteristics of Building Materials and Assemblies.

- .2 [CAN/ULC S104-\[10\]](#), Standard Method of Fire Tests for Door Assemblies.
- .3 [CAN/ULC S106-\[15\]](#), Standard Method of Fire Tests of Windows and Glass Block Assemblies.

### 1.03 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-Installation Meetings: Convene meeting before beginning work of this Section with Contractor, Subcontractor:
  - .1 Verify project requirements.
  - .2 Review installation and substrate conditions.
  - .3 Coordination with other Subcontractors.
  - .4 Review manufacturer's written installation instructions and warranty requirements.
- .2 Sequencing: Comply with manufacturer's recommendations for sequencing construction operations.

### 1.04 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Division 1.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, product literature and data sheets for glass, sealants, and glazing accessories and include product characteristics, performance criteria, physical size, finish, and limitations.
  - .2 Submit WHMIS SDS.
- .3 Shop Drawings: Submit drawings stamped and signed by professional engineer registered or licensed in Ontario, Canada.
- .4 Samples:
  - .1 Submit for review and acceptance of each type of unit.
  - .2 Samples will not be returned for inclusion into Work.
  - .3 Submit glass manufacturer samples and sealant material.
  - .4 Submit manufacturer samples of surface-applied glazing films.
- .5 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .6 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
  - .1 Submit testing and analysis of glass in accordance with Division 1 specifications.
  - .2 Submit shop inspection and testing for glass.
- .7 Sustainable Design Submittals:
  - .1 Reserved.

### 1.05 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Division 1.
- .2 Operation and Maintenance Data: Submit maintenance data for glazing and incorporate into manual.

### 1.06 QUALITY ASSURANCE

- .1 Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

- .2 Mock-ups: Construct mock-ups in accordance with Division 1.
  - .1 Construct mock-up to include glass glazing.
  - .2 Mock-up will be used:
    - .1 To judge quality of work, substrate preparation, and material application.
    - .2 For testing to determine compliance with performance requirements.
  - .3 Consultant will require minimum 48 hours to review the mock-up.
  - .4 Approved mock-up may remain as part of finished Work.

## 1.07 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store, and handle materials in accordance with Division 1.
- .2 Storage and Handling Requirements:
  - .1 Store materials in a clean dry location and in accordance with manufacturer's recommendations.
  - .2 Store and protect glazing from nicks, scratches, and edge damage.
  - .3 Protect prefinished aluminum surfaces.
  - .4 Replace defective or damaged materials with new.

## 1.08 AMBIENT CONDITIONS

- .1 Ambient Requirements:
  - .1 Install glazing when ambient temperature is 10°C minimum. Maintain ventilated environment for 24 hours after application.
  - .2 Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.
  - .3 Refer to manufacturer's instructions for minimum ambient temperature for application of bird deterrent glazing film.

## 2 PRODUCTS

### 2.01 MATERIALS

- .1 Design Criteria:
  - .1 Ensure continuity of building enclosure vapour and air barrier using glass and glazing materials as follows:
  - .2 Utilize inner lite of multiple lite sealed units for continuity of air and vapour seal.
  - .3 Size glass to withstand wind loads, dead loads and positive and negative live loads to suit applicable climatic data for location of work.
  - .4 Limit glass deflection to 1/200 with full recovery of glazing materials.
  - .5 Exterior glazing design and materials: to CSA Standard A460 for bird-friendly design.
- .2 Flat Glass:
  - .1 Safety glass: to [CAN/CGSB-12.1](#), transparent, minimum 10 mm thick.
    - .1 Type 2-tempered.
    - .2 Class B-float.
    - .3 Category 11.
  - .2 Fire rated glass: to [CAN/ULC S104](#) and [CAN/ULC S106](#), specialty tempered glass.
    - .1 Standard of acceptance product: Pyran Platinum L.
      - .1 Thickness: minimum 9mm.
      - .2 Appearance: Clear, no amber tint.
      - .3 Surface: Float glass quality.
      - .4 Impact safety-rated: Yes.
      - .5 Fire-rating: Match fire-rating of door or partition.
- .3 Insulating Glass Units:

.1 Reserved.

.4 Sealant: as recommended by manufacturer and in accordance with Section 07 92 00 - Joint Sealants.

.1 Ensure sealant does not contain chemical restrictions to **UL 2761**.

## 2.02 GLAZING SURFACE FILMS

.1 Reserved.

## 2.03 ACCESSORIES

.1 Setting blocks: Provide suitable neoprene, EPDM, or silicone, 80-90 Shore A durometer hardness to [ASTM D 2240](#), to suit glazing method, glass lite weight and area.

.2 Spacer shims: Provide suitable neoprene or silicone, 50-60 Shore A durometer hardness to [ASTM D 2240](#), 75 mm long x one half height of glazing stop x thickness to suit application. Self-adhesive on one face.

.3 Glazing tape:

.1 Preformed butyl compound with integral resilient tube spacing device, 10-15 Shore A durometer hardness to [ASTM D 2240](#); coiled on release paper; size to suit application; black colour.

.2 Closed cell polyvinyl chloride foam, coiled on release paper over adhesive on two sides, maximum water absorption by volume 2%, designed for compression of 25%, to effect an air and vapour seal; size to suit application.

.4 Glazing splines: resilient polyvinyl chloride, silicone or EPDM, extruded shape to suit glazing channel retaining slot, colour as selected.

.5 Glazing clips: manufacturer's standard type.

.6 Lock-strip gaskets: to [ASTM C 542](#).

.7 Mirror attachment accessories:

.1 Stainless or plated steel, J-shaped profile, sized to match thickness of mirror.

.2 Plastic rosettes.

.3 Mirror adhesive, chemically compatible with mirror coating and wall substrate.

.4 Mirror frames: Refer to drawings.

## 3 EXECUTION

### 3.01 EXAMINATION

.1 Verification of Conditions: Verify conditions of substrates previously installed are acceptable for beginning glazing installation in accordance with manufacturer's instructions.

.1 Verify that openings for glazing are correctly sized and within tolerance.

.2 Verify that surfaces of glazing channels or recesses are clean, free of obstructions, and ready to receive glazing.

.3 Visually inspect substrates.

.4 Correct unacceptable conditions immediately upon discovery.

.5 Proceed with installation only after unacceptable conditions have been remedied.

### 3.02 PREPARATION

.1 Clean contact surfaces with solvent and wipe dry.

- .2 Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- .3 Prime surfaces scheduled to receive sealant.
- .4 Preparation - Glazing films:
  - .1 Clean glazing before beginning installation using neutral cleaning solution.
  - .2 Ensure no deleterious material adheres to glazing.
  - .3 Ensure dust, grease, and chemical residue are removed from surface of glazing before installation of film.
  - .4 Examine glazing under natural daylight and identify cracks, blisters, bubbles, discolouration, edge defects or other anomalies that may cause film to delaminate or cause vision transparency or distortion problems.

### **3.03 INSTALLATION: EXTIOER – DRY METHOD (PREFORMED GLAZING)**

- .1 Reserved.

### **3.04 INSTALLATION: EXTERIOR – WET/DRY TAPE AND SEALANT**

- .1 Reserved.

### **3.05 INSTALLATION: EXTERIOR – WET METHOD (SEALANT AND SEALANT)**

- .1 Reserved.

### **3.06 INSTALLATION: INTERIOR**

- .1 Perform work in accordance with GANA Glazing Manual and GANA Laminated Glazing Reference Manual for glazing installation methods.
- .2 Install all glazing in accordance with respective manufacturer's requirements.

### **3.07 INSTALLATION: INTERIOR WET/DRY METHOD (TAPE AND SEALANT)**

- .1 Reserved.

### **3.08 INSTALLATION: INTERIOR – WET METHOD COMPOUND AND COMPOUND**

- .1 Reserved.

### **3.09 INSTALLATION: MIRRORS**

- .1 Set mirrors with adhesive, applied in accordance with adhesive manufacturer's instructions.
- .2 Set mirrors with clips. Anchor rigidly to wall construction.
- .3 Set in frame.
- .4 Place plumb and level.

### **3.10 INSTALLATION: PLASTIC FILM**

- .1 Where indicated, install plastic film in accordance with film manufacturer's instructions.
- .2 Place without air bubbles, creases, or visible distortion.
- .3 Site Installation of Glazing Film:
  - .1 Remove window stops and window sealing device.
  - .2 Ensure dust, grease, and chemical residue are removed from surface of glazing before

- installation of film.
- .3 Examine glazing under natural daylight and identify cracks, blisters, bubbles, discolouration, edge defects or other anomalies that may cause film to delaminate, or cause vision transparency or distortion problems. Replace defective glazing before starting work.
- .4 Proceed with work only after correcting defects.
- .5 Install glazing film to glazing windows ensuring no blisters, bubbles, scratches, or distortions.
- .4 Cut film edges straight and square.
- .5 Ensure film is installed tight to glass perimeter with razor cut edge. Cut edges in accordance with manufacturer's written instructions.
- .6 Splicing:
  - .1 Splice film only when glazing is greater in width than film.
  - .2 Splice film only after receipt of written approval from Departmental Representative.
  - .3 Use butted factory edges only.
  - .4 Ensure maximum overlap of 3 mm.
- .7 Use only water and film slip solution on glazing to facilitate positioning of film.
- .8 Ensure removal of excess water from between film and glazing.
- .9 Re-install stops and sealing devices.
- .10 Wash interior and exterior of each window and film, using cleaning solution recommended by film manufacturer.
- .11 Remove and replace film that continues to show blisters, bubbles, tears, scratches, edge defects or vision distortion in film when viewed under natural daylight from 2.0 metres minimum after 30 day period.

### **3.11 INSTALLATION: BIRD-DETERRENT TREATMENT**

- .1 Reserved.

### **3.12 CLEANING**

- .1 Progress Cleaning: clean in accordance with Division 1 specifications.
  - .1 Remove traces of primer and sealants.
  - .2 Remove glazing materials from finish surfaces.
  - .3 Remove labels.
  - .4 Clean glass and mirrors using approved non-abrasive cleaner in accordance with manufacturer's instructions.
- .2 Waste Management: Perform in accordance with Division 1 specifications.

### **3.13 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 After installation, mark each lite with an "X" by using removable plastic tape or paste.
  - .1 Do not mark heat absorbing or reflective glass units.
- .3 Repair damage to adjacent materials caused by glazing installation.

**3.14 SCHEDULE**

.1 Refer to drawings.

**END OF SECTION**



## **1 GENERAL**

### **1.01 RELATED REQUIREMENTS**

- .1 Refer to the following specifications sections where work is included as part of project:
  - .1 Section 07 21 16 – Blanket Insulation.
  - .2 Section 07 26 00 – Vapour Retarders.
  - .3 Section 07 84 00 – Firestopping.
  - .4 Section 07 92 00 - Joint Sealants.
  - .5 Section 09 22 16 – Non-Structural Metal Framing.

### **1.02 REFERENCE STANDARDS**

- .1 Aluminum Association (AA):
  - .1 AA DAF 45-[03(R2009)], Designation System for Aluminum Finishes.
- .2 American Society for Testing and Materials (ASTM):
  - .1 [ASTM C 475-\[02\(2015\)\]](#), Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
  - .2 [ASTM C 514-\[04\(2014\)\]](#), Standard Specification for Nails for the Application of Gypsum Board.
  - .3 [ASTM C 557-\[03\(2009\)e1\]](#), Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing.
  - .4 [ASTM C 840-\[16\]](#), Standard Specification for Application and Finishing of Gypsum Board.
  - .5 [ASTM C 954-\[15\]](#), Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.
  - .6 [ASTM C 1002-\[14\]](#), Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
  - .7 [ASTM C 1047-\[14a\]](#), Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
  - .8 [ASTM C 1177/C 1177M-\[13\]](#), Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
  - .9 [ASTM C 1178/C 1178M-\[13\]](#), Standard Specification for Glass Mat Water-Resistant Gypsum Backing Board.
  - .10 [ASTM C 1280-\[13a\]](#), Standard Specification for Application of Gypsum Sheathing.
  - .11 [ASTM C 1396/C 1396M-\[14a\]](#), Standard Specification for Gypsum board.
- .3 Association of the Wall and Ceilings Industries International (AWCI):
  - .1 AWCI Levels of Gypsum Board Finish-[GA-214-2015].
- .4 Canada Green Building Council (CaGBC):
  - .1 LEED Canada-NC Version 1.0-[2004], LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For New Construction and Major Renovations (including Addendum [2009]).
  - .2 LEED Canada-CI Version 1.0-[2007], LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide For Commercial Interiors.
- .5 Canadian General Standards Board (CGSB):
  - .1 [CAN/CGSB-51.34-\[M86\(R1988\)\]](#), Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
  - .2 [CAN/CGSB-71.25-\[M88\]](#), Adhesive, for Bonding Drywall to Wood Framing and Metal

Studs.

- .6 Green Seal Environmental Standards (GS)
  - .1 GS-11-[2008, 2nd Edition], Paints and Coatings.
- .7 Underwriters' Laboratories of Canada (ULC):
  - .1 CAN/ULC-S101, Standard Methods of Fire Endurance Tests of Building Construction Materials.
  - .2 CAN/ULC-S102-[10], Standard Method of Test of Surface Burning Characteristics of Building Materials and Assemblies.

### **1.03 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Division 1.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for gypsum board products and related components and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
  - .1 Submit gypsum board assembly drawings stamped and signed by professional engineer registered or licensed in Ontario, Canada.
  - .2 Indicate components such as fastener type, dimensions, spacing and locations at gypsum board edges, ends and in field of board as well as installation methods. Components and work to confirm to [ASTM C 840](#) standard specification for application and finishing of gypsum board.
  - .3 Indicate type of joint compound, and number of joint compound layers.
  - .4 Indicate number and location of electrical boxes for wall and ceiling.
  - .5 Indicate size, thickness, height of stud framing for all assemblies shown in drawings.
  - .6 Indicate cUL/ ULC design listing for each specified fire-rated assembly tested to CAN/ULC-S101.
  - .7 Indicate STC performance for assemblies with specified acoustical performance requirements.
- .4 Samples:
  - .1 When requested, submit for review and acceptance of each component specified or necessary for complete installation. Include technical descriptive data.
- .5 Certifications:
  - .1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .6 Sustainable Design Submittals:
  - .1 Reserved.

### **1.04 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address and applicable standard designation.
- .3 Exercise care in unloading gypsum board materials shipment to prevent damage.
- .4 Storage and Handling Requirements in accordance with [ASTM C 840-16](#):
  - .1 Store gypsum board assemblies materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

- .2 Store and protect all materials.
  - .3 Protect gypsum board from direct exposure to rain, snow, sunlight, or other excessive weather conditions.
  - .4 Protect ready mix joint compounds from freezing, exposure to extreme heat and direct sunlight.
  - .5 Protect from weather, elements and damage from construction operations.
  - .6 Handle gypsum boards to prevent damage to edges, ends or surfaces.
  - .7 Replace defective or damaged materials with new.
- .5 Develop Construction Waste Management Plan and/or Waste Reduction Workplan related to Work of this Section and in accordance with Division 1.
- .6 Packaging Waste Management: remove in accordance with Construction Waste Management Plan and/or Waste Reduction Workplan.

#### **1.05 AMBIENT CONDITIONS**

- .1 Maintain temperature 10 °C minimum, 21 °C maximum for 48 hours prior to and during application of gypsum boards and joint treatment, and for 48 hours minimum after completion of joint treatment.
- .2 Apply board and joint treatment to dry, clean, frost free surfaces.
- .3 Ventilation: ventilate building spaces as required to remove excess moisture that would prevent drying of joint treatment material immediately after its application.

#### **1.06 QUALITY ASSURANCE**

- .1 Qualifications: Contractors performing work in this section shall be a member of The Interior Systems Contractors Association of Ontario (ISCA).
- .2 Submit proof of membership when requested by Consultant.

### **2 PRODUCTS**

#### **2.01 MATERIALS**

- .1 Gypsum wall board, regular type: to ASTM C1396, CAN/ULC-S114, CAN/ULC-S102. Refer to drawings.
- .2 Gypsum wall board, fire-rated: to ASTM C1396, CAN/ULC-S114, CAN/ULC-S102. Type X gypsum wall board. Refer to drawings.
- .3 Cement backerboard (substrate for tiling): to ASTM C1325, CAN/ULC-S114, CAN/ULC-S102. Non-combustible, moisture and mold-resistant, fiber-mat reinforced cementitious backer units.
- .4 Moisture-resistant board: to ASTM C1396, CAN/ULC-S114, CAN/ULC-S102. Non-combustible, moisture and mold-resistant gypsum core, refer to drawings.
- .5 Exterior gypsum soffit board: to [ASTM C 1396/C 1396M-\[14a\]](#), 16 mm thick, 1200 mm wide x maximum practical length.
- .6 Glass mat water-resistant gypsum backing board: to [ASTM C 1178/C 1178M-\[13\]](#), 16 mm thick, 1200 mm wide x maximum practical length.
- .7 Glass mat gypsum substrate sheathing: to [ASTM C 1177/C 1177M-\[13\]](#), 16 mm thick, 1200 mm wide x maximum practical length.

- .8 Shaftliner panels: to ASTM C1658, ASTM C1396, CAN/ULC-S114, CAN/ULC-S102. Non-combustible, moisture and mold-resistant gypsum core surfaced with fiberglass mats. Refer to drawings.
- .9 Drywall furring channels: galvanized steel channels for screw attachment of gypsum board, refer to drawings.
- .10 Resilient drywall furring: galvanized steel for resilient attachment of gypsum board. Refer to drawings.
- .11 Nails: to [ASTM C 514-14](#).
- .12 Steel drill screws: to [ASTM C 1002-14](#).
- .13 Stud adhesive: to [CAN/CGSB-71.25](#), [ASTM C 557](#).
- .14 Laminating compound: as recommended by manufacturer, asbestos-free.
- .15 Casing beads, corner beads, control joints and edge trim: to [ASTM C 1047](#), PVC perforated flanges, one piece length per location unless otherwise noted by cUL/ULC design listings.
- .16 Sealants:
  - .1 Acoustic sealant: in accordance with Section 07 92 00 - Joint Sealants.
- .17 Polyethylene: to [CAN/CGSB-51.34](#), Type 2
- .18 Insulating strip: rubberized, moisture resistant with self-sticking permanent adhesive on one face, lengths as required.
- .19 Joint compound: to [ASTM C 475](#), asbestos-free

## **2.02 FINISHES**

- .1 Reserved.

## **3 EXECUTION**

### **3.01 EXAMINATION**

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for gypsum board assemblies installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate prior to installation.
  - .2 Correct unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied.

### **3.02 ERECTION**

- .1 Do application and finishing of gypsum board to [ASTM C 840-16](#) and manufacturer's installation requirements except where specified otherwise.
- .2 Do application of gypsum sheathing to [ASTM C 1280-13a](#) and manufacturer's installation requirements.
- .3 Erect hangers and runner channels for suspended gypsum board ceilings to [ASTM C 840-16](#) except where specified otherwise

- .4 Support light fixtures by providing additional ceiling suspension hangers within 150 mm of each corner and at maximum 600 mm around perimeter of fixture.
- .5 Install work level to tolerance of 1:1200.
- .6 Frame with furring channels, perimeter of openings for access panels, light fixtures, diffusers, grilles and other openings unless otherwise noted.
- .7 Install furring channels parallel to, and at exact locations of steel stud partition header track.
- .8 Furr for gypsum board faced vertical bulkheads within and at termination of ceilings.
- .9 Furr above suspended ceilings for gypsum board fire and sound stops and to form plenum areas as indicated.
- .10 Install wall furring for gypsum board wall finishes to [ASTM C 840-16](#), except where specified otherwise
- .11 Furr openings and around built-in equipment, cabinets, access panels, on four sides. Extend furring into reveals. Check clearances with equipment suppliers.
- .12 Furr duct shafts, beams, columns, pipes and exposed services where indicated.
- .13 Erect drywall resilient furring transversely across framing members and between layers of gypsum board. Secure to each support with drywall screws.

### **3.03 APPLICATION**

- .1 Apply gypsum board after bucks, anchors, blocking, sound attenuation, electrical and mechanical work have been approved.
- .2 Perform application in accordance with manufacturer and cUL/ULC design listing requirements for each specified assembly.
- .3 Exterior Soffits and Ceilings: install exterior gypsum board perpendicular to supports; stagger end joints over supports. Install with 6 mm gap where boards abut other work.
- .4 Apply bead of acoustic sealant continuously around periphery of each face of partitioning to seal gypsum board/structure junction where partitions abut fixed building components. Seal full perimeter of cut-outs around electrical boxes, ducts, in partitions where perimeter sealed with acoustic sealant.
- .5 Install ceiling boards in direction that will minimize number of end-butt joints. Stagger end joints.
- .6 Install gypsum board with face side out.
- .7 Do not install damaged or damp boards.
- .8 Locate edge or end joints over supports. Stagger vertical joints over different studs on opposite sides of wall.

### **3.04 INSTALLATION**

- .1 Erect accessories straight, plumb or level, rigid and at proper plane. Use full length pieces where practical. Make joints tight, accurately aligned and rigidly secured. Mitre and fit corners accurately, free from rough edges.
- .2 Install casing beads around perimeter of suspended ceilings.

- .3 Install casing beads where gypsum board butts against surfaces having no trim concealing junction and where indicated.
- .4 Install insulating strips continuously at edges of gypsum board and casing beads abutting metal window and exterior door frames, to provide thermal break.
- .5 Install shadow mould at gypsum board/ceiling juncture where indicated. Minimize joints; use corner pieces and splicers.
- .6 Construct control joints in accordance with drawings.
- .7 Provide continuous polyethylene dust barrier behind and across control joints.
- .8 Locate control joints where indicated and at changes in substrate construction.
- .9 Install control joints straight and true.
- .10 Ensure that screws or nails are properly applied in process of attaching gypsum board to framing without damaging of gypsum board edges and ends.
- .11 Construct expansion joints as detailed, at building expansion and construction joints. Provide continuous dust barrier.
- .12 Install expansion joint straight and true.
- .13 Install cornice cap in accordance with drawings where gypsum board partitions do not extend to ceiling.
- .14 Fit cornice cap over partition, secure to partition track with two rows of sheet metal screws staggered at 200 mm on centre.
- .15 Splice corners and intersections together and secure to each member with 3 screws.
- .16 Install access doors to electrical and mechanical fixtures specified in respective sections.
  - .1 Rigidly secure frames to furring or framing systems.
- .17 Finish face panel joints and internal angles with joint system consisting of joint compound, joint tape and taping compound installed according to manufacturer's directions and feathered out onto panel faces.
- .18 Gypsum Board Finish: finish gypsum board walls and ceilings to following levels in accordance with AWCI Levels of Gypsum Board Finish:
  - .1 Levels of finish:
    - .1 Level 0: no tapping, finishing or accessories required. Applies to temporary construction.
    - .2 Level 1: embed tape for joints and interior angles in joint compound. Surfaces free of excess joint compound; tool marks and ridges are acceptable. Applies to dust proof hoardings, plenum areas above ceiling, concealed pipe chases.
    - .3 Level 2: embed tape for joints and interior angles in joint compound and apply one separate coat of joint compound over joints, angles, fastener heads and accessories; surfaces free of excess joint compound; tool marks and ridges are acceptable. Applies to surfaces scheduled for tile finishes.
    - .4 Level 3: embed tape for joints and interior angles in joint compound and apply two separate coats of joint compound over joints, angles, fastener heads and accessories; surfaces smooth and free of tool marks and ridges. Applies to unfinished areas.
    - .5 Level 4: embed tape for joints and interior angles in joint compound and apply three separate coats of joint compound over joints, angles, fastener heads and accessories; surfaces smooth and free of tool marks and ridges. Applies to

- .6 service rooms, mechanical and electrical rooms, and equipment rooms.  
Level 5: embed tape for joints and interior angles in joint compound and apply three separate coats of joint compound over joints, angles, fastener heads and accessories; apply a thin skim coat of joint compound to entire surface; surfaces smooth and free of tool marks and ridges. Applies to all areas not identified above.
- .19 Finish corner beads, control joints and trim as required with two coats of joint compound and one coat of taping compound, feathered out onto panel faces.
- .20 Fill screw head depressions with joint and taping compounds to bring flush with adjacent surface of gypsum board, invisible after surface finish is completed.
- .21 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.
- .22 Completed installation smooth, level or plumb, free from waves and other defects and ready for surface finish.
- .23 Apply one coat of white primer sealer over surface to be textured. When dry apply textured finish in accordance with manufacturer's instructions.
- .24 Mix joint compound slightly thinner than for joint taping.
- .25 Apply thin coat to entire surface using trowel or drywall broad knife to fill surface texture differences, variations or tool marks.
- .26 Allow skim coat to dry completely.
- .27 Remove ridges by light sanding or wiping with damp cloth.

### **3.05 CLEANING**

- .1 Progress Cleaning: clean in accordance with Division 1.
  - .1 Leave Work area clean at end of each day.
  - .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Division 1.
- .2 Waste Management:
  - .1 Separate waste materials in accordance with Construction Waste Management plan prepared by Contractor.
  - .2 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

### **3.06 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by gypsum board assemblies installation.

### **3.07 SCHEDULE**

- .1 Refer to drawings for assemblies schedules.

**END OF SECTION**

## **1 GENERAL**

### **1.01 RELATED REQUIREMENTS**

- .1 Section 07 92 00 - Joint Sealants.
- .2 Section 09 21 16 – Gypsum Board Assemblies.

### **1.02 REFERENCE STANDARDS**

- .1 ASTM International (ASTM):
  - .1 [ASTM C 645-\[14e1\]](#), Standard Specification for Nonstructural Steel Framing Members.
  - .2 [ASTM A 653/A 653M-\[07\]](#), Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanized) by the Hot-Dip Process.
  - .3 [ASTM C 754-\[15\]](#), Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
- .2 Underwriter's Laboratories (UL):
  - .1 UL-2768- [2011], Architectural Surface Coatings.
- .3 The Master Painters Institute (MPI):
  - .1 Architectural Painting Specification Manual - current edition.
    - .1 MPI #26, Primer, Galvanized Metal, Cementitious.

### **1.03 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Division 1.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for metal framing and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Submit WHMIS SDS in accordance with Division 1.
- .3 Shop Drawings:
  - .1 Submit shop drawings prepared and sealed by professional engineer licensed to practice in Ontario, Canada.
  - .2 Indicate stud size, thickness, limiting height, stud and track types, fastening details and all other applicable details for specified assemblies. Refer to drawings.
- .4 Sustainable Design Submittals:
  - .1 Reserved.

### **1.04 QUALITY ASSURANCE**

- .1 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.
- .2 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .3 Installer Qualifications: Contractors performing work in this section shall be a member of The Interior Systems Contractors Association of Ontario (ISCA). Submit proof of membership when requested by Consultant.



## **1.05 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with manufacturer's requirements.
- .2 Delivery and Acceptance Requirements: deliver materials to Site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect all materials.
  - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan and/or Waste Reduction Workplan related to Work of this Section.
- .5 Packaging Waste Management: remove in accordance with Construction Waste Management plan.

## **2 PRODUCTS**

### **2.01 MATERIALS**

- .1 Non-load bearing channel stud framing: to [ASTM C 645](#), roll formed from hot dipped zinc-coated (galvanized) steel sheet in accordance with [ASTM A 653](#), Z180, for screw attachment of gypsum board.
  - .1 Knock-out service holes at minimum 460 mm centres.
- .2 Floor and ceiling tracks: to [ASTM C 645](#), in widths to suit stud sizes, and as follows:
  - .1 Slotted Deflection Track: Premanufactured slotted top runner, refer to drawings.
  - .2 Double Runner Deflection Track: Outside runner using minimum 75 mm flanges; inner runner 33 mm; maintaining 25 mm minimum deflection space.
  - .3 Deep Leg Deflection Track: Top runner having minimum 75 mm down standing legs; maintaining 13 mm minimum deflection space.
  - .4 Base Runner: Bottom track with upstanding legs.
- .3 Furring Channels: Commercial steel sheet in accordance with [ASTM A 653](#), Z180, hot dipped zinc-coated (galvanized), as follows:
  - .1 Hat Shaped, Rigid Furring Channels: [ASTM C 645](#), refer to drawings.
  - .2 Resilient Furring Channels: 13 mm deep members designed to reduce sound transmission having asymmetrical face attached to single flange by a slotted leg (web), refer to drawings.
- .4 Curving Tracks: Commercial steel sheet with [ASTM A 653](#), Z180, hot dipped zinc-coated (galvanized), complete with flexible sliding straps to allow for curvature indicated on drawings; width to suit framing.
- .5 Metal channel stiffener: cold rolled steel, coated with rust inhibitive coating.
- .6 Acoustical sealant: in accordance with Section 07 92 00 - Joint Sealants.
- .7 Reserved.
- .8 Insulating strip: rubberized, moisture resistant with self sticking adhesive on one face, lengths as required.

### **3 EXECUTION**

#### **3.01 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for non-structural metal framing application in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate.
  - .2 Correct unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation after unacceptable conditions have been remedied.

#### **3.02 ERECTION**

- .1 Erect partitions in accordance with framing requirements of [ASTM C 754](#).
- .2 Align partition tracks at floor and ceiling and secure to structural construction component.
- .3 Install damp proof course under stud shoe tracks of partitions on slabs on grade.
- .4 Place studs vertically at spacing specified on drawings and not more than 38 mm from abutting walls, and at each side of openings and corners.
  - .1 Position studs in tracks at floor and ceiling. Cross brace steel studs as required to provide rigid installation to manufacturer's instructions.
- .5 Erect metal studding to tolerance of 1:1000.
- .6 Attach studs to top and bottom track using screws unless otherwise noted.
- .7 Co-ordinate simultaneous erection of studs with installation of service lines. Align web openings when erecting studs.
- .8 Co-ordinate erection of studs with installation of door/window frames and special supports or anchorage for work specified in other Sections.
- .9 Provide two studs extending from floor to ceiling at each side of openings wider than stud centres specified.
  - .1 Secure studs together, 50 mm apart using column clips or other approved means of fastening placed alongside frame anchor clips.
- .10 Install heavy gauge single jamb studs at openings.
- .11 Erect track at head of door/window openings and sills of sidelight/window openings to accommodate intermediate studs.
  - .1 Secure track to studs at each end, in accordance with manufacturer's instructions.
  - .2 Install intermediate studs above and below openings in same manner and spacing as wall studs.
- .12 Frame openings and around built-in equipment, cabinets, access panels, on four sides. Extend framing into reveals. Check clearances with equipment suppliers.
- .13 Provide 40 mm stud or furring channel secured between studs for attachment of fixtures behind lavatory basins, toilet and bathroom accessories, and other fixtures including grab bars and towel rails, attached to steel stud partitions.
- .14 Install steel studs or furring channel between studs for attaching electrical and other boxes.
- .15 Extend partitions to ceiling height except where noted otherwise on drawings.

- .16 Maintain clearance under beams and structural slabs to avoid transmission of structural loads to studs by installing slotted deflection tracks.
- .17 Install continuous insulating strips to isolate studs from uninsulated surfaces.
- .18 Install two continuous beads of acoustical sealant under studs and tracks around perimeter of sound control partitions.
- .19 Curved Partition Tracks:
  - .1 Shape curving tracks to profiles indicated on drawings in accordance with manufacturer's instructions.
  - .2 Bend track to uniform curve and locate straight lengths so they form a true tangent to arcs.
  - .3 Support outside (cut) leg of track by clinching steel sheet strip, 25 mm high, by thickness of track metal, to inside of cut legs using metal lock fasteners.
  - .4 Begin and end arc with a stud and space intermediate studs equally along arcs at stud spacing recommended in writing by gypsum board manufacturer for radii indicated. On straight lengths of minimum 2 studs at ends of arcs, place studs at 150 mm on centre.

### **3.03 CLEANING**

- .1 Progress Cleaning: clean in accordance with Division 1.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Division 1.
- .3 Waste Management: separate waste materials In accordance with Construction Waste Management plan.

### **3.04 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by non-structural metal framing application.

**END OF SECTION**

## **1 GENERAL**

### **1.01 RELATED REQUIREMENTS**

- .1 Division 21 specification sections for sprinkler heads in acoustical panel ceilings).
- .2 Division 23 specification sections for HVAC.
- .3 Division 26 specification sections for lighting systems.
- .4 Division 27 specification sections for PA systems.

### **1.02 DEFINITIONS**

- .1 Articulation Classification (AC): Indication of attenuation of sound being reflected from ceiling materials to adjacent areas in open plan areas, in accordance with [ASTM E 1111/E 1111M](#).
- .2 Ceiling Attenuation Class (CAC): Indication of amount of attenuation of sound passing up through a panel through the open plenum and back down through a panel into adjacent spaces where a partition is not full height, in accordance with [ASTM E 1414/E 1414M](#).
- .3 Light Reflectance (LR): The percentage amount of light returned from the surface of a material compared to the source.
- .4 Noise Reduction Coefficient (NRC): Measure of the absorption of sound energy over four frequencies. An indication of the amount of noise a panel can absorb - measured in 0.05 increments in accordance with [ASTM C 423](#).
- .5 Sound Absorption Average (SAA): Measure of the absorption of sound energy over twelve frequencies. An indication of the amount of sound a panel can absorb - measured in 0.01 increments in accordance with [ASTM C 423](#).

### **1.03 REFERENCE STANDARDS**

- .1 ASTM International (ASTM):
  - .1 [ASTM A 580/A 580M-\[18\]](#), Standard Specification for Stainless Steel Wire.
  - .2 [ASTM A 641/A 641M-\[19\]](#), Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
  - .3 [ASTM C 423-\[17\]](#), Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
  - .4 [ASTM C 635/C 635M-\[17\]](#), Standard Specifications for the Manufacture, Performance and Testing of Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings.
  - .5 [ASTM C 636/C 636M-\[19\]](#), Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.
  - .6 [ASTM E 580/E 580M-\[20\]](#) Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions.
  - .7 [ASTM E 1111/E 1111M-\[14\]](#), Standard Test Method for Measuring the Interzone Attenuation of Open Office Components.
  - .8 [ASTM E 1264-\[19\]](#), Standard Classification for Acoustical Ceiling Products.
  - .9 [ASTM E 1414/E 1414M-\[21a\]](#), Standard Test Method for Airborne Sound Attenuation between Rooms Sharing a Common Ceiling Plenum.
  - .10 [ASTM E 1477-\[98a\]](#), Standard Test Method for Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers.
  - .11 [ASTM F 1667-\[18a\]](#) Standard Specification for Driven Fasteners: Nails, Spikes and Staples.
- .2 Canadian General Standards Board (CGSB):

- .1 [CAN/CGSB-51.34-M86](#), Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
- .3 Ceilings & Interior Systems Construction Association (CISCA):
  - .1 Ceiling Systems Handbook, [2019].
  - .2 Seismic Construction Handbook, [2018].
- .4 CSA Group (CSA):
  - .1 [CSA S832-\[14\]](#), Seismic Risk Reduction of Operational and Functional Components (OFCs) of Buildings.
- .5 Government of Canada:
  - .1 Workplace Fit-Up Standards [2.0].
- .6 ULC Standards (ULC):
  - .1 CAN/ULC-S102-[10], Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
  - .2 CAN/ULC-S702.1-[14], Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification.

#### **1.04 COORDINATION**

- .1 Do not begin installation of ceiling suspension system until work above ceiling has been reviewed by Consultant.
- .2 Coordinate ceiling work to accommodate components of other Sections built into acoustical ceilings, including the following:
  - .1 Expansion Joint Cover Assemblies.
  - .2 Wet Pipe Sprinkler Systems (specifically sprinkler heads in acoustical panel ceilings).
  - .3 Dry Pipe Sprinkler Systems (specifically sprinkler heads in acoustical panel ceilings).
  - .4 Acoustical Air Plenums.
  - .5 Diffusers, Registers and Grilles (specifically mechanical units in acoustical panel ceilings).
  - .6 Radiant Heating Units (specifically units installed in or adjacent to acoustical panel ceilings).
  - .7 Lighting.
  - .8 Lighting - Central Emergency System.
  - .9 Public Address and Mass Notification Systems.

#### **1.05 PRE-INSTALLATION MEETINGS**

- .1 Conduct pre-installation meeting in accordance with Division 1 at Project site before beginning work, with Contractor and applicable Subcontractors to:
  - .1 verify Project requirements,
  - .2 discuss coordination with work of other Sections,
  - .3 review manufacturer's installation instructions and warranty conditions,
  - .4 discuss and coordinate exact locations of ceiling-mounted components,
  - .5 discuss accepted shop drawings for special installation details, and
  - .6 review existing substrate conditions.

#### **1.06 SEQUENCING**

- .1 Schedule installation of acoustical panel ceilings to occur after completion of overhead mechanical and electrical work, where possible.
- .2 Begin installation after building envelope, and dust and moisture producing activities are complete, and paint is dry.

## **1.07 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit samples in accordance with Division 1.
- .2 Product Data: Submit manufacturer's installation instructions, product literature, and data sheets for ceiling suspension system, acoustic panels, and system accessories. Include product characteristics, performance criteria, physical sizes, finishes, and limitations.
- .3 Shop Drawings:
  - .1 Submit reflected ceiling plans for special grid patterns as indicated on Drawings.
  - .2 Indicate lay-out, insert and hanger spacing and fastening details, splicing method for main and cross runners, location of access splines, change in level details, access door dimensions and locations, lateral bracing and accessories.
- .4 Samples for Initial Selection:
  - .1 Submit actual samples of acoustical panel that are 150 mm x 150 mm of specified product.
  - .2 Submit samples that are approximately 200 mm long of each specified type of ceiling suspension system component.
- .5 Samples for Verification:
  - .1 Reserved.
- .6 Delegated Design Submittals:
  - .1 Submit delegated design shop drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
  - .2 Indicate that components and installation methods conform to specified seismic design and construction requirements of Contract Documents and in accordance with [ASTM E 580/E 580M](#).
  - .3 Include supporting details, treatment of cross runners, main runners, and wall closures at terminal ends, suspension wire, lateral force bracing, light fixtures, services within the ceiling, seismic isolation joints, and partition bracing.
- .7 Test Reports: Submit test data indicating that fasteners and anchors used to suspend ceiling systems have a minimum capacity of 890 N in tension, and anchors to attach bracing wires have minimum a capacity of 1960 N in tension.
- .8 Sustainable Design Submittals: Reserved.

## **1.08 CLOSEOUT SUBMITTALS**

- .1 Submit in accordance with Division 1.
- .2 Submit maintenance information for acoustical ceiling systems and incorporate into manual. Include warnings of cleaning methods that may damage finished surfaces.
- .3 Submit final certificate from design professional responsible for delegated detail design of ceiling indicating conformity with accepted shop drawings.

## **1.09 MAINTENANCE MATERIAL SUBMITTALS**

- .1 Supply extra acoustical units in accordance with Division 1.
- .2 Supply extra materials from same production run as installed materials.
- .3 Supply acoustical units amounting to 5% of gross ceiling area for each pattern and type of acoustical panel required for Project. Clearly identify each type of acoustic unit, including colour and texture.

## **1.10 QUALITY ASSURANCE**

- .1 Certifications:
  - .1 Fire-Resistance Rated Suspension System: Certified by a Canadian Certification Organization accredited by the Standards Council of Canada.
  - .2 Submit manufacturer's product certificates, certifying materials comply with specified performance criteria and physical requirements.
- .2 Manufacturers: Obtain materials for each type of acoustical panel ceiling system (panels and suspension system) from a single manufacturer. Provide products exposed to view from the same production run for each room, with consistent appearance.
- .3 Mock-Ups: Construct a mock-up in accordance with Division 1.
  - .1 When requested, construct mock-up a minimum 10 m<sup>2</sup> of each type of acoustical ceiling assembly. Ceiling system mock-up to show basic construction and assembly, treatment at walls, splicing, interlocking, finishes, acoustical unit installation..
  - .2 Construct mock-up at Project site where directed by Consultant.
  - .3 Consultant will require a minimum 48 hours to review the mock-up.
  - .4 Mock-up may not remain as part of the finished work.

## **1.11 DELIVERY, STORAGE, AND HANDLING**

- .1 Perform in accordance with Division 1.
- .2 Storage and Handling Requirements:
  - .1 Store materials flat, off ground, indoors, and in a clean, dry, and well-ventilated area.
  - .2 Protect acoustical ceiling components from nicks, scratches, and other damage.

## **1.12 AMBIENT CONDITIONS**

- .1 Maintain temperature and humidity levels within manufacturer's specified range.

## **1.13 WARRANTY**

- .1 Manufacturer Warranty:
  - .1 Coverage of manufacturing defects in materials and workmanship resulting in failure of suspension system for 15 years from date of Substantial Performance.

# **2 PRODUCTS**

## **2.01 REGULATORY REQUIREMENTS**

- .1 Fire-Resistance Rated Acoustic Panel Ceilings: Meeting requirements of CAN/ULC-S102, labelled and listed by ULC Standards, Warnock Hersey Intertek (WHI), or another testing and inspecting agency acceptable to authorities having jurisdiction (AHJ).

## **2.02 SUSTAINABILITY CHARACTERISTICS**

- .1 Reserved.

## **2.03 DESIGN CRITERIA**

- .1 Superimposed Loads: Determine superimposed loads applied to ceiling suspension systems by components of the building and verify that adequate hangers are installed to support additional loads in conjunction with normal loads of the ceiling system, and as follows:
  - .1 Maximum Deflection: Limit deflection to L/360 in accordance with [ASTM C 635/C 635M](#) deflection test.

- .2 Seismic Restraints: Design system to withstand seismic forces in accordance with [CSA S832](#) and as outlined in applicable Building Code for normal Importance Category facilities based on a full uniform ceiling load acceleration in accordance with [ASTM A 580/A 580M](#). Ceiling areas less than 13.4 m<sup>2</sup> and surrounded by walls connected to structure above do not require seismic restraints.

## 2.04 MATERIALS

- .1 Classification: Intermediate-Duty system to [ASTM C 635/C 635M](#).
- .2 Acceptable Manufacturers:
  - .1 Armstrong.
  - .2 Rockfon.
  - .3 Canadian Gypsum Company (CGC).

## 2.05 ACOUSTICAL CEILING SUSPENSION

- .1 Ceiling Suspension System: **FINISH TYPE ACT-1**
  - .1 Manufacturer: Armstrong.
  - .2 Product: Prelude XL, exposed tee 15/16" suspension system.
  - .3 Size: Refer to drawings.
  - .4 Material: Hot-dipped galvanized steel.
  - .5 Colour: White.
- .2 Hanger Wire: To [ASTM A 641/A 641M](#), galvanized soft annealed steel wire:
  - .1 Access Panel Ceilings: as recommended by manufacturer.
  - .2 Fire-Rated Assemblies: To ULC design requirements, to seismic Design Category for seismic assemblies.
  - .3 Other Ceilings: as recommended by manufacturer.
- .3 Hanger Inserts: Purpose made.
- .4 Carrying Channels: as recommended by system manufacturer and as required to support ceiling assembly.
- .5 Accessories: Splices, clips, wire ties, retainers and wall moulding to complement suspension system components, and as recommended by system manufacturer.
- .6 Seismic Components and Accessories: In accordance with reviewed shop drawings.

## 2.06 ACOUSTICAL CEILING PANELS

- .1 Acoustical Ceiling Panels: **FINISH TYPE ACT-1**
  - .1 Manufacturer: Armstrong.
  - .2 Product: Ultima Health Zone 1935.
  - .3 Colour: White (WH).
  - .4 Size: Refer to drawings.
  - .5 Edge Type: Square lay-in.
  - .6 Texture: Smooth.
  - .7 Noise Reduction Coefficient (NRC): min. 0.70.
  - .8 Ceiling Attenuation Class (CAC): min. 38.
  - .9 Light Reflectance (LR): 0.86.
  - .10 Fire Rating: Class A to ASTM E84 and CAN/ULC S102.
  - .11 Gaskets: N/A.
  - .12 Clips: N/A.



## **2.07 ACCESSORIES**

- .1 Hold Down Clips: Purpose made clips to secure panel to suspension system from same manufacturer as acoustical panel ceiling system.

## **3 EXECUTION**

### **3.01 EXAMINATION**

- .1 Verify substrate conditions are acceptable for installation of acoustical ceiling panel and suspension system in accordance with manufacturer's instructions.
  - .1 Visually inspect substrates.
  - .2 Correct unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation after unacceptable conditions are remedied.

### **3.02 INSTALLATION - SUSPENSION SYSTEM**

- .1 Comply with manufacturer's installation instructions and recommendations, including product technical bulletins, installation instructions, and data sheets.
- .2 Install suspension system in accordance with accepted shop drawings, Certification Organizations tested design requirements and [ASTM C 636/C 636M](#) except where specified otherwise.
- .3 Install suspension system by suspending ceiling hangers from building's structural members, and as follows:
  - .1 Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
  - .2 Attach hangers to structural members or intermediate structural supports.
  - .3 Fasten hangers to cast-in-place hanger inserts, powder actuated fasteners, or drilled in anchors that extend through forms into concrete.
  - .4 Splay hangers only where required to miss obstructions. Offset resulting horizontal forces by bracing or counter-splaying.
- .4 Lay out system according to reflected ceiling plan.
- .5 Installation Tolerances: Finished ceiling system square with adjacent walls and level within 1:1000.
- .6 Secure hangers to overhead structure using attachment methods specified by manufacturer's installation instructions.
- .7 Install hangers spaced at a maximum 1200 mm on centre and within 150 mm from ends of main tees or in accordance with manufacturer's instructions where more stringent.
- .8 Coordinate suspension system with location of related components. Provide carrying channels as necessary to bridge at unavoidable interference between suspension system and other work above ceiling.
- .9 Install wall moulding to provide correct ceiling height.
- .10 Completed suspension system to support super-imposed loads, such as lighting fixtures, diffusers, grilles and speakers.
- .11 Support light fixtures and diffusers with additional ceiling suspension hangers within 150 mm of each corner and at a maximum 610 mm around perimeter of fixture.

- .12 Refer to manufacturer's instructions regarding cross member attachment to main runner to provide rigid assembly.
- .13 Frame at openings for light fixtures, air diffusers, speakers, and at changes in ceiling heights.
- .14 Install access splines where indicated.
- .15 Expansion Joints:
  - .1 Refer to drawings.
- .16 Install perimeter trim at floating installations securely anchored to suspension system, in accurate alignment with adjacent assemblies. Install curved trim members in smooth curves to radius indicated.

### **3.03 INSTALLATION - ACOUSTICAL CEILING PANEL SYSTEM**

- .1 Install lay-in acoustical panels in ceiling suspension system in accordance with manufacturer's instructions and as indicated.
- .2 Install panels with edges fully hidden from view by flanges of suspension system runners and mouldings.
- .3 In fire-rated ceiling systems, secure lay-in panels with hold-down clips and protect over light fixtures, diffusers, air return grilles and other appurtenances according to Certification Organizations design requirements.

### **3.04 SITE QUALITY CONTROL**

- .1 Site Tests and Inspections: Arrange for periodic site visits by design professional responsible for delegated ceiling design work to review installed work for conformity to design.
- .2 Manufacturer Services: Arrange for periodic site visits by manufacturer's representative to review installed work for conformity to manufacturer's installation instructions and recommendations.
  - .1 Submit written site reports after visit.
- .3 Non-Conforming Work:
  - .1 Do not support ceilings directly from permanent metal forms, floor deck, or other non-structural framing.
  - .2 Do not attach hangers to steel roof deck or steel deck tabs.
  - .3 Do not level ceilings by putting kinks in suspension wires. Kinks in suspension wires are not acceptable.
  - .4 Conceal fasteners including pop rivets on mouldings and trims.

### **3.05 CLEANING**

- .1 Progress Cleaning: In accordance with Division 1.
- .2 Final Cleaning: In accordance with Division 1, and touch-up scratches, abrasions, voids, and other defects in painted surfaces.

### **3.06 PROTECTION**

- .1 Protect installed products from damage during construction.
- .2 Repair damage to adjacent materials caused by acoustical suspension installation.

### **3.07 SCHEDULES**

- .1 Refer to drawings for finish schedule.

**END OF SECTION**

## **1 GENERAL**

### **1.01 SUMMARY**

- .1 This Section includes requirements for the following:
  - .1 Resilient sheet flooring.
  - .2 Resilient base.
  - .3 Flash coved base.
  - .4 Flooring accessories.

### **1.02 RELATED REQUIREMENTS**

- .1 Reserved.

### **1.03 DEFINITIONS**

- .1 Static Dissipative Flooring: Flooring system able to conduct a charge to ground as indicated by electrical resistance range of  $1.0 \times 10^9$  ohms, to a maximum of  $1.0 \times 10^{10}$  ohms.
- .2 Static Conductive Flooring: Flooring system able to conduct a charge to ground as indicated by electrical resistance range of  $2.5 \times 10^6$  ohms and  $< 1.0 \times 10^9$  ohms measured in accordance with ANSI/ESD STM7.1 and meeting all three recommended electrical parameters of ANSI/ESD S20.20.

### **1.04 REFERENCE STANDARDS**

- .1 American Association of Textile Chemists and Colorists (AATCC):
  - .1 AATCC 134-[2019], Electrostatic Propensity of Carpets.
- .2 American National Standards Institute (ANSI)/Electrostatic Discharge Association (ESD):
  - .1 ANSI/ESD STM7.1-[20], For the Protection of Electrostatic Discharge Susceptible Items - Flooring Systems Resistive Characterization.
  - .2 ANSI/ESD S20.20-[14], Protection of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices).
- .3 American National Standards Institute (ANSI)/National Floor Safety Institute (NFSI):
  - .1 ANSI/NFSI B101.1-[20], Test Method for Measuring the Wet SCOF of Hard-Surface Walkways.
  - .2 ANSI/NFSI B101.3-[20], Test Method for Measuring the Wet DCOF of Hard Surface Walkways.
- .4 ASTM International (ASTM):
  - .1 [ASTM D 2047-\[17\]](#), Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine.
  - .2 [ASTM E 96/E 96M-\[13\]](#), Water Vapor Transmission of Materials.
  - .3 [ASTM F 150-\[06\]](#), Standard Test Method for Electrical Resistance of Conductive and Static Dissipative Resilient Flooring.
  - .4 [ASTM F 710-\[21\]](#), Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
  - .5 [ASTM F 1303-\[04\]](#), Standard Specification for Sheet Vinyl Floor Covering with Backing.
  - .6 [ASTM F 1482-\[21\]](#), Standard Practice for Installation and Preparation of Panel Type Underlayments to Receive Resilient Flooring.
  - .7 [ASTM F 1859-\[21\]](#), Standard Specification for Rubber Sheet Floor Covering Without Backing.
  - .8 [ASTM F 1860-\[21\]](#), Standard Specification for Rubber Sheet Floor Covering With Backing.
  - .9 [ASTM F 1861-\[21\]](#), Standard Specification for Resilient Wall Base.
  - .10 [ASTM F 1869-\[16a\]](#), Standard Test Method for Measuring Moisture Vapor Emission Rate

- of Concrete Subfloor Using Anhydrous Calcium Chloride.
- .11 [ASTM F 1913-\[19\]](#), Standard Specification for Vinyl Sheet Floor Covering Without Backing.
- .12 [ASTM F 2034-\[18\]](#), Standard Specification for Sheet Linoleum Floor Covering.
- .13 [ASTM F 2169-\[15\]](#), Standard Specification for Resilient Stair Treads.
- .14 [ASTM F 2170-\[19A\]](#), Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.
- .15 [ASTM F 3010-\[18\]](#), Standard Practice for Two-Component Resin Based. Membrane-Forming Moisture Mitigation Systems for Use Under Resilient Floor Coverings.
- .5 CSA Group (CSA):
  - .1 [CSA B651-\[12\]](#), Accessible Design for the Built Environment.
- .6 General Services Administration, Federal Test Standard (FTS):
  - .1 FTS 101C, Method 4046, Electrostatic Properties of Materials.
- .7 National Floor Covering Association (NFCA):
  - .1 NFCA Floor Covering Reference Manual, [2018].
  - .2 Quality Assurance Program (QAP).
- .8 ULC Standards (ULC):
  - .1 [CAN/ULC-S102.2-\[10\]](#), Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies.

#### **1.05 ADMINISTRATIVE REQUIREMENTS**

- .1 Coordination:
  - .1 Contractor to review all drawings and coordinate installation of all indicated floor patterns and inset designs.
- .2 Pre-installation Meetings: arrange a meeting to discuss substrate conditions, and confirm complex flooring patterns.
  - .1 Review NFCA QAP Inspection procedures, and prepare reports for submission to Consultant when requested.
- .3 Sequencing: Install flooring after painting and ceiling work is complete.

#### **1.06 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Division 1.
- .2 Product Data: Submit manufacturer's instructions, product literature, and data sheets for resilient sheet flooring and accessories. Include product characteristics, performance criteria, dimensions, finishes, and limitations.
- .3 Samples for Initial Selection: Submit the following for Consultant's initial selection of colours:
  - .1 300 x 300mm samples of each type of resilient sheet flooring.
  - .2 Small samples of resilient base.
  - .3 Samples of stair nosing.
  - .4 Samples of stair tread.
  - .5 Samples of stair riser.
  - .6 Samples of sheet flooring welding beads.
  - .7 Samples of accessories where exposed to view.
- .4 Shop Drawings:
  - .1 Submit shop drawings showing flooring sheet layout, designs and details including special designs and cove bases.

- .5 Sustainable Design Submittals:
  - .1 Reserved.
- .6 Site Quality Control Submittals:
  - .1 Submit floor substrate test results prior to beginning flooring installation. Include comparison of sheet flooring manufacturer's acceptable alkaline level and recommended maximum moisture emission rates to site test results for each type of flooring.
  - .2 Submit information in accordance with NFCA QAP procedures and requirements. Submit inspection results and reports for review. When deviations from specified physical conditions or performance criteria are found, notify Consultant of findings.

#### **1.07 CLOSEOUT SUBMITTALS**

- .1 Operations and Maintenance Data: Submit manufacturer's cleaning and repair recommendations in accordance with Division 1.
- .2 Warranty Documentation: Submit manufacturer's warranties.

#### **1.08 MAINTENANCE MATERIAL SUBMITTALS**

- .1 Submit maintenance information for flooring system.

#### **1.09 QUALITY ASSURANCE**

- .1 Preparation, materials, and workmanship in accordance with NFCA QAP requirements. Repair or replace deficient work in accordance with NFCA QAP requirements.
- .2 Installers:
  - .1 Experienced in resilient sheet flooring with minimum 5 years documented successful installations.
  - .2 Resilient sheet flooring installer to have completed flooring manufacturer's training program. Submit certification upon Consultant's request.
- .3 Third-Party Independent Inspector Qualifications: Assigned by a NFCA Accredited QAP provider.
- .4 Mock-Ups: Construct mock-up in accordance with Division 1, and as follows:
  - .1 Construct a mock-up of resilient sheet flooring including a flooring seam and integral cove base at an outside wall corner.
  - .2 Acceptable mock-up may remain as part of the completed work.

#### **1.10 DELIVERY, STORAGE, AND HANDLING**

- .1 Perform in accordance with Division 1.
- .2 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging, with manufacturer's labels.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground, indoors, in a clean dry location, and in accordance with manufacturer's recommendations in well-ventilated area.
  - .2 Protect adhesives, fillers, and sealants from freezing.
  - .3 Store and protect materials from nicks, scratches, and blemishes.
- .4 Packaging Waste Management: Perform in accordance with Division 1.

#### **1.11 SITE CONDITIONS**

- .1 Ambient Conditions: before installation, continuously during, and after installation, maintain the

following conditions, except when manufacturer's recommendations are more stringent:

- .1 Ambient room temperature: 18 to 29 degrees C.
- .2 Floor substrate temperature: minimum 15 degrees C.
- .3 Relative humidity: 40 to 60%.

## 1.12 WARRANTY

- .1 Provide manufacturer's standard limited warranty for materials.
- .2 Provide installer's warranty to warrant installer's workmanship for 1 year commencing from the date of project substantial performance covering all materials and labour required to repair defects.

## 2 PRODUCTS

### 2.01 REGULATORY REQUIREMENTS

- .1 Meet requirements of [CAN/ULC S102.2](#) for required Flame Spread Ratings labelled and listed by ULC Standards or another agency acceptable to Authorities Having Jurisdiction (AHJ).

### 2.02 PERFORMANCE CRITERIA

- .1 Provide resilient sheet flooring system with fully welded seams to be liquid-tight.

### 2.03 MATERIALS

- .1 Acceptable Manufacturers:
  - .1 Polyflor.
  - .2 Forbo.
  - .3 Altro.
- .2 Resilient Sheet Flooring: **FINISH TYPE FF-1.**
  - .1 Manufacturer: Polyflor.
  - .2 Product: Pearlazzo Homogeneous Vinyl Sheet Flooring c/w PUR Finish.
  - .3 Thickness: 2.0mm
  - .4 Colour: Raincloud 9718.
  - .5 Slip Resistance:
    - .1 DIN 51130 / DIN EN 16165 Ann. B: R9.
    - .2 AS 4586: R9.
    - .3 ASTM D2047: SCOF  $\geq 0.6$ .
  - .6 Static Electrical Propensity:
    - .1 EN 1815:  $\leq 2.0$  kV Classified as 'antistatic'.
  - .7 Welding: Cold weld.
  - .8 Wall Base: Integral coved wall base, 6" high, c/w colour-matched vinyl top cap.
- .3 Wall Base:
  - .1 Manufacturer: Refer to Finish Type FF-1.
  - .2 Product: Refer to Finish Type FF-1.
  - .3 Height: Refer to Finish Type FF-1.
  - .4 Colour: Refer to Finish Type FF-1.

### 2.04 ACCESSORIES

- .1 Primer: Where recommended by sheet flooring manufacturer for site conditions and application.
- .2 Reserved.

- .3 Adhesives: Types recommended by flooring manufacturer for substrate; above, on, or below grade.
  - .1 Cove base adhesives: Type recommended by base manufacturer to suit application.
  - .2 Static conductive flooring adhesive: Full spread adhesive, specially formulated for static conductive flooring, and as recommended by sheet flooring manufacturer for application.
- .4 Reserved.
- .5 Heat Welding Bead: Solid strand product to be provided by sheet flooring manufacturer for heat welding seams, and as follows:
  - .1 Colour and pattern: Matching colour and pattern of resilient flooring.
- .6 Reserved.
- .7 Reserved.
- .8 Resilient Transition and Edge Strips: Refer to drawings.
- .9 Edging at Floor Penetrations: Refer to drawings, where not specified use edging type recommended by flooring manufacturer.
- .10 Flash Cove Base Filler Strip: Pre-formed radius to support flash cove base, 25 mm radius, PVC.
- .11 Flash Cove Base Cap: refer to drawings.
- .12 Reserved.

### **3 EXECUTION**

#### **3.01 EXAMINATION**

- .1 Verification of Conditions: Verify that substrate conditions are clean, free of cracks, ridges, depressions, scale, foreign materials, and acceptable for resilient sheet flooring installation in accordance with manufacturer's instructions.
  - .1 Proceed with installation only after unacceptable conditions are remedied.
- .2 Pre-installation Testing: Perform tests to verify concrete floors are within moisture vapour emissions levels and pH range specified by manufacturer.

#### **3.02 PREPARATION**

- .1 Demolition: Remove existing resilient flooring.
- .2 If concrete floor substrate vapour emissions exceed manufacturer's recommendations, prepare substrate in accordance with [ASTM F 3010](#).
- .3 Prepare concrete floor substrates to [ASTM F 710](#).
- .4 Remove subfloor ridges and bumps.
- .5 Clean floor of dust, mildew, alkaline salts, laitance, concrete film-forming curing compounds, paint, solvents, wax, oil, grease, residual adhesive, adhesive removing compounds, sealants, soap, and other foreign material.
- .6 Fill low spots, cracks, joints, holes and other defects with sub-floor filler. Trowel and float to leave smooth, flat hard surface. Prohibit traffic until filler is dry and cured.
- .7 Prime concrete slab to resilient flooring manufacturer's recommendations.



- .8 Do not use permanent markers on floor substrates.

### **3.03 INSTALLATION - FLOORING**

- .1 Provide high ventilation rate maximizing outside air during installation in accordance with manufacturer's instructions. If possible, vent directly to outside. Do not let contaminated air recirculate through building air distribution system.
- .2 Apply adhesive uniformly using manufacturer's recommended trowel, followed by a roller or similar tool to knock down trowel ridges and eliminate them from telegraphing through finished flooring. Do not spread more adhesive than can be covered by sheet flooring before initial set takes place.
- .3 Lay flooring with seams in directions indicated on Drawings. Where not specified, lay flooring to produce the least number of seams. Border widths shall be a minimum 1/3 the width of full material.
- .4 Continuously weld according to manufacturer's instructions.
- .5 Do not install flooring over building expansion joints.
- .6 As installation progresses, roll sheet flooring in accordance with manufacturer's installation recommendations, for full adhesion and to expel air bubbles.
- .7 Promptly remove excess adhesive.
- .8 Cut flooring neatly around fixed objects.
- .9 Install feature strips and special patterns where indicated. Fit joints tightly.
- .10 Install flooring in pan type floor access covers. Maintain continuity of floor pattern.
- .11 Install sheet flooring continuously in areas which will be under built-in furniture.
- .12 Install sheet flooring continuously through areas to receive demountable partitions.
- .13 Terminate flooring under centreline of door, in openings where adjacent floor finish materials or colours are dissimilar.
- .14 Install floor transition strips at unprotected and exposed edges where sheet flooring terminates, unless otherwise noted.
- .15 Install floor transition strip between changes in flooring material and or thickness, select appropriate strip profile, unless otherwise noted.

### **3.04 INSTALLATION – STAIR FINISHES**

- .1 Reserved.

### **3.05 INSTALLATION - BASE**

- .1 Lay out resilient base to keep the number of joints at a minimum.
- .2 Clean substrate and apply one coat of adhesive.
- .3 Set resilient base against wall and floor surfaces tightly by using 3-kg hand roller.
- .4 Install straight and level, to variation of 1:1000.

- .5 Scribe, cut, and fit wall base to door frames and other obstructions.
- .6 Cope wall base at internal corners. Install formed straight wall base for external corners. Install premoulded wall base corner units for right angle external and internal corners. Install formed straight wall base for non-90 degree corners.
- .7 Provide straight (toeless) type base where floor finish is carpet, cove type base elsewhere. Refer to Drawings for locations of straight (toeless) base, cove base, and flash cove base.

### **3.06 SITE QUALITY CONTROL**

- .1 Site Inspections:
  - .1 Contractor to review installation with flooring installer and correct all defects prior to notifying Consultant for review.
- .2 Manufacturer's Site Services:
  - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, protecting and initial cleaning of product and submit Manufacturer's Site Reports.
  - .2 Provide manufacturer's site services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
- .3 For specialty resilient flooring materials or systems, the manufacturer's representative shall review all surfaces and conditions for material applications and provide sufficient site reviews and reports to ensure installation conforms with the product warranty requirements.

### **3.07 CLEANING**

- .1 Progress Cleaning: Clean in accordance with Division 1.
- .2 Final Cleaning: Perform in accordance with Division 1.
  - .1 Clean flooring base, surfaces to manufacturer's recommendations.
- .3 Waste Management: Perform in accordance with Division 1.

### **3.08 PROTECTION**

- .1 Prohibit traffic on floor after installation. Protect new floors until adhesive is fully cured. Refer to manufacturer's requirements.
- .2 Where flooring areas will receive heavy traffic, rolling loads, or pallet jacks, protect flooring with 6-mm-thick temporary hardboard panels. Sweep or vacuum under panel areas prior to placement.

### **3.09 SCHEDULES**

- .1 Refer to drawings for finish schedule.

**END OF SECTION**

## **1 GENERAL**

### **1.01 RELATED REQUIREMENTS**

- .1 Refer to drawings and applicable Division 8 and 9 specifications sections.

### **1.02 REFERENCE STANDARDS**

- .1 Environmental Protection Agency (EPA):
  - .1 Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, EPA Method 24 - Surface Coatings.
  - .2 SW-846, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
  - .1 Safety Data Sheets (SDS).
- .3 Master Painters Institute (MPI):
  - .1 The Master Painters Institute (MPI)/Architectural Painting Specification Manual (ASM) - [current edition].
  - .2 Standard GPS-1- [12], MPI Green Performance Standard.
  - .3 Standard GPS-2- [12], MPI Green Performance Standard.
- .4 National Research Council Canada (NRC):
  - .1 National Fire Code of Canada [2015] (NFC).
- .5 Society for Protective Coatings (SSPC):
  - .1 SSPC Painting Manual, Volume Two, 8th Edition, Systems and Specifications Manual.

### **1.03 ADMINISTRATIVE REQUIREMENTS**

- .1 Scheduling:
  - .1 Submit work schedule for various stages of painting to Consultant for review. Submit schedule minimum of 48 hours in advance of proposed operations.
  - .2 Obtain written authorization from Consultant for changes in work schedule.
  - .3 Schedule painting operations to prevent disruption of occupants and operation of machinery or equipment.

### **1.04 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide in accordance with Division 1.
- .2 Product Data:
  - .1 Provide manufacturer's instructions, printed product literature and data sheets for paint and paint products and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Submit copies of WHMIS SDS in accordance with Division 1.
  - .3 Confirm products to be used are in MPI's approved product list.
- .3 Upon completion, provide records of products used. List products in relation to finish system and include the following:
  - .1 Product name, type and use.
  - .2 Manufacturer's product number.
  - .3 Colour numbers.
  - .4 MPI Environmentally Friendly classification system rating.
  - .5 Manufacturer's Safety Data Sheets (SDS).
- .4 Samples:
  - .1 Submit full range colour sample chips to indicate where colour availability is restricted.

- .2 Submit sample panels of each paint with specified paint or coating in colours, gloss/sheen and textures required to MPI Architectural Painting Specification Manual standards submitted on following substrate materials:
  - .1 3 mm plate steel for finishes over metal surfaces.
  - .2 13 mm plywood (with veneer matching species where specified) for finishes over wood surfaces.
  - .3 50 mm concrete block for finishes over concrete or concrete masonry surfaces.
  - .4 13 mm gypsum board for finishes over gypsum board and other smooth surfaces.
- .3 Retain reviewed samples on-site to demonstrate acceptable standard of quality for appropriate on-site surface.
- .5 Test reports: Provide certified test reports for paint from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.
  - .1 Lead, cadmium and chromium: presence of and amounts.
  - .2 Mercury: presence of and amounts.
  - .3 Organochlorines and PCBs: presence of and amounts.
- .6 Certificates: Provide certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties. MPI Gateway #.
- .7 Manufacturer's Instructions:
  - .1 Provide manufacturer's installation and application instructions.
- .8 Sustainable Design Submittals:
  - .1 Reserved.

#### **1.05 CLOSEOUT SUBMITTALS**

- .1 Provide in accordance with Division 1.
- .2 Operation and Maintenance Data: Provide operation and maintenance data for painting materials for incorporation into manual.
- .3 Include:
  - .1 Product name, type and use.
  - .2 Manufacturer's product number.
  - .3 Colour numbers.
  - .4 MPI Environmentally Friendly classification system rating.

#### **1.06 MAINTENANCE MATERIAL SUBMITTALS**

- .1 Extra Stock Materials:
  - .1 Provide maintenance materials in accordance with Division 1.
  - .2 Deliver extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels.
  - .3 Quantity: provide one sealed, 4 litre can of each type and colour of primer and finish coating. Identify colour and paint type in relation to established colour schedule and finish system.

#### **1.07 QUALITY ASSURANCE**

- .1 Qualifications:
  - .1 Contractor: to have a minimum of 5 years proven satisfactory experience and be a member of Ontario Painting Contractors Association (OPCA). When requested by Consultant, provide proof of membership.
  - .2 Qualified journeypersons as defined by local jurisdiction to be engaged in painting work.

- .3 Apprentices: may be employed provided they work under direct supervision of qualified journey person in accordance with trade regulations.
- .4 Conform to latest MPI requirements for exterior painting work including preparation and priming.
- .5 Materials: in accordance with MPI Painting Specification Manual "Approved Product" listing and from a single manufacturer for each system used.
- .6 Retain purchase orders, invoices and documents to prove conformance with noted MPI requirements when requested by Consultant.
- .7 Standard of Acceptance:
  - .1 Walls: no defects visible from a distance of 1000 mm at 90 degrees to surface.
  - .2 Soffits: no defects visible from floor at 45 degrees to surface when viewed using final lighting source.
  - .3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.
- .2 Mock-Ups:
  - .1 Prepare and paint designated surface, area, room or item to requirements specified herein, with specified paint or coating showing selected colours, number of coats, gloss/sheen, textures and quality of work to MPI Painting Specification Manual standards for review and approval.
  - .2 Construct mock-ups in accordance with Division 1.
    - .1 Coordinate with Consultant location and items to be painted for mock-up review purposes.
    - .2 Mock-up will be used:
      - .1 To judge quality of work, substrate preparation, operation of equipment and material application and skill to MPI Architectural Painting Specification Manual standards.
    - .3 Locate where directed.
    - .4 Allow 48 hours for inspection of mock-up before proceeding with Work.
    - .5 When accepted, mock-up will demonstrate minimum standard of quality required for this work. Approved mock-up may remain as part of finished work.

#### **1.08 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
  - .1 Labels: to indicate:
    - .1 Type of paint or coating.
    - .2 Compliance with applicable standard.
    - .3 Colour number in accordance with established colour schedule.
- .3 Storage and Handling Requirements:
  - .1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Observe manufacturer's recommendations for storage and handling.
  - .3 Store materials and supplies away from heat generating devices.
  - .4 Store materials and equipment in well ventilated area with temperature range 7 degrees C to 30 degrees C.
  - .5 Keep areas used for storage, cleaning and preparation, clean and orderly. After completion of operations, return areas to clean condition to approval of Owner.
  - .6 Remove paint materials from storage only in quantities required for same day use.
  - .7 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling storage, and disposal of hazardous materials.
  - .8 Fire Safety Requirements:
    - .1 Provide fire extinguisher adjacent to storage area.

- .2 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.
- .3 Handle, store, use and dispose of flammable and combustible materials in accordance with the National Fire Code of Canada (NFC).
- .4 Develop Construction Waste Management Plan and/or Waste Reduction Workplan related to Work of this Section and in accordance with Division 1.
- .5 Packaging Waste Management: remove for reuse and/or disposal in accordance with Construction Waste Management Plan and/or Waste Reduction Workplan.

## 1.09 SITE CONDITIONS

- .1 Ambient Conditions:
  - .1 Heating, Ventilation and Lighting:
    - .1 Ventilate enclosed spaces in accordance with manufacturer's recommendations where possible.
    - .2 Provide heating facilities to maintain ambient air and substrate temperatures above 10 degrees C for 24 hours before, during and after paint application until paint has cured sufficiently.
    - .3 Provide continuous ventilation for 7 days after completion of application of paint.
    - .4 Coordinate use of existing ventilation system with Owner and ensure its operation during and after application of paint as required.
    - .5 Provide temporary ventilating and heating equipment where permanent facilities are not available or supplemental ventilating and heating equipment if ventilation and heating from existing system is inadequate to meet minimum requirements.
    - .6 Provide minimum lighting level of 323 Lux on surfaces to be painted.
  - .7 Temperature, Humidity and Substrate Moisture Content Levels:
    - .1 Unless pre-approved written approval by product manufacturer, perform no painting when:
      - .1 Ambient air and substrate temperatures are below 10 degrees C.
      - .2 Substrate temperature is above 32 degrees C unless paint is specifically formulated for application at high temperatures.
      - .3 Substrate and ambient air temperatures are not expected to fall within MPI or paint manufacturer's prescribed limits.
      - .4 The relative humidity is under 85 % or when the dew point is more than 3 degrees C variance between the air/surface temperature. Paint should not be applied if the dew point is less than 3 degrees C below the ambient or surface temperature. Use sling psychrometer to establish the relative humidity before beginning paint work.
      - .5 Rain or snow are forecast to occur before paint has thoroughly cured or when it is foggy, misty, raining or snowing at site.
      - .6 Ensure that conditions are within specified limits during drying or curing process, until newly applied coating can itself withstand 'normal' adverse environmental factors.
    - .2 Perform painting work when maximum moisture content of the substrate is below:
      - .1 12 % for concrete and masonry (clay and concrete brick/block). Allow new concrete and masonry to cure minimum of 28 days.
      - .2 15 % for hard wood.
      - .3 17 % for soft wood.
      - .4 12 % for plaster and gypsum board.
    - .3 Test for moisture using calibrated electronic Moisture Meter. Test concrete floors for moisture using "cover patch test".
    - .4 Test concrete, masonry and plaster surfaces for alkalinity as required.

- .8 Surface and Environmental Conditions:
  - .1 Apply paint finish in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.
  - .2 Apply paint to adequately prepared surfaces and to surfaces within moisture limits.
  - .3 Apply paint when previous coat of paint is dry or adequately cured.
- .9 Additional interior application requirements:
  - .1 Apply paint finishes when temperature at location of installation can be satisfactorily maintained within manufacturer's recommendations.
  - .2 Apply paint in occupied facilities before or after building operation hours (after-hours) only. Schedule operations to approval of Owner such that painted surfaces will have dried and cured sufficiently before occupants are affected.

## **2 PRODUCTS**

### **2.01 PERFORMANCE REQUIREMENTS**

- .1 Environmental Performance Requirements:
  - .1 In accordance with specified paint coating products.

### **2.02 MATERIALS**

- .1 Only paint materials listed in the MPI Approved Products List (APL) are acceptable for use on this project.
- .2 Provide paint materials for paint systems from single manufacturer unless otherwise noted.
- .3 Conform to latest MPI requirements for interior painting work including preparation and priming.
- .4 Provide all paint coatings specified on drawings and indicated in this specification section.

### **2.03 COLOURS**

- .1 Provide colours as indicated on drawings. Provide closest matching colour from paint manufacturer where no specific paint code is provided.
- .2 Second coat in three coat system to be tinted slightly lighter colour than top coat to show visible difference between coats.
- .3 For deep and ultra deep colours; provide 4 coats.

### **2.04 MIXING AND TINTING**

- .1 Perform colour tinting operations prior to delivery of paint to site.
- .2 Mix paste, powder or catalyzed paint mixes in accordance with manufacturer's written instructions.
- .3 Use and add thinner in accordance with paint manufacturer's recommendations. Do not use kerosene or similar organic solvents to thin water-based paints.
- .4 Thin paint for spraying in accordance with paint manufacturer's instructions.
- .5 Re-mix paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity. Strain as necessary.

## 2.05 GLOSS/SHEEN RATINGS

- .1 Paint gloss is defined as sheen rating of applied paint, in accordance with following values:

<u>Gloss Level Category</u>	<u>Gloss @ 60 degrees</u>	<u>Sheen @ 85 degrees</u>
Level 1 – Matte (Flat)	Max. 5	Max. 10
Level 2 – Velvet	Max. 10	10 to 35
Level 3 – Eggshell	10 to 25	10 to 35
Level 4 – Satin	20 to 35	min. 35
Level 5 – Semi-gloss	35 to 70	
Level 6 – Gloss	70 to 85	
Level 7 – High Gloss	More than 85	

- .2 Gloss level ratings of painted surfaces as indicated on drawings.

## 2.06 PAINT TYPES

- .1 Paint Finish for Walls: **FINISH TYPE PT-1.**

- .1 Acceptable Manufacturer: Benjamin-Moore.
- .2 Product: Premium-grade Interior Latex Based Paint.
- .3 Primer: As per manufacturer's recommendations for applicable substrate.
- .4 Colour: Chantilly Lace #OC-65.
- .5 Sheen: Eggshell.

- .2 Paint Finish for Doors and Frames: **FINISH TYPE PT-2.**

- .1 Acceptable Manufacturer: Benjamin-Moore.
- .2 Product: Premium-grade Interior Latex Based Paint.
- .3 Primer: As per manufacturer's recommendations for applicable substrate.
- .4 Colour: Collingwood #OC-28.
- .5 Sheen: Semi-gloss.

- .3 Paint Finish for GWB Ceilings and Bulkheads: **FINISH TYPE PT-3.**

- .1 Acceptable Manufacturer: Benjamin-Moore.
- .2 Product: Premium-grade Interior Latex Based Paint.
- .3 Primer: As per manufacturer's recommendations for applicable substrate.
- .4 Colour: Chantilly Lace #OC-65.
- .5 Sheen: Matte (Flat).

- .4 Paint Finish for Walls: **FINISH TYPE PT-4.**

- .1 Acceptable Manufacturer: Benjamin-Moore.
- .2 Product: Premium-grade Interior Latex Based Paint.
- .3 Primer: As per manufacturer's recommendations for applicable substrate.
- .4 Colour: Tranquility AF490.
- .5 Sheen: Eggshell.

## 2.07 SPECIAL FINISHES

- .1 Reserved.

## 2.08 SOURCE QUALITY CONTROL

- .1 Perform following tests on each batch of consolidated post-consumer material before surface coating is reformulated and canned. Testing by laboratory or facility which has been accredited by



Standards Council of Canada.

- .1 Lead, cadmium and chromium are to be determined using ICP-AES (Inductively Coupled Plasma - Atomic Emission Spectroscopy) technique no. 6010 as defined in EPA SW-846.
- .2 Mercury is to be determined by Cold Vapour Atomic Absorption Spectroscopy using Technique no. 7471 as defined in EPA SW-846.
- .3 Organochlorines and PCBs are to be determined by Gas Chromatography using Technique no. 8081 as defined in EPA SW-846.

### **3 EXECUTION**

#### **3.01 MANUFACTURER'S INSTRUCTIONS**

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheet.

#### **3.02 GENERAL**

- .1 Perform preparation and operations for interior painting in accordance with MPI Architectural Painting Specifications Manual except where specified otherwise
- .2 Apply paint materials in accordance with paint manufacturer's written application instructions.

#### **3.03 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable to be painted in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate with painting Contractor.
  - .2 Correct unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied.
- .2 Conduct moisture testing of surfaces to be painted using properly calibrated electronic moisture meter, except test concrete floors for moisture using simple "cover patch test". Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.
- .3 Maximum moisture content as follows:
  - .1 Stucco, plaster and gypsum board: 12 %.
  - .2 Concrete: 12 %.
  - .3 Clay and Concrete Block/Brick: 12 %.
  - .4 Hard Wood: 15 %.
  - .5 Soft Wood: 17%.

#### **3.04 PREPARATION**

- .1 Protection:
  - .1 Protect existing building surfaces and adjacent structures from paint spatters, markings and other damage by suitable non-staining covers or masking. If damaged, clean and restore surfaces to match existing condition.
  - .2 Protect items that are permanently attached such as Fire Labels on doors and frames.
  - .3 Protect factory finished products and equipment.
  - .4 Protect passing pedestrians, building occupants and general public in and about the building.
- .2 Surface Preparation:
  - .1 Remove electrical cover plates, light fixtures, surface hardware on doors, bath accessories and other surface mounted equipment, fittings and fastenings prior to undertaking painting operations. Identify and store items in secure location and

- re-installed after painting is completed.
- .2 Move and cover furniture and portable equipment as necessary to carry out painting operations. Replace as painting operations progress.
- .3 Place "WET PAINT" signs in occupied areas as painting operations progress. Signs to approval of Owner.
- .4 Remove any rough areas, patch and repair as required all surfaces prior to painting.
- .3 Clean and prepare surfaces in accordance with MPI Architectural Painting Specification Manual requirements. Refer to MPI Manual in regard to specific requirements and as follows:
  - .1 Remove dust, dirt, and other surface debris.
  - .2 Wash surfaces with a biodegradable detergent and clean warm water using a stiff bristle brush to remove dirt, oil and other surface contaminants.
  - .3 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.
  - .4 Allow surfaces to drain completely and allow to dry thoroughly.
  - .5 Prepare surfaces for water-based painting, water-based cleaners should be used in place of organic solvents.
  - .6 Use trigger operated spray nozzles for water hoses.
  - .7 Many water-based paints cannot be removed with water once dried. Minimize use of mineral spirits or organic solvents to clean up water-based paints.
- .4 Reserved.
- .5 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining coats. Apply primer, paint, or pretreatment as soon as possible after cleaning and before deterioration occurs.
- .6 Where possible, prime non-exposed surfaces of new wood surfaces before installation. Use same primers as specified for exposed surfaces.
  - .1 Apply sealer to MPI #36 over knots, pitch, sap and resinous areas
  - .2 Apply wood filler to nail holes and cracks.
  - .3 Tint filler to match stains for stained woodwork.
- .7 Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 1000 mm.
- .8 Carried out during shop priming: clean metal surfaces to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with MPI requirements. Remove traces of blast products from surfaces, pockets and corners to be painted.
- .9 Touch up of shop primers with primer as specified.
- .10 Do not apply paint until substrates are properly prepared in accordance with manufacturer's requirements.

### **3.05 EXISTING CONDITIONS**

- .1 Conduct moisture testing of surfaces to be painted using properly calibrated electronic moisture meter, except test concrete floors for moisture using simple "cover patch test" and report findings to Consultant. Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.
- .2 Unless otherwise stated by paint manufacturer, maximum moisture content as follows:
  - .1 Stucco: 12 %.
  - .2 Concrete: 12 %.
  - .3 Clay and Concrete Block/Brick: 12 %.
  - .4 Hard Wood: 15 %.
  - .5 Soft Wood: 17%.

### 3.06 APPLICATION

- .1 Conform to manufacturer's application instructions unless specified otherwise.
- .2 Brush and Roller Application:
  - .1 Apply paint in uniform layer using brush and/or roller type suitable for application.
  - .2 Work paint into cracks, crevices and corners.
  - .3 Paint surfaces and corners not accessible to brush using spray, daubers and/or sheepskins. Paint surfaces and corners not accessible to roller using brush, daubers or sheepskins.
  - .4 Brush and/or roll out runs and sags, and over-lap marks. Rolled surfaces free of roller tracking and heavy stipple.
  - .5 Remove runs, sags and brush marks from finished work and repaint.
- .3 Spray application:
  - .1 Provide and maintain equipment that is suitable for intended purpose, capable of atomizing paint to be applied, and equipped with suitable pressure regulators and gauges.
  - .2 Keep paint ingredients properly mixed in containers during paint application either by continuous mechanical agitation or by intermittent agitation as frequently as necessary.
  - .3 Apply paint in uniform layer, with overlapping at edges of spray pattern. Back roll first coat application.
  - .4 Brush out immediately all runs and sags.
  - .5 Use brushes and rollers to work paint into cracks, crevices and places which are not adequately painted by spray.
- .4 Use dipping, sheepskins or daubers only when no other method is practical in places of difficult access.
- .5 Apply coats of paint continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.
- .6 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.
- .7 Sand and dust between coats to remove visible defects.
- .8 Finish surfaces both above and below sight lines as specified for surrounding surfaces, including such surfaces as tops of interior cupboards and cabinets and projecting ledges.
- .9 Finish inside of cupboards and cabinets as specified for outside surfaces.
- .10 Finish closets and alcoves as specified for adjoining rooms.
- .11 Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.
- .12 Wood, drywall, plaster, stucco, concrete, concrete masonry units and brick; if sprayed, must be back rolled.
- .13 Prime all substrates to be painted in accordance with paint manufacturer's recommendations for specified paint types. For painting over dark colours, provide sufficient coats of primer to hide existing dark colours.
- .14 Apply a minimum of 2 coats of specified paints unless otherwise specified in manufacturer's instructions. Apply additional coats as required to hide existing colours where painting over already painted surface.

### **3.07 MECHANICAL/ ELECTRICAL**

- .1 Paint finished area exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment with colour and finish to match adjacent surfaces, except as indicated.
- .2 Boiler room, mechanical and electrical rooms: paint exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment.
- .3 Other unfinished areas: leave exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment in original finish and touch up scratches and marks.
- .4 Do not paint over nameplates.
- .5 Keep sprinkler heads free of paint.
- .6 Paint inside of ductwork where visible behind grilles, registers and diffusers with primer and one coat of matt black paint.
- .7 Paint fire protection piping red.
- .8 Paint disconnect switches for fire alarm system and exit light systems in red enamel.
- .9 Paint natural gas piping yellow.
- .10 Paint both sides and edges of backboards for telephone and electrical equipment before installation. Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.
- .11 Do not paint interior transformers and substation equipment.

### **3.08 SITE TOLERANCES**

- .1 Walls: no defects visible from a distance of 1000 mm at 90 degrees to surface.
- .2 Ceilings: no defects visible from floor at 45 degrees to surface when viewed using final lighting source.
- .3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

### **3.09 SITE QUALITY CONTROL**

- .1 Inspect with painting Contractor completed work, identify all defects for correction prior to notifying Consultant for review.
- .2 Where "special" painting, coating or decorating system applications (i.e. elastomeric coatings) or non- MPI listed products or systems are to be used, paint or coating manufacturer will provide as part of this work, certification of surfaces and conditions for specific paint or coating system application as well as on site supervision, inspection and approval of their paint or coating system application as required at no additional cost to Owner.
- .3 Standard of Acceptance:
  - .1 Walls: no defects visible from a distance of 1000 mm at 90 degrees to surface.
  - .2 Ceilings: no defects visible from floor at 45 degrees degrees to surface when viewed using final lighting source.
  - .3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.
- .4 When requested, field inspection of painting operations to be carried out by representative of paint manufacturer.

- .5 Retain purchase orders, invoices and other documents to prove conformance with noted MPI requirements when requested by Consultant.

### **3.10 CLEANING**

- .1 Progress Cleaning: clean in accordance with Division 1.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Division 1.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Division 1.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

### **3.11 RESTORATION**

- .1 Clean and re-install hardware items removed before undertaken painting operations.
- .2 Remove protective coverings and warning signs as soon as practical after operations cease.
- .3 Remove paint splashings on exposed surfaces that were not painted. Remove smears and spatter immediately as operations progress, using compatible solvent.
- .4 Protect freshly completed surfaces from paint droppings and dust to approval of Owner. Avoid scuffing newly applied paint.
- .5 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition as approved by Owner.

**END OF SECTION**

## **1 GENERAL**

### **1.01 RELATED REQUIREMENTS**

- .1 Refer to applicable specification sections related to door hardware and metal fabrications where available.

### **1.02 REFERENCE STANDARDS**

- .1 Aluminum Association (AA):
  - .1 AA DAF 45-[03(R2009)], Designation System for Aluminum Finishes.
- .2 Canada Green Building Council (CaGBC):
  - .1 LEED Canada-NC Version 1.0-[2004], LEED (Leadership in Energy and Environmental Design): Green Building Rating System for New Construction and Major Renovations (including Addendum 2007).
  - .2 LEED Canada-NC-[2009], LEED (Leadership in Energy and Environmental Design): Green Building Rating System for New Construction and Major Renovations 2009.
  - .3 LEED Canada-CI Version 1.0-[2007], LEED (Leadership in Energy and Environmental Design): Green Building Rating System for Commercial Interiors.
  - .4 LEED Canada-EB: O&M-[2009], LEED (Leadership in Energy and Environmental Design): Green Building Rating System for Existing Buildings: Operations and Maintenance 2009.

### **1.03 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Division 1.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for wall and corner guards and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Submit WHMIS SDS in accordance with Division 1. Indicate VOC's for material as follows:
    - .1 Caulking materials during application and curing.
    - .2 Adhesives.
- .3 Shop Drawings:
  - .1 Submit shop drawings for items requiring fabrication, Indicate on drawings large scale details, materials, finishes, dimensions, anchorage and assembly.
- .4 Samples:
  - .1 Submit samples of specified products when requested by Consultant.
- .5 Sustainable Design Submittals:
  - .1 Reserved.

### **1.04 QUALITY ASSURANCE**

- .1 Test Reports:
  - .1 Submit certified test reports showing compliance with specified performance characteristics and physical properties.
- .2 Certificates:
  - .1 Submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

## **1.05 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect all items.
  - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan and/or Waste Reduction Workplan related to Work of this Section and in accordance with Division 1.
- .5 Packaging Waste Management: remove for reuse and return to manufacturer where possible.

## **2 PRODUCTS**

### **2.01 MATERIALS**

- .1 Bump Guard Type "BR1":
  - 1. Manufacturer: C-S Group
  - 2. Model: FR-225
  - 3. Material: PVC-Free Acrovyn.
  - 4. Size: 57.2mm [2-1/4"] H x 19.1mm [3/4"] wall offset, refer to drawings for lengths.
  - 5. Accessories: Provide required accessories for proper installation, including corner and end caps.
  - 6. Mounting: Mechanically fastened with concealed fasteners. Refer to drawings for all required locations.
  - 7. Finish: 949 White.
- .2 Corner Guard Type "CG1":
  - 8. Manufacturer: C-S Group
  - 9. Model: CO-8, 4.8mm [3/16"] nose radius, 90 deg.
  - 10. Material: Type 316 Stainless Steel, 18 ga.
  - 11. Size: 50mm x 50mm [2" x 2"], refer to drawings for height.
  - 12. Accessories: Provide required accessories for proper installation.
  - 13. Mounting: Mechanically fastened with concealed fasteners. Refer to drawings for all required locations. Seal all edges to wall surface with clear silicone sealant.
  - 14. Finish: #4 Satin finish.
- .3 Wall Protection Panels:
  - 1. Refer to Section 09 72 16\_16 Sheet Wall Covering.

### **2.02 ACCESSORIES**

- .1 Fasteners: in accordance with manufacturer's installation instructions.
- .2 Adhesive: water and chemical resistant type as recommended by manufacturer for substrate.

### **2.03 RESERVED**

- .1 Reserved.

### **3 EXECUTION**

#### **3.01 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for wall and corner guards installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate.
  - .2 Correct unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied.

#### **3.02 MANUFACTURER'S INSTRUCTIONS**

- .1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

#### **3.03 INSTALLATION**

- .1 Install units on solid backing and erect with materials and components straight, tight and in alignment.
- .2 Install wall guards in accordance with manufacturer's instructions and where indicated on drawings, straight and level to variation plus or minus 3 mm over 3000 mm straight edge, non-cumulative.
- .3 Install corner guards and door frame bumpers in accordance with manufacturer's instructions and where indicated on drawings.

#### **3.04 CLEANING**

- .1 Progress Cleaning: clean in accordance with Division 1.
  - .1 Leave Work area clean at end of each day.
- .2 Perform cleaning after installation to remove construction and accumulated environmental dirt.
- .3 Clean surfaces after installation using manufacturer's written recommended cleaning procedures.
- .4 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.
- .5 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Division 1.
- .6 Waste Management: separate waste materials for reuse and recycling in accordance with Division 1.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

#### **3.05 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by wall and corner guards installation.

**END OF SECTION**



## **1 GENERAL**

### **1.01 RELATED REQUIREMENTS**

- .1 Reserved.

### **1.02 REFERENCE STANDARDS**

- .1 ASTM International:
  - .1 [ASTM D 1784-\[11\]](#), Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
- .2 CSA Group (CSA)
  - .1 CSA Z600, Safety of Corded Window Covering Products.
- .3 Underwriters' Laboratories of Canada (ULC):
  - .1 CAN/ULC-S102, Surface Burning Characteristics of Building Materials and Assemblies.
  - .2 CAN/ULC-S109, Standard Method for Flame Tests of Flame-resistant Fabrics and Films.

### **1.03 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit submittals in accordance with Division 1.
- .2 Product Data:
  - .1 Submit manufacturer's printed product literature and data sheets for roller shades and fabric and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
  - .1 Indicate plans, elevations, sections, product details, installation and mounting details, operational clearances, wiring diagrams and relationship to adjacent work.
  - .2 Use same room designations as indicated on drawings, field verified window dimensions, quantities, type of shade, controls, shadeband materials, and colour, and include opening sizes and key to typical mounting details.
- .4 Samples:
  - .1 Submit samples in accordance with Division 1.
  - .2 Submit duplicate 300 x 300 mm sample of each type of finish specified.
- .5 Manufacturer's Instructions:
  - .1 Submit manufacturer's installation instructions.
  - .2 Submit manufacturer's data, including methods for maintaining roller shades, precautions regarding cleaning materials and methods, instructions for operating hardware and controls.

### **1.04 QUALITY ASSURANCE**

- .1 Regulatory Requirements:
  - .1 Surface burning characteristics of materials: listed and labelled by an organization accredited by Standards Council of Canada.
- .2 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
- .3 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements, including CAN/ULC-S109.

- .4 Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

## **1.05 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Division 1 and manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect roller shades from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove and dispose in accordance with Division 1.

## **2 PRODUCTS**

### **2.01 MANUAL SHADE SYSTEM**

- .1 Product: Legrand Solarfective Teleshade TS Series Shading System: system shall be a smooth operating chain and sprocket roller shade system sunscreen or opaque roll or double type contained in a factory assembled shade cassette unit.
  - .1 Product Substitutions: refer to Section 01 23 00 1.1.4 and provide Letter of Equivalence.
- .2 Base Configurations:
  - .1 SF-T1: Manual Teleshade 4 cassette with front fascia. Cassette size 3-1/16"D x 3-15/16"H. Maximum shade size up to 129"W (3.28m) x 110"H (2.79m).
- .3 Chain Operation:
  - .1 Clutchless, Easy-lift action, chain operated with ability to close shade at any point across length of travel.
  - .2 Chain position: left or right. Indicate on shop drawings for consultant review. Where shades are arranged in a series gang chains together in pairs wherever possible.
  - .3 Manual override shall allow shade to be pulled down by the hembar without using the chain or damaging the shade system.
- .4 Crank Operation:
  - .1 Gear box with crank handle. Operation shall be smooth flowing with infinite positioning with ability to close shade at any point across length of travel. Gear box is factory installed into the shade cassette unit and can be removed, if needed, without disassembly of the shade unit.
  - .2 Crank position: left or right. Indicate on shop drawings for consultant review. Where shades are arranged in a series gang cranks together in pairs wherever possible.
  - .3 Manual override shall allow shade to be pulled down by the hembar without using the chain or damaging the shade system.
  - .4 Crank Handle: one-piece or folding type with handle having an anodized finish. Crank handle lengths to suit installed height of shade system. Contractor to site verify.
- .5 Assembly:
  - .1 Fully factory assembled and pre-tested shade cassette unit consisting of two end brackets, chain or crank installed as required, shade tube, extruded aluminum fascia, hembar, fabric shade material, regular or reverse roll shade material, and cassette mounting attachment brackets for on-site installation. Brackets for the shade cassette unit

- shall be adjustable to level the unit for building irregularities and to minimize light gap above the shade cassette unit. Provide shade cassette unit ready for installation using attachment brackets fabricated from aluminum, included with each unit.
- .2 Attachment Brackets: T5 6005 Aluminum Brackets shall be designed and fabricated to allow for simple direct installation of the shade cassette unit to the building structure. Standard types as follows:
  - .1 Mounting Type: Between Mullions.
  - .2 Mounting Type: Face of Mullions.
  - .3 Mounting Type: Ceiling.
  - .4 Mounting Type: Above Ceiling, vented.
- .3 End Bracket within Cassette Unit: complete with nylon drive sprocket. Finish to match fascia.
- .6 Shade Tube:
  - .1 Extruded T5 6005 aluminum shade tube shall be 1/16" thick, complete with continuous screw fins for strength and drive capabilities when attached to the nylon sprocket. Manufacturer to select tube with sufficient diameter size so deflection caused by weight of shade material and shade size is not visible and good performance is assured.
- .7 Fascia and End Caps:
  - .1 Extruded T5 6003 or 6360 aluminum fascia and end caps. Fascia and end caps to be secured to cassette shade unit.
- .8 Shade Drive Assembly:
  - .1 Factory set for size and travel of shades.
  - .2 Provided with a built-in shock absorber to prevent chain breakage, under normal usage conditions.
  - .3 Factory installed upper bead stop to prevent shade from rolling beyond preset upper limit. Lower bead stop to be installed in field.
  - .4 Compliant child-safety active-spring-loaded tensioning chain retainer supplied with all chain drives. Design per Window Covering Materials Associated (WCMA).
  - .5 Manufacturer shall include and fabricate with roller shade a Lift Assist Mechanical (LAM), sized according to shade weight and consisting of a spring device installed in the roller shade tube. The manufacturer shall install a LAM spring on all very large or heavy shades.
  - .6 Drive Chain: shall be No. 10 stainless steel bead chain formed in a continuous loop. Chain with 90-pound tensile strength.
- .9 Hembar:
  - .1 Extruded T6 6360 aluminum with plastic end finials, attached in factory to shadeband fabric material. Hembar to be concealed with fabric wrap, with open ends.
- .10 Shadeband Material Attachment:
  - .1 Attach shadeband material to roller shade tube in factory.
- .11 Light Gap:
  - .1 Maintain equivalent and symmetrical light gaps on both sides of shade. Gap width to be 3/4" (19mm).
- .12 Shadeband Assembly Details:
  - .1 Shade Cassette Unit manufacturer to assemble roller shade with specified shadeband material to fill window opening from sill to head and from jamb to jamb unless otherwise indicated.
  - .2 Manufacturer shall assemble roller shade with the indicated front side of shadeband fabric material facing the interior of the room when roller shade is in down position.
  - .3 All shadeband material to hand flat without buckling, puckering, or distortion.
  - .4 Manufacturer to provide T6 6061 aluminum battens in standard roller shades as necessary to insure proper rolling of roller shades and for proper tracking. The installing

contractor and manufacturer shall fabricate roller shades with a width-to-height ratio that shall not exceed manufacturer's published guidelines. The batten shall be selected at manufacturers discretion based on size of shade and shadeband material selected. All locations of seams to be indicated in shop drawings for consultant review.

- .5 Manufacturer shall provide Railroaded type shadebands with seams as required to meet size requirements and to match other seams. All locations of seams to be indicated in shop drawings for consultant review. Manufacturer shall utilize battens in accordance with their published guidelines to minimize tracking distortion and for proper rolling of the shadeband material on the tube.

## **2.02 ACCESSORIES**

- .1 Double-dual Shade: Where specified, two roller shade bands consisting of a Sunscreen and an Opaque or Blackout shadeband material inside the shade cassette unit. Each roller shade shall be independently controlled by pull chain or crank as specified.
- .2 Pocket, Standard Continuous or Vented: Where specified, manufacturer shall provide appropriate metal pocket, for installation by others, to encase the roller shade assembly above the finished ceiling. Pocket can serve to provide isolation from ceiling plenum with continuous pocket or be used as a means to allow hot air trapped between glass and the shadeband to escape up and through openings in the vented pocket. Provide with all pocket components, including closure.
  - .1 Continuous pocket: Fabricated of T6 6063 extruded aluminum for use with the 4 inch shade cassette system. The assembly of the continuous pocket shall be specific to the shade cassette unit and allow for the shadeband to be installed securely and without screws. Closure shall be designed and built into the fascia. Manufacturer to select width of closure based upon single or dual shade and regular or reverse roll as specified. Closure colour to match hembar and fascia. The pocket shall be formed with a tile support with a continuous metal lip 3/4 inch (19.05 mm) for use with acoustical lay-in type ceilings.
  - .2 Vented pocket: Fabricated from T5 6005 extruded aluminum, small 3 inch (76.2 mm) brackets holding the frame of the pocket sections for use with the 4 inch shade cassette system. Sections to serve as intermediary between the attachment bracket and shade cassette unit. The pocket frame shall be formed with a continuous 3/4-inch (19.05 mm) metal lip tile support for use with acoustical lay-in type ceilings as standard.
  - .3 Closure for Pocket: Where specified, manufacturer shall provide a matching trim plate closure of finished T6 6063 aluminum, to conceal most of the opening of the cassette shade unit and associated roller shades. The closure shall be attached to the pocket via concealed fasteners. Closure shall be available for attachment to drywall-built pocket enclosures for achieving same results as with usage of factory supplied pocket. Manufacturer to offer width of closure based upon single or dual shade and regular or reverse roll as specified. Manufacturer shall offer a connector plate to butt seams of closure together for tight and secure fit. Closure shall have a specific location for routing and attaching low-voltage cabling and plastic "zip" cable tie hold downs for effective cable management, when motorized shades are utilized. Closure colour to match hembar and fascia.
  - .4 Room Darkening Side and Bottom Channels: Where specified, extruded T6 6063 aluminum channels 2-3/4 inches (57.15 mm) by 1-1/8 inches (28.575 mm) supplied to reduce light infiltration around the sides of the roller shades. Aluminum Channels to include .45 inch (11.43 mm), Pile/Fuzzy weather stripping to further minimize light infiltration. Channel finish to match hembar and fascia.

## **2.03 SHADE FABRIC**

- .1 Light Filtering Fabric:
  - .1 Colour: refer to drawings.
  - .2 Pattern: refer to drawings.

### **3 EXECUTION**

#### **3.01 MANUFACTURER'S INSTRUCTIONS**

- .1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

#### **3.02 EXAMINATION**

- .1 Do not begin installation until substrates have been properly prepared.
- .2 Examine area, and conditions, with installer present, for compliance with requirements for installation tolerances, operational clearances and blocking.
- .3 Identify locations of connections to building electrical system, and other conditions affecting performance of the work.

#### **3.03 PREPARATION**

- .1 Coordinate requirements for blocking and structural supports to ensure adequate means for installation of window shades.
- .2 Coordinate requirements for blocking, construction of shade pockets and structural supports to ensure adequate means for installation of window shades.
- .3 Coordinate installation of recessed shade pockets with construction of suspended acoustical panel ceilings and suspended gypsum board ceilings.
- .4 Coordinate requirements of power supply conduit and wiring required for window shade motors and controls.

#### **3.04 INSTALLATION**

- .1 Install in accordance with manufacturer's instructions.
- .2 Install roller shades level, plumb, square and true. Allow proper clearances for window operation hardware.
- .3 Installation shall be performed by manufacturer's authorized dealer or internal installation team.
- .4 Shade Pockets:
  - .1 Install shade pockets in conjunction with installation of suspended ceiling systems. Attach to supporting structure with screws through top of pocket at 24 inch (600 mm) centres minimum.
  - .2 Install corner pieces securely and in alignment with pockets.
  - .3 Install pocket ends securely and in alignment with pockets.
  - .4 After interior construction is essentially complete, install shade and operating mechanism in pocket.
- .5 Install the following items to conceal roller and operating mechanism. Do not use exposed fasteners.
  - .1 Fascias.
  - .2 Closure panels.
  - .3 Endcaps.
- .6 Perform cleaning after installation to remove construction and accumulated environmental dirt.
- .7 Install headbox, side channels, and sill channel with sealant to eliminate light peaks at perimeter

of shade system.

- .8 Position shades level, plumb, and at proper height relative to adjacent construction. Secure with fasteners recommended by manufacturer.
- .9 Electrical Connections: connect each roller shade motor operator and stationary control system to building electrical system and provide grounding in accordance with NFPA 70. Refer to Electrical requirements.

### **3.05 ADJUSTING**

- .1 Adjust and balance roller shades and motorized equipment to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.
- .2 Commissioning Control Systems: perform commissioning of integrated automation control systems.

### **3.06 TESTING**

- .1 Test motorized window shades to verify that controls, limit switches, interface to other building systems, and other operating components are functional. Correct deficiencies.
- .2 Test window shades to verify that operating mechanism, fabric retainer, crank or chain operation, and other operating components are functional. Correct deficiencies.
- .3 During daylight hours, lower shades and turn off interior lights. Verify that there are no light leaks at perimeter or within shade assembly. Correct deficiencies.
- .4 Demonstrate operation of shades to Owner / users

### **3.07 CLEANING AND PROTECTION**

- .1 Clean roller shade surfaces, after installation, according to manufacturer's written instructions.
- .2 Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer that ensures that roller shades are without damage or deterioration at time of Substantial Performance of the Work.
- .3 Replace damaged roller shades that cannot be repaired prior to Substantial Performance of the Work.
- .4 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

**END OF SECTION**

## **1 GENERAL**

### **1.01 RELATED REQUIREMENTS**

- .1 Refer to applicable Mechanical and Electrical drawings specifications regarding power, data, plumbing services integrated within casework.

### **1.02 REFERENCE STANDARDS**

- .1 American National Standards Institute (ANSI):
  - .1 **ANSI A208.1-[2009]**, Particleboard.
- .2 ASTM International (ASTM):
  - .1 [ASTM A 167-\[99\(2009\)\]](#), Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
  - .2 [ASTM A 240/A 240M-\[11b\]](#), Standard Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels.
  - .3 [ASTM A 653/A 653M-\[11\]](#), Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - .4 [ASTM B 117-\[11\]](#), Standard Practice for Operating Salt Spray (Fog) Apparatus.
  - .5 [ASTM B 456-\[11e1\]](#), Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.
  - .6 **ASTM E 54-[80(1996)]**, Standard Test Methods for Chemical Analysis of Special Brasses and Bronzes.
  - .7 [ASTM E 478-\[08\]](#), Standard Test Methods for Chemical Analysis of Copper Alloys.
- .3 Canada Green Building Council (CaGBC):
  - .1 LEED Canada-NC Version 1.0-[2004], LEED (Leadership in Energy and Environmental Design): Green Building Rating System for New Construction and Major Renovations (including Addendum [2007]).
  - .2 LEED Canada-NC-[2009], LEED (Leadership in Energy and Environmental Design): Green Building Rating System for New Construction and Major Renovations 2009.
  - .3 LEED Canada-CI Version 1.0-[2007], LEED (Leadership in Energy and Environmental Design): Green Building Rating System for Commercial Interiors.
  - .4 LEED Canada-EB: O&M-[2009], LEED (Leadership in Energy and Environmental Design): Green Building Rating System for Existing Buildings: Operations and Maintenance 2009.
- .4 CSA Group (CSA):
  - .1 [CSA O112.10-\[08\]](#), Evaluation of Adhesives for Structural Wood Products (Limited Moisture Exposure).
- .5 Electrical and Electronic Manufacturer's Association of Canada (EEMAC)
- .6 National Electrical Manufacturers Association (NEMA):
  - .1 **NEMA LD 3-[2005]**, High-Pressure Decorative Laminates (HPDL).

### **1.03 PRODUCTS SUPPLIED BUT NOT INSTALLED UNDER THIS SECTION**

- .1 Gas, air and vacuum cocks, faucets, tail pieces, strainers, traps, electrical outlets, non-integral sinks and drains.

### **1.04 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Division 1.
- .2 Product Data:

- .1 Submit manufacturer's instructions, printed product literature and data sheets for steel laboratory casework and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
  - .1 Indicate on drawings:
    - .1 Details of laboratory casework construction and related and dimensional position, with sections.
    - .2 Location of each casework unit.
    - .3 Location for roughing-in of plumbing, including sinks, faucets, strainers and cocks and electrical services.
- .4 Samples:
  - .1 Submit duplicate samples of:
    - .1 Countertop material.
    - .2 Standard colour of cabinet finish steel sheet.
    - .3 Cabinet hardware.
    - .4 Plumbing brass and electrical outlets.
- .5 Test Reports:
  - .1 Include test reports by independent testing laboratories indicating results of furniture finish tests.
- .6 Sustainable Design Submittals:
  - .1 Reserved.

## **1.05 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect all items.
  - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan and/or Waste Reduction Workplan related to Work of this Section and in accordance with Division 1 specifications.
- .5 Packaging Waste Management: remove for reuse and return to manufacturer where possible and in accordance with Construction Waste Management plan.

## **2 PRODUCTS**

### **2.01 MATERIALS**

- .1 Laboratory Steel Base and Wall Cabinets:
  - .1 Acceptable Manufacturer: Mott Manufacturing.
  - .2 Type: Inset.
  - .3 Construction: Type 316 Stainless Steel.
  - .4 Finish: Brushed, #4.
  - .5 Drawer Bodies, Shelves, Door & Drawer Liners, Removable Backs: 20 ga.
  - .6 Cabinet Gables, Tops, Bottoms, Toekicks, Outer Door & Drawer Front Panels, Table



- Frames, Filler Panels, Sloping Tops: 18 ga.
- .5 Hardware:
  - .1 Top & Intermediate Channels, Table Legs: 16 ga.
  - .2 Drawer Suspension, Hinge Plates: 14 ga.
  - .3 Cabinet Leveler Support: 11 ga.
  - .4 Five Knuckle Hinges (w/SS Fasteners): 14 ga.
  - .5 Door & Drawer Pulls: Stainless Steel D Pull.
  - .6 Door Roller Catch: Zinc Plated.
  - .7 3/8" Hex Head Leveler Bolts: Electro Plated.
  - .8 Cabinet Leveler Access Covers: PVC.
  - .9 Full Extension Drawer Glides: Zinc Plated.
  - .10 Shelf Clips: Stainless Steel.
  - .11 Locks and Keys: N/A.
  - .12 Other: Provide all hardware required for complete installation including items not specifically indicated.
- .6 Miscellaneous:
  - .1 Filler panels: Provide S/S filler panels as required.
  - .2 End/Side cover panels: Provide S/S end panels as required.
  - .3 Sloping dust caps: Provide S/S dust caps where required on drawings.
  - .4 Light Valances: Provide S/S light valances as per drawings.
  - .5 Levelers: Provide S/S levelers as required to level countertop.
- .2 Countertops – Stainless Steel:
  - .1 Acceptable Manufacturer: Mott Manufacturing.
  - .2 Material: Stainless steel, type 316, 14 ga. Welded to produce one piece integral construction.
  - .3 Finished: Brushed, #4.
  - .4 Support: Stainless steel stiffeners, 16 ga.
  - .5 Edge Profile: Marine edge.
  - .6 Backsplash: Refer to drawings.
  - .7 Integrated sink: Integral to counter, refer to drawings.
  - .8 Integrated drainboard: N/A.
- .3 Wall-mounted Shelving: reserved.
- .4 Table System: reserved.

## **2.04 LABORATORY SERVICE FITTINGS**

- .1 Metals: use min 80% red brass alloy for valve bodies.
  - .1 Make handles and turrets of brass forgings.
  - .2 Use solid brass bar stock or specially selected alloys for assembly components and operating parts such as valve stems, renewable seats and needle cones.
- .2 Completely enclose spring mechanisms.
  - .1 Design compression and needle valve stems to operate inside and make them replaceable.
  - .2 Include needle valves with stainless steel floating needles and removable seats.
- .3 Equip remote controls with universal joints.
- .4 Include fittings with wall flanges, shanks, lock nuts, couplings, nuts and tailpieces.
- .5 Identify fittings as to type of service with coloured plastic removable type buttons with engraved lettering and following colour coding.

SERVICE	LETTERING		COLOUR CODING
	ENGLISH	FRENCH	
Cold Water	CW	EF	Green
Hot Water	HW	EC	Red
Distilled Water	DIW	ED	White
Demineralized Water	DEW	EDEM	White
Vacuum	VAC	VIDE	Yellow
Air	AIR	AIR	Orange
Gas	GAS	GAZ	Yellow-Orange
Oxygen	OXY	OXY	Green
Nitrogen	N	N	Blue
Argon	A	A	White
Steam	ST	VAP	Black

- .6 Finish exposed parts of service fittings to [ASTM B 456](#), service condition SC 4, coating classification CuNi30dCr.
- .7 Provide grey vinyl corrosion resistant finish for service fittings installed inside fume hoods. Corrosion resistant finish to conform to following minimum requirements.
  - .1 Acid resistance: acid applied at rate of 60 drops per minute for 10 minutes on fixture coatings held approximately at angle of 45 degrees:
    - .1 Hydrochloric acid: 36.9%.
    - .2 Nitric acid: 70.6%.
    - .3 Sulfuric acid: 96.4%.
    - .4 Acetic acid: 96.4%.
    - .5 Discolouration and slight bubbling may occur with concentrated sulphuric acid only.
  - .2 Resistance to alkali and organic solvents: reagents and solvents applied at rate of 60 drops per minute on fixture coatings held approximately at angle of 45 degrees: alkali (50% sodium hydroxide), ethyl alcohol, toluol, xylol, benzol, carbon tetrachloride, phenol and mineral oil.
  - .3 Resistance to salt fog spray: samples of fixtures placed in salt fog cabinet for period of 125 hrs at temperature of 34-36 degrees C. Artificial sea water (composite per litre: 11 g MgC6HO, 1.2 g NaSO, and 25 g NaC1). Fixtures tested to [ASTM B 117](#) for 1000 hours
  - .4 Resistance to high humidity: samples of fixtures placed in high humidity cabinet maintained at 100% RH and 50 degrees C for period of 125 hours.
  - .5 Resistance to acid fumes: samples of fixtures placed in closed cylindrical glass containers approximately 20 L in volume, together with beaker of concentrated hydrochloric acid, nitric acid, and sulphuric acid. Maintain 23 degrees C temperature for period of 150 hours.

## 2.05 LABORATORY SINKS

- .1 Refer to drawings and coordinate with Mechanical plumbing requirements.
- .2 Stainless steel sinks: to **ASTM E 54** and [ASTM E 478](#), type 316 stainless steel, welded construction without solder or fill, exposed surface matching finish of countertop.
  - .1 Make sink integral if it occurs in stainless steel top.
  - .2 Use self rimming, flush mounted stainless steel sinks occurring in tops other than stainless steel. Include hold down brackets for self rimming sinks.
  - .3 Apply sound deadening material undercoating to sinks and drainboards.
  - .4 Include stainless steel waste fittings unless otherwise noted.
- .3 Epoxy sinks: cast from modified epoxy resins with powdered silicone filler.
  - .1 Support epoxy sinks with two painted 6 x 12 mm steel straps fixed to underside of counter top unless otherwise noted.

- .2 Weld sinks in place in epoxy tops using epoxy cement. In other locations mount sinks under top and seal joint with acid resistant sealant.
- .3 Provide epoxy waste fittings.

## **2.06 ELECTRICAL FITTINGS**

- .1 Electrical outlets: to applicable EEMAC and NEMA standards and CSA approval
  - .1 Refer to Electrical drawings and specifications for requirements.

## **2.07 CABINET HARDWARE**

- .1 Provide all manufacturer's standard hardware components required for proper operation of casework. Refer for drawings for additional requirements.

## **2.08 FABRICATION**

- .1 Fabricate steel laboratory casework to manufacturer's details and standards.
- .2 Where required, field weld stainless steel countertops together, grind and polish to make continuous.

# **3 EXECUTION**

## **3.01 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for steel laboratory casework installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate.
  - .2 Correct unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied.

## **3.02 INSTALLATION**

- .1 Install laboratory casework in accordance with manufacturer's installation requirements.
- .2 Apply small bead of clear silicone sealant at junction of counter top and adjacent wall finish.
- .3 After installation, adjust operating hardware.

## **3.03 CLEANING**

- .1 Progress Cleaning: clean in accordance with Division 1.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Division 1 specifications.
  - .1 Touch up marred or abraded finished surfaces.
  - .2 Wipe down surfaces to remove fingerprints and markings.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Division 1 specifications.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

### **3.04 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by steel laboratory casework installation.

**END OF SECTION**

## **1 GENERAL**

### **1.01 SUMMARY**

- .1 This section includes specification of lead sheets, lead-laminated gypsum board, lead-lined hollow metal doors and frames, radiation shielding leaded glass and hollow metal view window frames.

### **1.02 RELATED SECTIONS**

- .1 Section 08 11 13 – Hollow Metal Doors and Frames.
- .2 Section 09 21 16 – Gypsum Board Assemblies.

### **1.03 REFERENCE STANDARDS**

- .1 American Society for Testing and Materials International, (ASTM):
  - .1 ASTM B 749-25, Standard Specification for Lead and Lead Alloy Strip, Sheet, and Plate Products.

### **1.04 DEFINITIONS**

- .1 Lead Equivalence: thickness of lead that provides same attenuation (reduction of radiation passing through) as material in question under specified conditions.

### **1.05 SYSTEM DESCRIPTION**

Design Requirements:

- .1 Provide materials and workmanship, including joints and fasteners, that maintain continuity of radiation protection at all points and all directions equivalent to materials specified in thicknesses and locations indicated.
- .2 Lead-lined Assemblies: provide lead thickness in doors, door frames, window frames, and other items located in lead-lined assemblies, not less than that indicated for assemblies in which they are installed unless indicated otherwise.
- .3 Lead Glazing: provide lead equivalence not less than that indicated for assembly in which glazing is installed unless indicated otherwise.

### **1.06 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver materials in original packages, containers or bundles bearing manufacturers brand name and identification.
- .2 Store materials inside, level, under cover. Keep dry. Protect from weather, other elements, exposure to harmful environmental conditions such as static electricity, and damage from construction operations and other causes.
- .3 Handle to prevent damage to edges, ends or surfaces. Exercise care to protect from being bent or damaged.

### **1.07 SITE ENVIRONMENTAL REQUIREMENTS**

- .1 Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limited.

## **1.08 SUBMITTALS**

- .1 Submit product data in accordance with Division 1, for each product to be used, including:
  - .1 Preparation instructions and recommendations.
  - .2 Storage and handling requirements and recommendations.
  - .3 Installation methods.
- .2 Submit shop drawings in accordance with Division 1.
  - .1 Indicate dimensions, description of materials and finishes and general construction.
  - .2 Indicate layout of radiation-protected areas.
  - .3 Indicate lead thickness or lead equivalencies of components.

## **1.09 QUALITY ASSURANCE**

- .1 Qualifications: firm with minimum of 5 years successful experience manufacturing radiation protection products similar to those specified for this project.
- .2 Obtain radiation protection materials and accessories produced as standard products from single manufacturer regularly engaged in production of shielding materials, equipment and accessories.
- .3 Comply with requirements of local regulatory agencies where local standards and criteria exceed those of manufacturer.

## **1.10 WARRANTY**

- .1 Provide manufacturer's standard warranty.

## **2 PRODUCTS**

### **2.01 MATERIALS**

- .1 Lead Sheets: 99.9 percent pure unpierced virgin lead, free from dross, oxide inclusions, scale, laminations, blisters and cracks.
  - .1 Thickness: as indicated on Drawings.
  - .2 Variation in sheet thickness: not to exceed 3 percent.

### **2.02 MANUFACTURED UNITS**

- .1 Lead-Laminated Gypsum Board: single unpierced layer of sheet lead laminated to back of gypsum board, ASTM C 1396/1396M; gypsum core wall panel with additives to enhance fire resistance of core and surfaced with paper on front, back, and long edges; Type X, UL rated.
  - .1 Thickness: 5/8 inch (16 mm).
- .2 Lead-Lined Hollow Metal Doors:
  - .1 Construction: Refer to Section 08 11 13 - Hollow Metal Doors and Frames. Edges of doors shall be continuously seam welded, ground and filed to provide a smooth finish. The top and bottom of the doors shall be reinforced with continuous steel channels, spot welded to both sides of the door. Doors shall have 11 gauge steel angles, 12 inches (305 mm) long for hinge reinforcement.
  - .2 Face Sheet: 16 gauge.
  - .3 Vision Lite: Refer to Door, Frames and Hardware Schedule on Drawings for door types and vision glass requirements.
- .3 Lead-Lined Flush Wood Doors:
  - .1 Construction: Refer to Section 08 14 00 - Wood Doors.
  - .2 Face Sheet: Refer to Section 06 40 23\_13 – Plastic Laminate Finishing.
  - .3 Vision Lite: Refer to Door, Frames and Hardware Schedule on Drawings for door types

and vision glass requirements.

- .4 Lead-Lined Hollow Metal Door Frames: Refer to Section 08 11 13 - Hollow Metal Doors and Frames. 16 gauge (1.5 mm) welded steel frames with 2 inch (51 mm) face. Throat sized to wall thickness. Provide angle iron spot welded at 6 inches (152 mm) on centre, and anchor bolts to secure frame if lead thickness is 1/8 inch (3 mm) or greater. Design lead-lined door frames to accommodate lead lining up to 1/2 inch (13 mm) thick.
  - .1 Door Frame Supports: 2-1/4 inches (57 mm) steel angle iron.
- .5 Radiation Shielding Lead Glass (for use at vision windows and door lites): clear leaded glass containing 48 percent lead oxide (by weight) and 15 percent barium. Thickness as required to provide radiation protection equivalent to that provided by sheet lead in partition in which lead glass is installed. Refer to Drawings.
- .6 Lead-Lined Hollow Metal View Window Frames: Refer to Section 08 11 13 - Hollow Metal Doors and Frames. 16 gauge (1.5 mm) welded steel frames adjustable from 4-1/4 inches (108 mm) to 6 inches (152 mm) wall thickness. Design window frames to accept any thickness of radiation shielding leaded glass, radiation shielding X-Ray safety glass, or radiation shielding leaded acrylic.
  - .1 Protection: provide radiation protection equivalent to that provided by sheet lead in partition in which view window is installed.
  - .2 Stops: provide 1/2 inch (13 mm) removable stops.

## **2.03 ACCESSORIES**

- .1 Screw Fasteners: Type S Bugle Head, length as required.
- .2 Lead Strips: 2 inches (51 mm) wide, unless indicated otherwise, by same thickness as sheet lead laminated on gypsum board.
- .3 Lead Angles: Leak-proof, lead angle system providing complete coverage of gamma rays under in lieu of lead strips and lead discs where sheet lead thickness is greater than 1/8" (3 mm) thick.
- .4 Lead Discs: 3/8" (9.5 mm) diameter lead discs for use with screw heads.
- .5 Adhesive: acceptable to radiation protection product manufacturer and capable of adhering lead sheets where required.

## **3 EXECUTION**

### **3.01 EXAMINATION**

- .1 Examine the Work of other Sections that is to receive the Work of this Section and report defects. Proceed only when conditions are satisfactory.
- .2 Verify that steel framing is not less than 20 gauge (0.9 mm) with studs spaced not more than 16 inches (406 mm) on centre, unless noted otherwise.
- .3 Do not proceed until unsatisfactory conditions have been corrected.

### **3.02 INSTALLATION**

- .1 Comply with manufacturer's recommendations.
- .2 Adhere lead strips on face of studs at joints in lead-laminated gypsum board, including inside and outside corners. Use 2 inches (500 mm) wide strips by same thickness as sheet lead laminated on gypsum board.

- .3 Shim studs and other framing members as necessary to provide flat, flush finished surfaces.
- .4 Install lead angles per manufacturer's recommendations.
- .5 Install lead-laminated gypsum board on framing with screws spaced not more than 8 inches (203 mm) on centre along edges of board and 12 inches (305 mm) on centre in field of board.
- .6 Adhere lead discs to fastener heads. In each case, use method that provides continuous radiation shielding.
- .7 Where lead-laminated gypsum board is final substrate, apply joint treatment on fasteners and joints per Section 09 21 16 – Gypsum Board Assemblies.
- .8 Where second layer of gypsum board occurs over lead-laminated gypsum board, comply with Section 09 21 16 – Gypsum Board Assemblies for application of second layer.

### **3.03 INSTALLATION OF DOORS AND FRAMES**

- .1 Install lead-lined steel door frames per Section 08 11 00 – Hollow Metal Doors and Frames. Comply with NAAMM HMMA 840 unless otherwise indicated. Set frames accurately in position, plumb, and braced securely until permanent anchors are set.
  - .1 Secure door frames with steel stud anchors if lead lining is below 1/8 inch (3 mm) thick.
  - .2 Door Frame Supports (utilize if lead thickness is 1/8 inch (3 mm) or greater):
    - .1 Run steel angle supports full height on each door frame jamb to structure above.
    - .2 Weld supports to steel joists.
    - .3 Spot weld supports at 6 inches (152 mm) along jambs and at corners of jambs and head frame.
    - .4 Anchor frame to substrate with fasteners appropriate for substrate.
    - .5 Apply coat of asphalt mastic or paint to lead lining in door frames where lead will come in contact with masonry or grout.
  - .3 Provide 3 anchors per jamb, located adjacent to hinge on hinge jamb, and at corresponding heights on strike jamb.
  - .4 In metal stud construction, use wall anchors attached to studs with screws.
  - .5 Lap lead lining of frames over lining in walls at least 1 inch (25 mm) or greater if indicated otherwise.
  - .6 Lead Lining of Frames: line inside of frames with lead thickness not less than that required in doors and walls in which frames are used. Form lead to match frame contour, continuous in each jamb and across head, lapping stops. Form lead shields around areas prepared to receive hardware. Lap lining over lining in walls at least 1 inch (25 mm) or greater if indicated otherwise.
- .2 Line covers, escutcheons, and plates to provide effective shielding at cutouts and penetrations of frames and doors. Refer to the Section 08 71 00 - Door Hardware for other installation requirements.
- .3 Touch up damaged finishes with compatible coating after sanding smooth.

### **3.04 INSTALLATION OF WINDOW FRAMES**

- .1 Set unleaded side of frame plumb and square in wall opening on control room side of wall with shims.
- .2 Set leaded side of frame plumb and square in wall opening on CT Room side of wall.
- .3 Compress sides together against faces of wall.
- .4 Install setting blocks, shims, and glazing tape in glazing channel to prevent galls from touching steel frame.



- .5 Install radiation resistant glazing in telescopic frame.
- .6 Place steel stops in position and mark location of stop and frame retaining holes on steel frame.
- .7 Remove glazing and drill holes in steel frame.
- .8 Place glazing and stops and hand drive setting screws.

### **3.05 INSTALLATION OF PENETRATING ITEMS**

- .1 At penetrations of lead linings, provide lead shields to maintain continuity of protection.
- .2 Provide lead linings, sleeves, and other protection in thickness not less than that required in assembly being penetrated.
- .3 Cut wall penetration covers from lead sheet of equal or greater thickness than backing on adjacent wall panels. Cut wall penetration covers to size required to cover wall penetrations with laps 1 inch (25 mm) minimum wide.
- .4 Adhesive-apply lead sheet penetration covers on penetrating boxes and raceways and return penetration covers to backside of lead-backed wall panels with 1 inch (25 mm) minimum laps. Do not use penetrating fasteners unless indicated otherwise.
- .5 Install outlet boxes and conduit between studs using steel telescoping mounting brackets. Cover or line with lead sheet lapped over adjacent lead lining at least 1 inch (25 mm). Wrap conduit with lead sheet for 10 inches (250 mm) in from box.

### **3.06 ACCESSORY INSTALLATION**

- .1 Comply with manufacturer's recommendations.
- .2 Wherever lead protection is penetrated, cut, or punctured, assure continuity of shielding by use of sheet lead, lead plugs or other approved method.
- .3 Install sheet lead lining within steel door frames to provide radiation protection to levels indicated or levels required to match adjacent wall protection.
- .4 Wrap electrical outlet boxes, view window frames, and other penetrations through lead barrier material with sheet lead to provide radiation protection to levels indicated or levels required to match adjacent wall protection.

### **3.07 FIELD QUALITY CONTROL**

- .1 Field Inspection: Owner will engage qualified independent testing and inspection agency to perform field tests and inspections and prepare test reports.
- .2 Correct deficiencies in, or remove and replace, radiation protection that inspection reports indicate does not comply with specified requirements.
- .3 Testing: after radiology equipment has been installed and placed in operating condition, Owner will engage radiation health physicist to test radiation protection.
- .4 Correct deficiencies in, or remove and replace, radiation protection that testing indicates does not comply with specified requirements, including finishes and other Work covering defective Work.

### **3.08 ADJUSTING**

- .1 Check and readjust operating hardware items, leaving doors and frames undamaged and in proper operating condition.

**3.09 CLEANING**

- .1 Remove excess materials from site and leave Work areas broom clean.
- .2 Leave exposed surfaces ready for site finishing.

**3.10 PROTECTION**

- .1 Lock radiation-protected rooms once door hardware is installed. Limit access to only those persons performing Work in radiation-protected rooms or as directed by Owner.
- .2 Tape temporary paper signs on radiation-resistant walls with the following text: "DO NOT MOUNT EQUIPMENT ON THIS WALL WITHOUT COVERING PENETRATING FASTENERS WITH LEAD SHEET OF THICKNESS REQUIRED BY CONTRACT DOCUMENTS."

**END OF SECTION**

## **PART 1 - GENERAL**

### **1.1 SECTION INCLUDES**

- .1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Mechanical Divisions. It is intended as a supplement to each Section and is to be read accordingly.

### **1.2 REFERENCES**

- .1 Division 00 and Division 01 apply to and are a part of each Mechanical Division:
  - .1 Division 20 – Common Mechanical Requirements;
  - .2 Division 22 – Plumbing;
  - .3 Division 23 – Heating, Ventilating, and Air Conditioning;
  - .4 Division 25 – Integrated Automation.

### **1.3 SUBMITTALS**

- .1 Submit shop drawings/product data sheets for:
  - .1 pressure gauges and thermometers;
  - .2 electric motors (submit with equipment they are associated with).
- .2 Submit weight loads for selected equipment (upon request).
- .3 Submit a list of equipment identification nameplates indicating proposed wording and sizes.
- .4 Submit a list of pipe and duct identification colour coding and wording.
- .5 Submit a proposed valve tag chart and a list of proposed valve tag numbering and identification wording.
- .6 Submit any other submittals specified in this Section or other Sections of Mechanical Divisions.

### **1.4 MAINTENANCE MATERIAL SUBMITTALS**

- .1 As specified in Part 2 of this Section, submit a spare belt set, tagged, and identified, for each belt driven piece of equipment.

## **PART 2 - PRODUCTS**

### **2.1 FIRESTOPPING AND SMOKE SEAL MATERIALS**

- .1 Firestopping and smoke seal system materials for mechanical penetrations through fire rated construction are specified in Section 20 05 17 - Sleeves and Sleeve Seals for Mechanical Piping, and work is to be done as part of mechanical work unless otherwise specified in Division 07.

### **2.2 ACCESS DOORS**

- .1 Refer to Section 08 31 00.
- .2 Provide all access doors required for Mechanical work unless otherwise specified in Division 08. Coordinate consistency of look and finish of access doors on project with each Division of Work. Coordinate exact requirements with General Trades Contractor.
- .3 Access doors to be rust resistant steel door panels, with concealed hinges and positive locking and self-opening screwdriver operated lock. Wall type frame to be suitable for wall installation and have

integral keys for plaster walls. Doors in tile wall to be stainless steel and in ceilings to be suitable for plaster covering with only frame joint showing. Other doors to be prime painted steel.

- .4 Size access doors to suit the concealed work for which they are supplied, and wherever possible they are to be of standard size for all applications, but in any case they are to be minimum 300 mm x 300 mm (12" x 12") for hand entry and 600 mm x 600 mm (24" x 24") for body entry.
- .5 Lay-in type tiles, properly marked, may serve as access panels. Coordinate marking of ceiling tiles with the Consultant. Panels in glazed tile walls to be 12 gauge, 304 alloy stainless steel, No. 4 finish, with recessed frame secured with stainless steel counter-sunk flush head screws.
- .6 Panels in plaster surfaces to have dish-shaped door and welded metal lath, ready to take plaster. Provide a plastic grommet for door key access.
- .7 Other access doors to be welded 12 gauge steel, flush type with concealed hinges, lock and anchor straps, complete with factory prime coat. Submit to Consultant for review, details of non-standard door construction details.
- .8 Access doors in fire rated ceilings, walls, partitions, structures, etc., to be ULC listed and labelled and of a rating to maintain fire separation integrity.
- .9 Where access doors are located in surfaces where special finishes are required, they are to be of a recessed door type capable of accepting finish in which they are to be installed so as to maintain final building surface appearance throughout.
- .10 Manufacturers:
  - .1 SMS.
  - .2 Bauco.
  - .3 Acudor.

### 2.3 FLEXIBLE PIPING CONNECTORS

- .1 Double wall stainless steel flexible connectors for piping connections to vibration isolated equipment, each selected by manufacturer to suit the application. Shop drawings or product data sheets must indicate construction and performance requirements that suit the application.
- .2 Manufacturers:
  - .1 Hyspan Precision Products Inc.;
  - .2 Senior Flexonics Ltd.;
  - .3 The Metraflex Co.

## PART 3 - EXECUTION

### 3.1 GENERAL PIPING AND DUCTWORK INSTALLATION REQUIREMENTS

- .1 Unless otherwise specified, locate, and arrange horizontal pipes and ducts above or at ceiling on floors, arranged so that under consideration of all other work in area, maximum ceiling height and/or usable space is maintained. If required to maintain ceiling heights, reroute and/or resize ductwork, with Consultant's approval.
- .2 Unless otherwise specified, install work concealed in finished spaces, and concealed to degree possible in partially finished and unfinished spaces. Refer to and examine Architectural drawings and room finish schedules to determine finished, partially finished, and unfinished areas. Walls which are painted are considered finished.
- .3 Install pipes and ducts parallel to building lines and to each other.
- .4 Neatly group and arrange exposed work.

- .5 Locate work to permit easy access for service or maintenance as required and/or applicable. Locate valves, dampers and any other equipment which will or may need maintenance or repairs and which are to be installed in accessible construction so as to be easily accessible from access doors. Where valves, dampers and similar piping or ductwork accessories occur in vertical services in shafts, pipe spaces or partitions, locate accessories at floor level.
- .6 Make connections between pipes of different materials using adapters suitable for application. Provide cast brass dielectric type adapters/unions at connections between ferrous and copper pipe.
- .7 Comply with equipment and material manufacturer's installation instructions unless otherwise specified herein or on drawings, and unless such instructions contradict governing codes and regulations.
- .8 Carefully clean ducts, pipe and fittings prior to installation. Temporarily cap or plug ends of pipe, ducts and equipment which are open and exposed during construction.
- .9 Install piping and ductwork which are to be insulated so that they have sufficient clearance to permit insulation and finish to be applied continuously and unbroken around pipe or duct, except for ductwork at fire barriers, in which case insulation will be terminated at each side of the duct fire damper.
- .10 Inspect surfaces and structure prepared by other trades before performing work. Verify surfaces or structure to receive work has no defects or discrepancies which could result in poor application or cause latent defects in installation and workmanship. Report defects in writing. Installation of work will constitute acceptance of such surfaces as being satisfactory.
- .11 Any ferrous piping that exhibits in excess of 5% surface rust, either inside or outside or both, is to be wire brush cleaned to bare metal and coated with suitable primer. Steel pipe, fittings and accessories are to be free of corrosion and dirt when work is complete or prior to being concealed from view. Where dirt is evident, clean piping prior to being concealed.
- .12 Provide continuous galvanized sheet metal drip pan under drain, water and water solution piping extending through rooms with electrical equipment such as electrical, elevator equipment and transformer rooms, and other spaces provided primarily for the installation of electrical equipment. Drip pans are to be complete with a drain pipe connection and drain piping is to be extended to closest drain.
- .13 For factory applied finishes, repaint or refinish surfaces damaged during shipment and installation. Quality of repair work is to match original finish. This requirement also applies to galvanized finishes.
- .14 Where mechanical work is located in high humidity areas where ferrous metal products will be subject to corrosion and protection for such products is not specified, provide finishes on products to protect against corrosion or provide products which will not corrode in the environment, i.e. aluminium ductwork, copper or stainless steel pipe, etc.
- .15 Provide screwed unions or flanges in piping connections to equipment and in regular intervals in long (in excess of 12 m (40')) piping runs to permit removal of sections of piping.
- .16 Unless otherwise specified and except where space limitations do not permit, piping elbows are to be long radius. Eccentric reducers are to be installed with straight side at top of piping.

### 3.2 PIPE JOINT REQUIREMENTS

- .1 Do not make pipe joints in walls or slabs.
- .2 Ream piping ends prior to making joints.
- .3 Properly cut threads in screwed steel piping and coat male threads only with Teflon tape or paste, or an equivalent thread lubricant. After pipe has been screwed into fitting, valve, union, or piping accessory, not more than 2 pipe threads are to remain exposed.
- .4 Site bevel steel pipe to be welded or supply mill bevelled pipe. Remove scale and oxide from bevels and leave smooth and clean. Use factory made welding tees or welding outlet fittings for piping

branches off mains. Do not use shop or site fabricated fittings unless written approval has been obtained.

- .5 Welded joints are to be made by CWB certified licensed journeyman welders qualified in accordance with CSA B51, Boiler Pressure Vessel and Pressure Piping Code, and who are in possession of a proper certificate of qualification for each procedure to be performed. Each weld is to be identified with the welder's identification symbol, and welds are not to be concealed until they have been inspected and approved. Electrodes are to be in accordance with CSA W48 Series, Electrodes, and requirements of CAN/CSA W117.2, Safety in Welding, Cutting and Allied Processes are to be followed.
- .6 Unless otherwise specified, make flanged joints with Garlock 5500 or equivalent gasket materials to suit the application, and bolts and nuts. Bolts are not to be longer than length necessary to screw nut up flush to the end of bolt. Bolts used for flanged connections in piping with a working pressure of 690 kPa (100 psi) and greater are to be ASTM A-193 Grade B-7, with heavy hexagon nuts to ASTM A-194 CL-2H. Provide suitable washers between each bolt head and flange and between each nut and flange.
- .7 A random check of bolted flanged connections will be made to verify flanged connections are properly mated with no shear force acting on bolts. Supply labour to disconnect and reconnect selected flanged joints. If improperly mated joints are found, remove and reinstall affected piping so flanges mate properly. If improperly mated joints are found, additional joints will be checked, and you will be responsible for the repair of any other improper joints discovered.
- .8 Unless otherwise specified make soldered joints in copper piping using flux suitable for and compatible with type of solder being used. Clean the outside of pipe end and inside of fitting, valve, or similar accessory prior to soldering.
- .9 Joints in medical gas system piping are to be silver brazed in accordance with requirements of CAN/CSA Z7396.1.
- .10 Install mechanical joint fittings and couplings in accordance with manufacturer's instructions.
- .11 Grooves are to be rolled. Make arrangements with coupling and fitting manufacturer for shop and/or site instructions and demonstrations as required, and adhere to manufacturer's instructions with respect to pipe grooving, support, type of gasket required, anchoring and guiding the grooved piping system.
- .12 If pressure crimped couplings and fittings are used, ensure gaskets are fully compatible with piping fluid, and valves and piping accessories are suitable. Use only fitting manufacturer supplied crimping equipment. Comply with manufacturer's latest published specification, instructions, and recommendations with respect to pipe, coupling, and fitting preparation and installation, and support, anchoring and guiding of the piping system.
- .13 Solvent weld PVC piping in 2 parts, primer stage and cementing stage, in accordance with manufacturer's recommendations, ASTM D2855, and CSA requirements.
- .14 Install PVC piping with gasketed joints in accordance with manufacturer's current published specifications, instructions and recommendations, and CSA requirements.

### 3.3 DUCT OPENINGS

- .1 Duct openings, air inlet and outlet openings, fire damper and similar openings will be provided in new poured concrete work, masonry, drywall and other building surfaces by trade responsible for particular construction in which opening is required.
- .2 Size openings for fire dampers to suit damper arrangement with folding blade out of air stream.
- .3 For duct openings except where fire dampers are required, pack and seal space between duct or duct insulation and duct opening as specified above for pipe openings in non-fire rated construction.

### **3.4 SLEEVE AND FORMED OPENING LOCATION DRAWINGS**

- .1 Prepare and submit for review, drawings indicating size and location of required sleeves, recesses and formed openings in poured or precast concrete work.
- .2 Such drawings are to be completely and accurately dimensioned and relate sleeve, recesses, and formed openings to suitable grid lines and elevation datum, and are to take into account structural items such as grade beams, column caps, and column drop slabs.
- .3 Begin to prepare such drawings immediately upon notification of acceptance of bid and award of Contract.

### **3.5 INSTALLATION OF PIPE ESCUTCHEON PLATES**

- .1 Provide escutcheon plates suitably secured over exposed piping passing through finished building surfaces. A finished building surface is any surface with a factory finish or that receives a site applied finish.
- .2 Install plates so they are tight against building surface concerned, completely covering pipe sleeves and/or openings, except where waterproof sleeves extend above floors, in which case fit plate tightly around sleeve.

### **3.6 SUPPLY OF ACCESS DOORS**

- .1 Supply access doors to give access to mechanical work which may need maintenance or repair but which is concealed in inaccessible construction, except as otherwise specified herein or on drawings.
- .2 Before commencing installation of mechanical work, coordinate with other trades and prepare on a set of reflected ceiling plans and wall elevations, complete layouts of access doors. Submit these layouts for Consultant's review and show exact sizes and locations of such access doors. Locate and arrange mechanical work to suit.
- .3 Access doors will be installed by trade responsible for particular type of construction in which doors are required. Supply access doors to trade installing same at proper time.
- .4 Wherever possible, access doors to be of a standard size for each application. Confirm exact dimensions and minimum size restrictions with the Consultant prior to ordering.
- .5 Group piping and ductwork to ensure minimum number of access doors is required.
- .6 Coordinate with Electrical Contractor and General Trades Contractor to ensure access doors on project are provided by a single manufacturer, installed as part of work of General Trades Contractor and work involving both mechanical and electrical services should, where possible, be accessible from common access door. Coordinate work to ensure common location access doors are not supplied by both Mechanical Divisions and Electrical Divisions.
- .7 Identify access doors supplied for concealed medical gas system shut-off valves or equipment with a permanent label in accordance with requirements of CAN/CSA Z7396.1.

### **3.7 INSTALLATION OF VALVES**

- .1 Generally, valve locations are indicated or specified on drawings or specified in Sections of the Specification where valves are specified, however, regardless of locations shown or specified, following requirements apply:
  - .1 provide shut-off valves to isolate systems, at base of vertical risers, in branch take-offs at mains and risers on floors, to isolate equipment, to permit work phasing as required, and wherever else required for proper system operation and maintenance;
  - .2 install shut-off valves with handles upright or horizontal, not inverted, and located for easy access;

- .3 unless otherwise specified, provide a check valve in discharge piping of each pump;
- .4 valve sizes are to be same as connecting pipe size;
- .5 valves are to be permanently identified with size, manufacturer's name, valve model or figure number and pressure rating, and wherever possible, valves are to be product of same manufacturer;
- .6 for valves in insulated piping, design of valve stem, handle and operating mechanism is to be such that insulation does not have to be cut or altered in any manner to permit valve operation.

### **3.8 FINISH PAINTING OF MECHANICAL WORK**

- .1 Touch-up paint damaged factory applied finishes on mechanical work products.

### **3.9 PIPE LEAKAGE TESTING**

- .1 Before piping has been insulated or concealed, and before equipment, fixtures and fittings have been connected, test piping for leakage.
- .2 Tests are to be witnessed by the Consultant and/or Owner's representative, and, where required, representatives of governing authorities. Give ample notice of tests in writing and verify attendance. Have completed test report sheets dated and signed by those present to confirm proper test results.
- .3 When circumstances prevent scheduled tests from taking place, give immediate and adequate notice of cancellation to all who were scheduled to attend.
- .4 Gravity Drainage and Vent Piping
  - .1 Test piping in accordance with local governing building code.
  - .2 After fixtures and fittings are set and pipes are connected to building drain or drains, turn on water into pipe, fixtures, fittings and traps in order to detect any imperfect material or workmanship. Perform a smoke test if required by local governing authorities.
- .5 Pumped Drainage Piping
  - .1 Test piping with cold water at a pressure of 1-½ times normal working pressure and maintain pressure for a minimum of 2 hours.
- .6 Domestic Water Piping
  - .1 Test piping with cold water at a pressure of 1-½ times normal working pressure and maintain pressure for a minimum of 2 hours.
- .7 Sprinkler System Piping
  - .1 Test system piping in accordance with requirements of NFPA No. 13, "Installation of Sprinkler Systems", and in accordance with any additional requirements of governing authorities.
- .8 Standpipe System Piping
  - .1 Test system piping in accordance with requirements of NFPA No. 14, "Standpipe and Hose Systems", and in accordance with any additional requirements of governing authorities.
- .9 CO2 Fire Extinguishing System Piping
  - .1 Test system piping in accordance with requirements of NFPA No. 12, "Standard on Carbon Dioxide Extinguishing Systems", and in accordance with any additional requirements of governing authorities.
- .10 Heat Transfer (HVAC) System Piping
  - .1 Test piping with cold water at a pressure of 1035 kPa (150 psi) for a minimum of 2 hours.
- .11 Steam and Condensate Piping
  - .1 Test piping with cold water for a minimum of 2 hours at following pressures:



- .1 0 kPa to 105 kPa (0 psi to 15 psi) low pressure piping – 690 kPa (100 psi);
- .2 110 kPa to 690 kPa (16 psi to 100 psi) medium pressure piping – 1035 kPa (150 psi);
- .3 greater than 690 kPa (100 psi) high pressure piping – 1380 kPa (200 psi).
- .12 Compressed Air Piping
  - .1 Test piping with dry compressed air or nitrogen at 690 kPa (100 psi) for a minimum of 2 hours.
  - .2 Test piping joints with a water-soap solution while piping is under pressure to detect leaks.
- .13 Refrigerant Piping
  - .1 Test refrigerant piping for leakage and dehydrate in accordance with requirements of Chapter 18 of ASHRAE Handbook - Fundamentals.
- .14 Control Air Piping and Tubing
  - .1 Test control air piping and tubing with dry compressed air or nitrogen before concealing and again before connection of instruments.
  - .2 Rough-in test pressure is to be 345 kPa (50 psi) maintained over 24 hours with a pressure drop not to exceed 35 kPa (5 psi).
  - .3 Test joints for leaks with a soap solution.
  - .4 Finish test is to be 205 kPa (30 psi) with a permissible loss of 7 kPa (1 psi) over a 4 hour period. Prior to connecting instruments, blow systems clean and dry, and test component connections for leaks with a water/soap solution.
  - .5 Medical Gas System Piping
    - .1 Perform leakage and flow tests for piping using oil-free compressed air or oil-free dry nitrogen in accordance with requirements of CAN/CSA Z7396.1.
- .15 Pure Water Piping
  - .1 When piping has been properly flushed and cleaned, test at 690 kPa (100 psi) for 2 hours with only distilled water or filtered dry compressed air. If distilled water is used, drain system when testing is complete.
- .16 Following requirements apply to all testing:
  - .1 ensure piping has been properly flushed, cleaned and is clear of foreign matter prior to pressure testing;
  - .2 temporarily remove or valve off piping system specialties or equipment which may be damaged by test pressures prior to pressure testing systems, and flush piping to remove foreign matter;
  - .3 when testing is carried out below highest level of the particular system, increase test pressure by the hydrostatic head of 7 kPa (1 psi) for every 600 mm (24") below the high point;
  - .4 include for temporary piping connections required to properly complete tests;
  - .5 piping under test pressure is to have zero pressure drop for length of test period;
  - .6 tighten leaks found during tests while piping is under pressure. If this is impossible, remove and refit piping and reapply test until satisfactory results are obtained;
  - .7 where leaks occur in threaded joints in steel piping, no caulking of these joints will be allowed under any conditions;
  - .8 tests are to be done in reasonably sized sections so as to minimize number of tests required;
  - .9 in addition to leakage tests specified above, demonstrate proper flow throughout systems including mains, connections and equipment, as well as proper venting and drainage, and include for any necessary system adjustments to achieve proper conditions.

### **3.10 INTERRUPTION TO AND SHUT-DOWN OF MECHANICAL SERVICES AND SYSTEMS**

- .1 Coordinate shut-down and interruption to existing mechanical systems with Owner. Generally, shut-downs may be performed only between the hours of 12:00 midnight Friday until 6:00 a.m. Monday morning, unless otherwise specified in Division 01. Include for costs of premium time to perform work during nights, weekends or other times outside of normal working hours, which may be necessary to comply with stipulations specified herein this Article. Services for operation of existing non-renovated areas of building are to be maintained.
- .2 Upon award of a Contract, submit a list of anticipated shut-down times and their maximum duration.
- .3 Prior to each shut-down or interruption, inform Owner and the Consultant in writing 5 working days in advance of proposed shut-down or interruption and obtain written consent to proceed. Do not shut-down or interrupt any system or service without such written consent. Shutdowns of some essential services may require additional advance notification time.
- .4 Perform work associated with shut-downs and interruptions as continuous operations to minimize shut-down time and to reinstate systems as soon as possible, and, prior to any shut-down, ensure materials and labour required to complete the work for which shut-down is required are available at site.
- .5 Pipe freezing shall be used to connect new piping to existing piping. Alternative methods may be proposed, if site conditions are evaluated and permit, and are approved by the Consultant.
- .6 Where existing isolation valves do not hold, pipe freezing shall be used to connect new piping to existing piping.

### **3.11 CUTTING, PATCHING AND CORE DRILLING**

- .1 Unless otherwise provided by General Trades, perform cutting, patching, and core drilling of existing building required for installation of mechanical work. Perform cutting in a neat and true fashion, with proper tools and equipment to Consultant's approval. Patching is to exactly match existing finishes and be performed by tradesmen skilled in particular trade or application. Work is subject to review and acceptance by the Consultant.
- .2 Criteria for cutting holes for additional services:
  - .1 cut holes through slabs only; no holes to be cut through beams;
  - .2 cut holes 150 mm (6") diameter or smaller only; obtain approval from Structural Consultant for larger holes;
  - .3 keep at least 100 mm (4") clear from beam faces;
  - .4 space at least 3 hole diameters on centre;
  - .5 for holes that are required closer than 25% of slab span from supporting beam face, use cover meter above slab to clear slab top bars;
  - .6 for holes that are required within 50% of slab span, use cover meter underside of slab to clear slab bottom bars;
  - .7 submit sleeving drawings indicating holes and their locations for Structural Consultant's review.
- .3 Do not cut or drill any existing work without approval from Owner and Consultant. Be responsible for damage done to building and services caused by cutting or drilling.
- .4 Where pipes pass through existing construction, core drill an opening. Size openings to leave 12 mm (½") clearance around pipes or pipe insulation.
- .5 Prior to drilling or cutting an opening, determine, in consultation with Consultant and Owner, and by use of non-destructive radar scan (magnetic scan) of slab or wall, presence of any existing services and reinforcement bars concealed behind building surface to be cut and locate openings to suit. Coring is not permitted through concrete beams or girders.

- .6 Where drilling is required in waterproof slabs, size opening to permit snug and tight installation of a pipe sleeve sized to leave 12 mm (½") clearance around pipe or pipe insulation. Provide a pipe sleeve, constructed of Schedule 40 galvanized steel pipe with a flange at one end and of a length to extend 100 mm (4") above slab, in opening. Secure flange to the underside of slab and caulk void between sleeve and slab opening with proper non-hardening silicone base caulking compound to produce a water-tight installation.
- .7 Firestop and seal openings in fire rated construction. Do not leave openings open overnight unless approved by Owner and Consultant.

### **3.12 PACKING AND SEALING CORE DRILLED PIPE OPENINGS**

- .1 Pack and seal void between pipe opening and pipe or pipe insulation for length of opening as follows:
  - .1 non-fire rated interior construction – pack with mineral wool and seal both ends of opening with non-hardening silicone base caulking compound to produce a water-tight seal;
  - .2 exterior walls above grade – pack with mineral wool and seal both ends of sleeves water-tight with non-hardening silicone base caulking compound unless mechanical type seals have been specified;
  - .3 exterior walls below grade (and any other wall where water leakage may be a problem) – seal with link type mechanical seals as specified.

### **3.13 CLEANING MECHANICAL WORK**

- .1 Refer to cleaning requirements specified in Division 01.
- .2 Clean mechanical work prior to application for Substantial Performance of the Work.
- .3 Include for vacuum cleaning interior of air handling units and ductwork systems.

### **3.14 CONNECTIONS TO OTHER EQUIPMENT**

- .1 Carefully examine Contract Documents during bidding period and include for mechanical work piping and/or ductwork connections to equipment requiring such connections.

### **3.15 SEISMIC RESTRAINT ANCHOR POINTS FOR EQUIPMENT**

- .1 Where mechanical equipment requires seismic restraint, it is to be complete with manufacturer designed and rated seismic restraint anchor points and attachments, certified by equipment manufacturers, so equipment may be bolted down or restrained in the field.
- .2 Equipment to be restrained must be designed such that the strength and anchorage of its internal components exceed force level; used to restrain and anchor the equipment to the supporting structure.

### **3.16 INSTALLATION OF FLEXIBLE CONNECTORS**

- .1 Provide flexible connectors in piping connections to seismically restrained equipment, where applicable, and wherever else shown.
- .2 Provide flexible connectors in piping connections to vibration isolated equipment.

### **3.17 FAN NOISE LEVELS**

- .1 Submit sound power levels with fan shop drawings/product data, with levels measured to AMCA 300 and calculated to AMCA 301.

### **3.18 EQUIPMENT AND SYSTEM MANUFACTURER'S CERTIFICATION**

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

### **3.19 SYSTEM STARTUP**

- .1 When installation of equipment/systems is complete but prior to commissioning, perform start-up for equipment/systems as specified in mechanical work Sections in accordance with following requirements:
  - .1 Submit a copy of each equipment/system manufacturer's start-up report sheet to the Consultant for review, and incorporate any comments made by the Consultant.
  - .2 Under direct on-site supervision and involvement of equipment/system manufacturer's representative, start-up equipment/systems, make any required adjustments, document procedures, leave equipment/systems in proper operating condition, and submit to the Consultant complete set of start-up documentation sheets signed by manufacturer/supplier and Contractor.
  - .3 Commission interconnected life safety systems in accordance with CAN/ULC-S1001-11 and provide written report for Consultant's review.

**END OF SECTION**

## **PART 1 - GENERAL**

### **1.1 SECTION INCLUDES**

- .1 This Section specifies requirements, criteria, methods, and execution for mechanical demolition work that are common to one or more mechanical work Sections, and it is intended as a supplement to each Section and is to be read accordingly.

## **PART 2 - PRODUCTS – NOT USED**

## **PART 3 - EXECUTION**

### **3.1 DISCONNECTION AND REMOVAL OF EXISTING MECHANICAL WORK**

- .1 Where indicated on drawings, disconnect, and remove existing mechanical work, including hangers, supports, insulation, etc. Disconnect at point of supply, remove obsolete connecting services and make system safe. Cut back obsolete piping behind finishes and cap water-tight unless otherwise specified.
- .2 Scope and extent of demolition or revision work is only generally indicated on drawings. Estimate scope, extent and cost of work at site during bidding period site visit(s). Claims for extra costs for demolition work not shown or specified but clearly visible or ascertainable at site during bidding period site visits will not be allowed.
- .3 If any re-design is required due to discrepancies between mechanical drawings and site conditions, notify the Consultant who will issue a Site Instruction. If, in the opinion of the Consultant, discrepancies between mechanical drawings and actual site conditions are of a minor nature, required modifications are to be done at no additional cost.
- .4 Where existing mechanical services extend through, or are in an area to serve items which are to remain, maintain services in operation. Include for rerouting existing services concealed behind existing finishes and which become exposed during renovation work, so as to be concealed behind new or existing finishes.
- .5 Unless otherwise specified, remove from site and dispose of existing materials which have been removed and are not to be relocated or reused.
- .6 Unless otherwise specified, remove from site and dispose of temporary mechanical services and equipment which are not to be reused and/or retained.
- .7

**END OF SECTION**

## PART 1 - GENERAL

### 1.1 SECTION INCLUDES

- .1 This Section specifies requirements that are common to Mechanical Divisions work Sections and it is a supplement to each Section and is to be read accordingly. Where requirements of this Section contradict requirements of Division 00 or Division 01, conditions of Division 00 or Division 01 to take precedence.
- .2 Be responsible for advising product vendors of requirements of this Section.

### 1.2 RELATED REQUIREMENTS

- .1 Division 00 and Division 01 apply to and are a part of this Section.

### 1.3 DEFINITIONS

- .1 "concealed" – means hidden from normal sight in furred spaces, shafts, ceiling spaces, walls and partitions.
- .2 "exposed" – means work normally visible, including work in equipment rooms, service tunnels, and similar spaces.
- .3 "finished" - means when in description of any area or part of an area or a product which receives a finish such as paint, or in case of a product may be factory finished.
- .4 "provision" or "provide" (and tenses of "provide") – means supply and install complete.
- .5 "install" (and tenses of "install") – means secure in position, connect complete, test, adjust, verify, and certify.
- .6 "supply" – means to procure, arrange for delivery to site, inspect, accept delivery, and administer supply of products; distribute to areas; and include manufacturer's supply of any special materials, standard on site testing, initial start-up, programming, basic commissioning, warranties, and manufacturers' assistance to Contractor.
- .7 "delete" or "remove" (and tenses of "delete" or "remove") – means to disconnect, make safe, and remove obsolete materials; patch and repair/finish surfaces to match adjoining similar construction; include for associated re-programming of systems and/or change of documentation identifications to suit deletions, and properly dispose of deleted products off site unless otherwise instructed by Owner and reviewed with the Consultant.
- .8 "BAS" – means building automation system; "BMS" – means building management system; "FMS" – means facility management system; and "DDC" means direct digital controls; references to "BAS", "BMS", "FMS" and "DDC" generally mean same.
- .9 "governing authority" and/or "authority having jurisdiction" and/or "regulatory authority" and/or "Municipal authority" – means government departments, agencies, standards, rules and regulations that apply to and govern work and to which work must adhere.
- .10 "OSHA" and "OHSA" – stands for Occupational Safety and Health Administration and Occupational Health and Safety Act, and wherever either one is used, they are to be read to mean local governing occupational health and safety regulations that apply to and govern work and to which work must adhere, regardless if Project falls within either authority's jurisdiction.
- .11 "Mechanical Divisions" – refers to Division 20, Division 21, Division 22, Division 23, Division 25, and other Divisions as specifically noted, and which work as defined in Specifications and/or on drawings is responsibility of Mechanical Contractor, unless otherwise noted.
- .12 "Electrical Divisions" – refers to Division 26, Division 27, Division 28, and other Divisions as specifically noted, and which work as defined in Specifications and/or on drawings is responsibility of Electrical Contractor, unless otherwise noted.

- .13 "Consultant" – means person, firm or corporation identified as such in Agreement or Documents, and is licensed to practice in Place of the Work, and has been appointed by Owner to act for Owner in a professional capacity in relation to the Work.
- .14 Wherever words "indicated", "shown", "noted", "listed", or similar words or phrases are used in Contract Documents they are understood, unless otherwise defined, to mean product referred to is "indicated", "shown", "listed", or "noted" on Contract Documents.
- .15 Wherever words "reviewed", "satisfactory", "as directed", "submit", or similar words or phrases are used in Contract Documents they are understood, unless otherwise defined, to mean that work or product referred to is "reviewed by", "to the satisfaction of", "submitted to", etc., Consultant.

#### 1.4 DOCUMENTS

- .1 Documents for bidding include but are not limited to issued Drawings, Specifications and Addenda.
- .2 Specification is arranged in accordance with CSI/CSC 49 Divisions of MasterFormat.
- .3 Drawings and Specifications are portions of Contract Documents and identify labour, products and services necessary for performance of work and form a basis for determining pricing. They are intended to be cooperative. Perform work that is shown, specified, or reasonably implied on the drawings but not mentioned in Specification, or vice-versa, as though fully covered by both.
- .4 Review Drawings and Specifications in conjunction with documents of other Divisions and, where applicable, Code Consultant's report.
- .5 Unless otherwise specifically noted in Specifications and/or on Drawings, Sections of Mechanical Divisions are not intended to delegate functions nor to delegate work and supply of materials to any specific trade, but rather to generally designate a basic unit of work, and Sections are to be read as a whole.
- .6 Drawings are performance drawings, diagrammatic, and show approximate locations of equipment and connecting services. Any information regarding accurate measurement of building is to be taken on site. Do not scale Drawings, and do not use Drawings for prefabrication work.
- .7 Drawings are intended to convey the scope of work and do not show architectural and structural details. Provide, at your cost, offsets, fittings, transformations and similar products required as a result of obstructions and other architectural and/or structural details but not shown on Drawings.
- .8 Locations of equipment and materials shown may be altered, when reviewed by the Consultant, to meet requirements of equipment and/or materials, other equipment or systems being installed, and of building, all at no additional cost to Contract.
- .9 Specification does not generally indicate specific number of items or amounts of material required. Specification is intended to provide product data and installation requirements. Refer to schedules, Drawings (layouts, riser diagrams, schematics, details) and Specification to provide correct quantities. Singular may be read as plural and vice versa.
- .10 Starter/motor control centre (MCC)/variable frequency drive (VFD) schedule drawings are both mechanical and electrical, and apply to work of Mechanical Divisions and Electrical Divisions. Be responsible for reviewing starter, MCC, VFD, and motor specification requirements prior to Bid submission. Confirm and coordinate exact scope of work and responsibility of work between Mechanical Divisions and Electrical Divisions.
- .11 Drawings and Specifications have been prepared solely for use by party with whom Consultant has entered into a contract and there are no representations of any kind made by the Consultant to any other party.
- .12 In the case of discrepancies between the drawings and specifications, documents will govern in order specified in "General Conditions", however, when scale and date of drawings are same, or where discrepancy exists within specification, most costly arrangement will take precedence.



## **1.5 METRIC AND IMPERIAL MEASUREMENTS**

- .1 Generally, both metric and imperial units of measurement are given in Sections of Specification governed by this section. Measurement conversions may be generally "soft" and rounded off. Confirm exact measurements based on application. Where measurements are related to installation and onsite applications, confirm issued document measurements with applicable local code requirements, and/or as applicable, make accurate measurements onsite. Where significant discrepancies are found, immediately notify Consultant for direction.

## **1.6 EXAMINATION OF DOCUMENTS AND SITE**

- .1 Carefully examine Documents and visit site to determine and review existing site conditions that will or may affect work, and include for such conditions in Bid Price.
- .2 Report to Consultant, prior to Bid Submittal, any existing site condition that will or may affect performance of work as per Documents. Failure to do so will not be grounds for additional costs.
- .3 Upon finding discrepancies in, or omissions from Documents, or having doubt as to their meaning or intent, immediately notify Consultant, in writing.

## **1.7 WORK STANDARDS**

- .1 Where any code, regulation, bylaw, standard, contract form, manual, printed instruction, and installation and application instruction is quoted it means, unless otherwise specifically noted, latest published edition at time of submission of Bids adopted by and enforced by local governing authorities having jurisdiction. Include for compliance with revisions, bulletins, supplementary standards or amendments issued by local governing authorities.
- .2 Where regulatory codes, standards and regulations are at variance with Drawings and Specification, more stringent requirement will apply unless otherwise directed by Owner and reviewed with the Consultant.
- .3 Supplementary mandatory specification and requirements to be used in conjunction with project include but are not limited to following:
  - .1 Air-Conditioning, Heating and Refrigeration Institute (AHRI);
  - .2 Air Movement and Control Association (AMCA);
  - .3 American Iron and Steel Institute (AISI);
  - .4 American National Standards Institute (ANSI);
  - .5 American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc., (ASHRAE);
  - .6 American Society of Mechanical Engineers (ASME);
  - .7 American Society of Testing and Materials (ASTM);
  - .8 American Water Works Association (AWWA);
  - .9 Associated Air Balance Council (AABC);
  - .10 Building Industry Consulting Services, International (BICSI);
  - .11 Canadian Gas Association (CGA);
  - .12 Canadian General Standards Board (CGSB);
  - .13 Canadian Standards Association (CSA);
  - .14 Electrical and Electronic Manufacturers Association of Canada (EEMAC);
  - .15 Electrical Safety Authority (ESA);
  - .16 Electronic Industries Association (EIA);
  - .17 Factory Mutual Systems (FM);



- .18 Illuminating Engineering Society (IES);
- .19 Institute of Electrical and Electronic Engineers (IEEE);
- .20 International Standards Organization (ISO);
- .21 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS);
- .22 National Building Code of Canada (NBC);
- .23 National Electrical Manufacturers Association (NEMA);
- .24 National Environmental Balancing Bureau (NEBB);
- .25 National Fire Protection Association (NFPA);
- .26 National Standards of Canada;
- .27 NSF International;
- .28 Occupational Health and Safety Act (OHSA);
- .29 Ontario Building Code (OBC);
- .30 Ontario Electrical Safety Code (OESC);
- .31 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA);
- .32 Technical Standards and Safety Authority (TSSA);
- .33 Thermal Insulation Association of Canada (TIAC);
- .34 Underwriters' Laboratories of Canada (ULC);
- .35 Workplace Hazardous Materials Information System (WHMIS);
- .36 Material Safety Data Sheets by product manufacturers;
- .37 Local utility inspection permits;
- .38 Codes, standards, and regulations of local governing authorities having jurisdiction;
- .39 Additional codes and standards listed in Trade Sections;
- .40 Owner's standards.
- .4 Provide applicable requirements for barrier free access in accordance with latest edition of local governing building code.
- .5 Where any governing Code, Regulation, or Standard requires preparation and submission of special details or drawings for review they are to be prepared and submitted to appropriate authorities. Be responsible for costs associated with these submittals.
- .6 Unless otherwise specified, install equipment in accordance with equipment manufacturer's recommendations and instructions, and requirements of governing Codes, Standards, and Regulations. Governing Codes, Standards, and Regulations take precedence over manufacturer's instructions.
- .7 Work is to be performed by journeyperson tradesmen who perform only work that their certificates permit, or by apprentice tradesmen under direct on site supervision of experienced journeyperson tradesman. Journeyperson to apprentice ratio is not to exceed ratio determined by the Board as stated in Ontario College of Trades and Apprenticeship Act or local equivalent governing body in Place of the Work.
- .8 Journeyperson tradesmen are to have a copy of valid trade certificates available at site for review with the Consultant at any time.
- .9 Experienced and qualified superintendent is to be on-site at times when work is being performed.
- .10 Coordinate work inspection reviews and approvals with governing inspection department to ensure that construction schedule is not delayed. Be responsible for prompt notification of deficiencies to the Consultant and submission of reports and certificates to the Consultant.

- .11 Properly protect equipment and materials on site from damage due to elements and work of trades, to satisfaction of Owner and reviewed with the Consultant. Equipment and materials are to be in new condition upon Substantial Performance of the Work.
- .12 Mechanical piping system work, including equipment, must comply in all respects with requirements of local technical standards authorities and CSA B51, Boiler, Pressure Vessels and Pressure Piping Code. Where required, mechanical work products must bear a CRN number.
- .13 Electrical items associated with mechanical equipment are to be certified and bear stamp or seal of a recognized testing agency such as CSA, UL, ULC, ETL, etc., or bear a stamp to indicate special electrical utility approval.
- .14 Healthcare Facility Standards
  - .1 Comply with following CAN/CSA Standards:
    - .1 CAN/CSA Z317.13, Infection Control During Construction, Renovation, and Maintenance of Health Care Facilities: Prepare a list of areas of the work where infection control procedures are to be in force and review list and procedures with healthcare facility's Infection Control Officer or a designated healthcare facility representative prior to commencing work in aforementioned areas. As work proceeds, ensure infection control procedures are being maintained.
    - .2 CAN/CSA Z317.1, Special Requirements for Plumbing Installations in Health Care Facilities.
    - .3 CAN/CSA Z317.2, Special Requirements for Heating, Ventilation, and Air-Conditioning (HVAC) Systems in Health Care Facilities.
    - .4 CAN/CSA Z317.10, Handling of Health Care Waste Materials.
    - .5 CAN/CSA Z8000, Canadian Health Care Facilities.
    - .6 CAN/CSA Z8001, Commissioning of Health Care Facilities.
    - .7 CAN/CSA Z7396.1 Medical Gas Pipeline Systems - Part 1 Pipelines for Medical Gases, Medical Vacuum, Medical Support Gases, and Anaesthetic Gas Scavenging Systems.
  - .2 Prepare a separate set of "as-built" white prints on a day-to-day basis for medical gas piping system work.
  - .3 Comply with healthcare facility's latest policies and procedures regarding infection prevention and decontamination measures during work of project. Refer to additional requirements of Division 01.

## 1.8 PERMITS, CERTIFICATES, APPROVALS, AND FEES

- .1 Contact and confirm with local authorities having jurisdiction including utility providers, requirements for approvals from such authorities. Obtain and pay for permits, certificates, and approvals required to complete Work.
- .2 Be responsible for ensuring that authorities having jurisdiction which require on-site inspection of work, have ample notification to perform inspection, with sufficient lead time to correct deficiencies in a manner that will not impede schedule of completion of Work. If any defect, deficiency or non-compliant is found in work by inspection, be responsible for costs of such inspection, including any related expenses, making good and return to site, until work is passed by governing authorities.
- .3 Obtain and submit to Consultant, approval/inspection certificates issued by governing authorities to confirm that Work as installed is in accordance with rules and regulations of local governing authorities and are acceptable.
- .4 Include in each copy of operating and maintenance instruction manuals, copies of approvals and inspection certificates issued by regulatory authorities.

### 1.9 REQUIREMENTS FOR CONTRACTOR RETAINED ENGINEERS

- .1 Professional engineers retained to perform consulting services with regard to Project work, i.e. seismic engineer, fire protection engineer or structural engineer, are to be members in good standing with local Association of Professional Engineers, and are to carry and pay for errors and omissions professional liability insurance in compliance with requirements of governing authorities in Place of the Work.
- .2 Retained engineer's professional liability insurance is to protect Contractor's consultants and their respective servants, agents, and employees against any loss or damage resulting from professional services rendered by aforementioned consultants and their respective servants, agents, and employees in regards to the Work of this Contract.
- .3 Unless otherwise specified in Division 00 or Division 01, liability insurance requirements are as follows:
  - .1 coverage is to be a minimum of \$1,000,000.00 CDN inclusive of any one occurrence;
  - .2 insurance policy is not to be cancelled or changed in any way without insurer giving Owner minimum thirty days written notice;
  - .3 liability insurance is to be obtained from an insurer registered and licensed to underwrite such insurance in the Place of the Work;
  - .4 retained consultants are to ascertain that sub-consultants employed by them carry insurance in the form and limits specified above;
  - .5 evidence of the required liability insurance in such form as may be required is to be issued to Owner, Owner's Consultant, and Municipal Authorities as required prior to commencement of aforementioned consultant's services.

### 1.10 WORKPLACE SAFETY

- .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials. Submit WHMIS MSDS (Material Safety Data Sheets) for products where required, and maintain one copy at site in a visible and accessible location available to personnel.
- .2 Comply with requirements of Occupational Health and Safety Act and other regulations pertaining to health and safety, including worker's compensation/insurance board and fall protection regulations. When working in confined spaces, comply with requirements of Occupational Health and Safety Act - Ontario Regulation 632, "Confined Spaces" and any other applicable Ministry of Labour requirements.
- .3 If at any time during course of work, hazardous materials other than those identified in Documents and pertaining to Project Scope of Work, are encountered, or suspected that were not identified as being present and which specific instructions in handling of such materials were not given, cease work in area in question and immediately notify Consultant. Comply with local governing regulations with regards to working in areas suspected of containing hazardous materials. Do not resume work in affected area without approval from Owner and reviewed with the Consultant.

### 1.11 PLANNING AND LAYOUT OF WORK

- .1 Base installation layout, design, terminations, and supply of accessories, on Contract Documents with specific coordination with reviewed shop drawings.
- .2 Plan, coordinate, and establish exact locations and routing of services with affected trades prior to installation such that services clear each other as well as other obstructions. Generally, order of right of way for services to be as follows:
  - .1 piping requiring uniform pitch;
  - .2 piping 100 mm (4") dia. and larger;

- .3 large ducts (main runs);
  - .4 cable tray and bus duct;
  - .5 conduit 100 mm (4") dia. and larger;
  - .6 piping less than 100 mm (4") dia.;
  - .7 smaller branch ductwork;
  - .8 conduit less than 100 mm (4") dia.
- .3 Unless otherwise shown or specified, conceal work in finished areas, and conceal work in partially finished and/or unfinished areas to extent made possible by the area construction. Install services as high as possible to conserve headroom and/or ceiling space. Notify Consultant where headroom or ceiling space appears to be inadequate prior to installation of work.
- .4 Do not use Contract Drawing measurements for prefabrication and layout of piping, sheet metal work and such other work. Locations and routing are to generally be in accordance with Contract Drawings, however, prepare layout drawings for such work. Use established bench marks for both horizontal and vertical measurements. Confirm inverts, coordinate with and make allowances for work of other trades. Accurately layout work, and be entirely responsible for work installed in accordance with layout drawings. Where any invert, grade, or size is at variance with Contract Drawings, notify Consultant prior to proceeding with work.
- .5 Prepare plan and interference drawings (at a minimum drawing scale of 1:50 or 1/4"=1' 0") of work for coordination with each trade Contractor. Arrange for preparation of detailed section drawings of ceiling spaces of corridors and any other congested areas. Sections are to be cross referenced with plan drawings so that trades may make use of section drawings. Section drawings to indicate lateral and elevation dimensions of major services within ceiling space. Lateral dimensions are to be from grid lines and elevations from top of floor slab. Obtain from Consultant, engineering drawings for this use. Contractors' interference drawings are to be distributed among other Trade Contractors. Submit drawings to the Consultant for review. Failure of General Contractor to prepare and coordinate overall interface drawings of trades does not relieve respective Division Contractor of responsibility to ensure that work is properly planned and coordinated.
- .6 Carry out alterations in arrangement of work that has been installed without proper coordination, study, and review, even if in accordance with Contract Documents, in order to conceal work behind finishes, or to allow installation of other work, without additional cost. In addition, make necessary alterations in other work required by such alterations, without additional cost.
- .7 Shut-off valves, balancing devices, air vents, equipment, and similar products, particularly such products located above suspended ceilings must be located for easy access for servicing and/or removal. Products which do not meet this location requirement are to be relocated to an accessible location at no additional cost.
- .8 Be responsible for making necessary changes, at no additional cost, to accommodate structural and building conditions that were missed due to lack of coordination.

#### **1.12 SCHEDULING**

- .1 Include for any and all scheduling, coordination, and construction phasing to suit project, specified in Division 01 and/or as indicated on the drawings. Review exact phasing requirements with Consultant and Owner prior to start of Work. Facility must remain operational at all times.
- .2 Phasing and scheduling of Work is required in order to maintain existing building operations. Include costs (including costs for "off hours" work) for scheduling, co-ordination, and construction phasing to suit this project as specified in Division 01 and on drawings. Review phasing requirements with the Consultant prior to start of Work.
- .3 Protect existing areas above, below, and adjacent areas of Work from any debris, noise, or interruptions to existing services to satisfaction of Owner and reviewed with the Consultant. Maintain in operation existing services to these areas to allow Owner to continue use of these

areas. If services that are required to be maintained run through areas of renovations, provide necessary protection to services or reroute, in coordination with Owner and Consultant. Include for required premium time work to meet these requirements.

- .4 Work being performed within occupied spaces and work affecting surfaces adjacent to occupied spaces may need to be performed after regular business hours. For areas where spaces are used by Owner on a 24 hours basis or over various hours, coordinate hours of work with Owner on a regular basis to suit Owner's schedule. Execute work at times confirmed with and agreed to by Owner and reviewed with the Consultant, so as not to inconvenience Owner's occupation or in any way hinder Owner's use of building. Include for required premium timework to meet these requirements.
- .5 Project partial occupancy permits may be required throughout project. Provide for each partial permit, required local governing authority certificate and any other testing/verification certificates for systems.

### 1.13 COORDINATION

- .1 Review Contract Documents and coordinate work with work of each trade. Coordination requirements are to include but not be limited to following:
  - .1 requirements for openings, sleeves, inserts and other hardware necessary for installation of work;
  - .2 concrete work such as housekeeping pads, sumps, bases, etc., required for work, and including required dimensions, operating weight of equipment, location, etc.;
  - .3 depth and routing of excavation required for work, and requirements for bedding and backfill;
  - .4 wiring work required for equipment and systems but not specified to be done as part of mechanical work, including termination points, wiring type and size, and any other requirements.
- .2 Ensure materials and equipment are delivered to site at proper time and in such assemblies and sizes so as to enter into building and be moved into spaces where they are to be located without difficulty.
- .3 Wherever possible, coordinate equipment deliveries with manufacturers and/or suppliers so equipment is delivered to site when it is required, or so it can be stored within building, subject to available space as confirmed with Owner and reviewed with Owner, and protected from elements.
- .4 Ensure proper access and service clearances are maintained around equipment, and, where applicable, access space for future equipment removal or replacement is not impeded. Comply with code requirements with regards to access space provision around equipment. Remove and replace any equipment which does not meet this requirement.
- .5 Where work is to be integrated, or is to be installed in close proximity with work of other trades, coordinate work prior to and during installation.

### 1.14 PRODUCTS

- .1 Be responsible for ordering of products (equipment and materials) in a timely manner in order to meet project-scheduling timelines. Failure to order products to allow manufacturers sufficient production/delivery time to meet project-scheduling timelines is an unacceptable reason to request for other suppliers or substitutions.
- .2 Provide Canadian manufactured products wherever possible or required and when quality and performance is obtainable at a competitive price. Products are to be supplied from manufacturer's authorized Canadian representative, unless otherwise noted. Unless otherwise specified, products are to be new and are to comply with applicable respective Canadian standards. References to UL listings of products to include requirements that products are to be also Underwriters Laboratories of Canada (ULC) listed for use in Canada. Products are to meet or exceed latest ANSI/ASHRAE/IES



90.1 standards, as applicable. Do not supply any products containing asbestos materials or PCB materials.

- .3 Systems and equipment of this Project are to be "State of the Art" and be most recent and up to date series/version of product that is available at time of shop drawing review process. Products that have been stored or "on shelf" for an extended period of time will not be accepted. Software is to be of latest version available and be provided with updates available at time of shop drawing review process. Systems are to be designed such that its software is backwards compatible. Future upgrades are not to require any hardware replacements or additions to utilize latest software.
- .4 Products scheduled and/or specified have been selected to establish a performance and quality standard, and, in some instances, a dimensional standard. In most cases, base specified manufacturers are stated for any product specified by manufacturer's name and model number. Where manufacturers are listed, first name listed is base specified company. Bid Price may be based on products supplied by any of manufacturers' base specified or named as acceptable for particular product. If manufacturers are not stated for a particular product, base Bid Price on product supplied by base specified manufacturer.
- .5 Documents have been prepared based on product available at time of Bidding. If, after award of Contract, and if successful manufacturer can no longer supply a product that meets base specifications, notify Consultant immediately. Be responsible for obtaining other manufacturers product that complies with base specified performance and criteria and meets project timelines. Proposed products are subject to review and consideration by the Consultant and are considered as substitutions subject to a credit to Contract. In addition, if such products require modifications to room spaces, mechanical systems, electrical systems, etc., include required changes. Such changes are to be submitted in detail to the Consultant for review and consideration for acceptance. There will be no increase in Contract Price for revisions. Above conditions supplement and are not to supersede any specification conditions with regards to substitutions or failure to supply product as per issued documents.
- .6 Listing of a product as "acceptable" does not imply automatic acceptance by the Consultant and/or Owner. It is responsibility of Contractor to ensure that any price quotations received and submittals made are for products that meet or exceed specifications included herein.
- .7 If products supplied by a manufacturer named as acceptable are used in lieu of base specified manufacturer, be responsible for ensuring that they are equivalent in performance and operating characteristics (including energy consumption if applicable) to base specified products. It is understood that any additional costs (i.e. for larger starters, larger feeders, additional spaces, etc.), and changes to associated or adjacent work resulting from provision of product supplied by a manufacturer other than base specified manufacturer, is included in Bid Price. In addition, in equipment spaces where equipment named as acceptable is used in lieu of base specified equipment and dimensions of such equipment differs from base specified equipment, prepare, and submit for review accurately dimensioned layouts of rooms affected, identifying architectural and structural elements, systems and equipment to prove that equipment in room will fit properly meeting design intent. There will be no increase in Contract Price for revisions.
- .8 In addition to manufacturer's products base specified or named as acceptable, other manufacturers of products may be proposed as substitutions to the Consultant for review and consideration for acceptance, listing in each case a corresponding credit for each substitution proposed. However, base Bid Price on products base specified or named as acceptable. Certify in writing to the Consultant that proposed substitution meets space, power, design, energy consumption, and other requirements of base specified or acceptable product. It is understood that there will be no increase in Contract Price by reason of any changes to associated equipment, mechanically, electrically, structurally, or architecturally, required by acceptance of proposed substitution. Consultant has sole discretion in accepting any such proposed substitution of product. Indicate any proposed substitutions in areas provided on Bid Form. Do not order such products until they are accepted in writing by the Consultant.
- .9 Where products are listed as "or approved equal", certify in writing that product to be used in lieu of base specified product, at least meets space, power, design, energy consumption, and other

requirements of base specified product and is equivalent or better than base specified product. When requested by the Consultant, provide full design detail drawings and specifications of proposed products. Acceptance of these "or approved equal" products is at sole discretion of the Consultant. It is understood that there will be no increase in Contract Price by reason of any changes to associated equipment, mechanically, electrically, structurally, or architecturally, required by acceptance of approved equal product. There must be no increase in Contract price due to Consultant's rejection of proposed equivalent product.

- .10 Whenever use of product other than base specified product is being supplied, ensure corresponding certifications and product information (detailed catalogue and engineering data, fabrication information and performance characteristics) are submitted to the Consultant for review. Failure of submission of these documents to the Consultant in a timely manner to allow for review will result in base specified product to be supplied at Consultant's discretion, at no additional cost to Contract.
- .11 Products supplied by a manufacturer/supplier other than a manufacturer listed as acceptable may be considered for acceptance by the Consultant if requested in writing with full product documentation submitted, a minimum of 10 working days prior to Bid closing date.
- .12 Any proposed changes initiated by Contractor after award of Contract may be considered by the Consultant at the Consultant's discretion, with any additional costs for such changes if accepted by Owner and reviewed with the Consultant, and costs for review, to be borne by Contractor.
- .13 Whenever use of product other than based specified products or named as acceptable is being supplied, time for process of submission of other products and Consultant's review of products will not alter contract time or delay work schedule.

#### **1.15 SHOP DRAWINGS**

- .1 At start-up meeting, review with the Consultant products to be included in shop drawing submission. Prepare and submit list of products to the Consultant for review.
- .2 Submit electronic copies of shop drawings unless otherwise directed by the Consultant. Coordinate exact requirements with the Consultant.
- .3 Submit for review, drawings showing detail design, construction, and performance of equipment and materials as requested in Specification. Submit shop drawings to the Consultant for review prior to ordering and delivery of product to site. Include minimally for preparation and submission of following, as applicable:
  - .1 product literature cuts;
  - .2 equipment data sheets;
  - .3 equipment dimension drawings;
  - .4 system block diagrams;
  - .5 sequence of operation;
  - .6 connection wiring schematic diagrams;
  - .7 functionality with integrated systems.
- .4 Each shop drawing or product data sheet is to be properly identified with project name and product drawing or specification reference. Shop drawing or product data sheet dimensions are to match dimension type on drawings.
- .5 Where any item of equipment is required by Code or Standard or By-Law to meet a specific energy efficiency level, or any other specific requirement, ensure this requirement is clearly indicated on submission.
- .6 Ensure proposed products meet each requirement of Project. Endorse each shop drawing copy "CERTIFIED TO BE IN ACCORDANCE WITH ALL REQUIREMENTS". Include company name, submittal date, and sign each copy. Shop drawings that are received and are not endorsed, dated and signed will be returned to be resubmitted.

- .7 Consultant to review shop drawings and indicate review status by stamping shop drawing copies as follows:
  - .1 "REVIEWED" or "REVIEWED AS NOTED" (appropriately marked) – If Consultant's review of shop drawing is final, Consultant to stamp shop drawing;
  - .2 "RETURNED FOR CORRECTION" – If Consultant's review of shop drawing is not final, Consultant to stamp shop drawing as stated above, mark submission with comments, and return submission. Revise shop drawing in accordance with Consultant's notations and resubmit.
- .8 Following is to be read in conjunction with wording on Consultant's shop drawing review stamp applied to each and every shop drawing or product data sheet submitted:
  - .1 "THIS REVIEW BY CONSULTANT IS FOR SOLE PURPOSE OF ASCERTAINING CONFORMANCE WITH GENERAL DESIGN CONCEPT. THIS REVIEW DOES NOT MEAN THAT CONSULTANT APPROVES DETAILED DESIGN INHERENT IN SHOP DRAWINGS, RESPONSIBILITY FOR WHICH REMAINS WITH CONTRACTOR. CONSULTANT'S REVIEW DOES NOT RELIEVE CONTRACTOR OF RESPONSIBILITY FOR ERRORS OR OMISSIONS IN SHOP DRAWINGS OR OF CONTRACTOR'S RESPONSIBILITY FOR MEETING REQUIREMENTS OF CONTRACT DOCUMENTS. BE RESPONSIBLE FOR DIMENSIONS TO BE CONFIRMED AND CORRELATED AT JOB SITE, FOR INFORMATION THAT PERTAINS SOLELY TO FABRICATION PROCESSES OR TO TECHNIQUES OF CONSTRUCTION AND INSTALLATION, AND FOR COORDINATION OF WORK OF SUB-TRADES."
- .9 Submit each system and each major component as separate shop drawing submissions. Submit together, shop drawings for common devices such as devices of each system are to be submitted together.
- .10 Obtain shop drawings for submission from product manufacturer's authorized representatives and supplemented with additional items specified herein.
- .11 Do not order product until respective shop drawing review process has been properly reviewed with the Consultant.
- .12 Where extended warranties are specified for equipment items, submit specified extended warranty with shop drawing submittal.
- .13 Applicable mechanical equipment has been selected to meet energy efficiency requirements of ANSI/ASHRAE/IES 90.1, Energy Standards for Buildings, and shop drawings/product data submittals for such equipment must indicate compliance with this Standard or they will be returned for correction and re-submittal.

#### **1.16 EQUIPMENT LOADS**

- .1 Supply equipment loads (self-weight, operating weight, housekeeping pad, inertia pads, etc.) to the Consultant, via shop drawing submissions, prior to construction.
- .2 Where given choice of specific equipment, actual weight, location, and method of support of equipment may differ from those assumed by the Consultant for base design. Back-check equipment loads, location, and supports, and include necessary accommodations.
- .3 Where supporting structure consists of structural steel framing, it is imperative that equipment loads, location, and method of support be confirmed prior to fabrication of structural steel. Review locations of equipment with the Consultant prior to construction.

#### **1.17 OPENINGS**

- .1 Supply opening sizes and locations to the Consultant to allow verification of their effect on design, and for inclusion on structural drawings where appropriate.
- .2 No openings are permitted through completed structure without written approval from Owner and reviewed with the Consultant. Show required openings on a copy of structural drawings. Identify



exact locations, elevations, and size of proposed openings and submit to the Consultant for review, well in advance of doing work.

- .3 Prior to leaving site at end of each day, walk through areas of work and check for any openings, penetrations, holes, and/or voids created under scope of work of project, and ensure that any openings created under scope of work have been closed off, fire-stopped and smoke-sealed. Unless directed by Owner and reviewed with the Consultant, do not leave any openings unprotected and unfinished overnight.

#### **1.18 SCAFFOLDING, HOISTING AND RIGGING**

- .1 Unless otherwise specified or directed, supply, erect and operate scaffolding, rigging, hoisting equipment and associated hardware required for work, and subject to approval from Owner and reviewed with the Consultant.
- .2 Immediately remove from site scaffolding, rigging and hoisting equipment when no longer required.
- .3 Do not place major scaffolding/hoisting equipment loads on any portion of structure without approval from Owner and reviewed with the Consultant.

#### **1.19 CHANGES IN THE WORK**

- .1 Whenever Consultant proposes in writing to make a change or revision to design, arrangement, quantity, or type of work from that required by Contract Documents, prepare and submit to the Consultant for review, a quotation being proposed cost for executing change or revision.
- .2 Quotation is to be a detailed and itemized estimate of product, labour, and equipment costs associated with change or revision, plus overhead and profit percentages and applicable taxes and duties.
- .3 Unless otherwise specified in Division 00 or Division 01, allowable maximum percentages for overhead and profit are to be 7% and 5% respectively.
- .4 Unless otherwise specified in Division 00 or Division 01, following additional requirements apply to all quotations submitted:
  - .1 when change or revision involves deleted work as well as additional work, cost of deleted work (less overhead and profit percentages but including taxes and duties) is to be subtracted from cost of additional work before overhead and profit percentages are applied to additional work;
  - .2 material costs are not to exceed those published in the latest edition of Allpriser price guide, less 20%;
  - .3 mechanical material labour unit costs are to be in accordance with Mechanical Contractors Association of America Labor Estimating Manual, less 25%;
  - .4 electrical material labour unit costs are to be in accordance with National Electrical Contractors Association Manual of Labor Units at difficult level, less 25%;
  - .5 costs for journeyman and apprentice labour must not exceed prevailing rates at time of execution of Contract and must reflect actual personnel performing work;
  - .6 cost for site superintendent must not exceed 10% of total hours of labour estimated for change or revision, and change or revision must be such that site superintendent's involvement is necessary;
  - .7 costs for rental tools and/or equipment are not to exceed local rental costs;
  - .8 overhead percentage will be deemed to cover quotation costs other than actual site labour and materials, and rentals;
  - .9 quotations, including those for deleted work, to include a figure for any required change to Contract time.

- .5 Quotations submitted that are not in accordance with requirements specified above will be rejected and returned for re-submittal. Failure to submit a proper quotation to enable Consultant to expeditiously process quotation and issue a Change Order will not be grounds for any additional change to Contract time.
- .6 Make requests for changes or revisions to work to Consultant in writing and, if Consultant agrees, will issue Notice of Change.
- .7 Do not execute any change or revision until written authorization for the change or revision has been obtained from the Consultant.

#### **1.20 PROGRESS PAYMENT BREAKDOWN**

- .1 Prior to submittal of first progress payment draw, submit a detailed breakdown of work cost to assist Consultant in reviewing and approving progress payment claims.
- .2 Payment breakdown is subject to Owner's approval and Consultant's review. Progress payments will not be processed until an approved breakdown is in place. Breakdown is to include one-time claim items such as mobilization and demobilization, insurance, bonds (if applicable), shop drawings and product data sheets, commissioning including testing, adjusting and balancing, system testing and verification, and project closeout submittals.
- .3 Indicate equipment, material and labour costs for site services (if applicable) and indicate work of each trade in same manner as indicated on progress draw.

#### **1.21 NOTICE FOR REQUIRED FIELD REVIEWS**

- .1 Whenever there is a requirement for the Consultant to perform a field review prior to concealment of any work, to inspect/re-inspect work for deficiencies prior to Substantial Performance of the Work, for commissioning demonstrations, and any other such field review, give minimum 5 working days' notice in writing to the Consultant.
- .2 If Consultant is unable to attend a field review when requested, arrange an alternative date and time.
- .3 Do not conceal work until the Consultant advises that it may be concealed.
- .4 When Consultant is requested to perform a field review and work is not ready to be reviewed, reimburse Consultant for time and travel expenses.

#### **1.22 PRELIMINARY TESTING**

- .1 When directed by the Consultant, promptly arrange, pay for, and perform site tests on any piece of equipment or any system for such reasonable lengths of time and at such times as may be required to prove compliance with Specification and governing Codes and Regulations, prior to Substantial Performance of the Work.
- .2 When, in Consultant's opinion, tests are required to be performed by a certified testing laboratory, arrange and pay for such tests.
- .3 These tests are not to be construed as evidence of acceptance of work, and it is agreed and understood that no claim for delays or damage will be made for injury or breakage to any part or parts of equipment or system due to test where such injuries or breakage were caused by faulty parts and/or workmanship of any kind.
- .4 When, in Consultant's opinion, tests indicate that equipment, products, etc., are defective or deficient, immediately remove such equipment and/or products from site and replace them with acceptable equipment and/or products, at no additional cost.

### **1.23 PROVISIONS FOR SYSTEMS/EQUIPMENT USED DURING CONSTRUCTION**

- .1 Permanent building mechanical systems are not to be used for temporary heating or cooling purposes during construction.

### **1.24 TEMPORARY SERVICES**

- .1 Coordinate with Prime Contractor, requirements for temporary services including but not limited to temporary heating, cooling, and water. Unless otherwise noted, provide required services in compliance with requirements of local governing building code and local governing inspection authorities.
- .2 Maintain fire protection of areas which may include fire watch during temporary shutdowns of existing systems, in accordance with requirements of local governing code and local governing authorities.

### **1.25 MAINTAINING EQUIPMENT PRIOR TO ACCEPTANCE**

- .1 Maintain equipment in accordance with the manufacturer's printed instructions prior to start-up, testing and commissioning.
- .2 Employ a qualified millwright to check and align shafts, drives, and couplings on all base mounted split coupled motor driven equipment.
- .3 Where equipment lubrication fittings are not easily accessible, extend the fittings to accessible locations using copper or aluminium tubing.
- .4 All filters are to be new upon Substantial Performance of the Work. This is in addition to any spare filters specified.

### **1.26 RECORD DOCUMENTATION**

- .1 Drawings for this project have been prepared on a CAD system using [AutoCAD] [Revit] software of release version reviewed with the Consultant. For purpose of producing record "as built" drawings, copies of Contract Drawings can be obtained from the Consultant.
- .2 As work progresses at site, clearly mark in red in a neat and legible manner on a set of bound white prints of Contract Drawings, changes, and deviations from routing of services and locations of equipment shown on Contract Drawings, on a daily basis. Changes and deviations include those made by addenda, change orders, and site instructions. Use notes marked in red as required. Maintain white print red line as-built set at site for exclusive use of recording as-built conditions, keep set up-to-date at all times, and ensure set is always available for periodic review. As-built set is also to include the following:
  - .1 dimensioned location of inaccessible concealed work;
  - .2 locations of control devices with identification for each;
  - .3 for underground piping and ducts, record dimensions, invert elevations, offsets, fittings, cathodic protection and accessories if applicable, and locate dimensions from benchmarks to be preserved after construction is complete;
  - .4 for fire protection systems, record actual locations of equipment, sprinkler heads, and valves, drains, and test locations, and deviations of pipe routing and sizing from that shown on the drawings;
  - .5 location of piping system air vents;
  - .6 location of concealed services terminated for future extension and work concealed within building in inaccessible locations.
- .3 Before applying for a Certificate of Substantial Performance of the Work, update a clean copy of Contract Drawing set in accordance with marked up set of "as-built" white prints including deviations

from original Contract Drawings, thus forming an "as-built" drawing set. Submit "as-built" site drawing prints to the Consultant for review. Make necessary revisions to drawings as per Consultant's comments, to satisfaction of the Consultant.

- .4 Use final reviewed "as-built" drawing set to provide CAD files of drawings thus forming true "as-built" set of Contract Drawings. Identify set as "Project Record Copy". Load digital copies of final reviewed by the Consultant as-built drawings onto USB type flash drive. Provide 2 complete sets of "as-built" drawings on separate USBs. Submit "as-built" sets of white prints and USBs to Consultant.
- .5 Submitted drawings are to be of same quality as original Contract Drawings. CAD drawing files are to be compatible with [AutoCAD] [Revit] software release version confirmed with the Consultant.
- .6 Unless otherwise noted in Division 00 or Division 01, failure to maintain accurate record drawings will incur additional 5% holdback on progress claims until drawings are brought up to date to satisfaction of Owner and reviewed with the Consultant.
- .7 For projects with phased turnover of project (refer to Division 01), review with the Consultant completeness of as-built drawings prior to turn over of an area. Interim as-built drawings to be made available to Owner's maintenance personnel.
- .8 Where part of the Mechanical Scope of Work, retain and pay for services of a land surveyor registered in Place of the Work to measure, verify, and record size, location, invert elevation and pitch of buried piping services, and, when complete, transfer survey work to as-built drawings.
- .9 Requirements regarding medical gas piping system as-built record drawings are as follows:
  - .1 Obtain from Owner, existing medical gas piping record drawings and, on a day-to-day basis, record alteration work and new work, including location of concealed piping, and, if a drawing CAD files are available, update files using compatible CAD software, in accordance with requirements of CAN/CSA Z7396.1.

#### 1.27 OPERATION AND MAINTENANCE DATA

- .1 For each item of equipment for which a shop drawing is required (except for simple equipment), supply indexed copies of equipment manufacturers' operating and maintenance (O&M) instruction data manuals. Consolidate each copy of data as a PDF file on a USB drive. Consolidated O&M manual PDF to include:
  - .1 front cover: project name; wording – "Mechanical Systems Operating and Maintenance Manual"; and date;
  - .2 introduction sheet listing Consultant, Contractor, and Subcontractor names, street addresses, telephone and fax numbers, and e-mail addresses;
  - .3 equipment manufacturer's authorized contact person name, telephone number and company website;
  - .4 Table of Contents sheet, and corresponding index tab sheets;
  - .5 copy of each "REVIEWED" or clean, updated "REVIEWED AS NOTED" shop drawing or product data sheet, with manufacturer's/supplier's name, telephone and fax numbers, email address, company website address, and email address for local source of parts and service; when shop drawings are returned marked "Reviewed As Noted" with revisions marked on shop drawing copies, they are to be revised by equipment supplier to incorporate comments marked on "Reviewed" shop drawings and a clean updated copy is to be included in operating and maintenance manuals;
  - .6 Operating data is to include:
    - .1 pressure test reports, and certificates issued by governing authorities;
    - .2 description of each system and its controls;
    - .3 control schematics for equipment/systems including building environmental controls;

- .4 wiring and connection diagrams;
- .5 if applicable, BAS architecture and all required operating data;
- .6 description of operation of each system at various loads together with reset schedules and seasonal variances;
- .7 operation instruction for each system and each component;
- .8 description of actions to be taken in event of emergencies and/or equipment failure;
- .9 valve tag schedule, and flow diagrams to indicate valve locations.
- .7 Maintenance data is to include:
  - .1 operation and trouble-shooting instructions for each item of equipment and each system;
  - .2 schedules of tasks, frequency, tools required, and estimated task time;
  - .3 recommended maintenance practices and precautions;
  - .4 complete parts lists with numbers.
- .8 Performance data is to include:
  - .1 equipment and system start-up data sheets;
  - .2 equipment performance verification test results, and final commissioning report;
  - .3 final testing, adjusting and balancing reports.
- .9 copies of warranties;
- .10 items requested specifically in Section Articles.
- .2 Operating and maintenance instructions are to relate to job specific equipment supplied under this project and related to Owner's building. Language used in manuals is to contain simple practical operating terms and language easy for in-house maintenance staff to understand how to operate and maintain each system.
- .3 Before applying for a Certificate of Substantial Performance of the Work, assemble one copy of O&M Manual and submit to the Consultant for review prior to assembling remaining copies. Incorporate Consultant's comments into final submission.

## 1.28 COMMISSIONING

- .1 An independent Commissioning Agent is retained by Owner to perform equipment and system commissioning work as specified in Division 01, and in Section 20 08 00 – Commissioning of Mechanical Systems. Interface, cooperate and coordinate with Owner's Commissioning Agent. Submit copies of submittals such as shop drawings/product data sheets, schedules, O&M manuals, and test reports to Commissioning Agent as required.
  - .1 Retain services of a testing, adjusting, and balancing agency to perform testing and balancing of mechanical system air/fluid flows and capacities, prior to operational performance testing. Refer to Section 20 05 93 – Testing, Adjusting, and Balancing for Mechanical Systems.
  - .2 Test, adjust and operate equipment and systems after start-up but before functional performance testing, to confirm operations are in accordance with requirements of Contract Documents. Verify modes and sequences of control and monitoring, interlocks, and responses to emergency conditions. Complete commissioning data sheets to document successful operational performance testing.
  - .3 Repeat successful operational performance testing with completed commissioning data sheet documentation in the presence of Consultant and Owner to validate and verify equipment and systems are complete in all respects, function correctly, and are ready for acceptance.

- .4 Submit final commissioning data sheets, TAB reports as specified in Section 20 05 93 – Testing, Adjusting, and Balancing for Mechanical Systems, project closeout documents, and other required submittals.

#### **1.29 WARRANTY**

- .1 Unless otherwise specified in Division 00 and Division 01, warrant mechanical work to be in accordance with Contract Documents and free from defects for a period of 1 year from date of issue of a Certificate of Substantial Performance of the Work.
- .2 Where equipment includes extended warranty period, e.g., 5 years, first year of warranty period is to be governed by terms and conditions of warranty in Contract Documents, and remaining years of warranty are to be direct from equipment manufacturer and/or supplier to Owner. Submit signed and dated copies of extended warranties to the Consultant.
- .3 Warranty to include parts, labour, travel costs and living expenses incurred by manufacturer's authorized technician to provide factory authorized on-site service.
- .4 Repair and/or replace any defects that appear in Work within warranty period without additional expense to Owner. Be responsible for costs incurred in making defective work good, including repair or replacement of building finishes, other materials, and damage to other equipment. Ordinary wear and tear and damage caused wilfully or due to carelessness of Owner's staff or agents is exempted.
- .5 Do not include Owner deductible amounts in warranties.
- .6 It is understood that warranties are to commence from time of Substantial Performance of the Work, regardless of what is noted within following Sections of Specification. Be responsible for providing whatever "bridging" or additional extended warranty period is required from time that material is purchased until this time.
- .7 Visit building during warranty period with Owner representatives. Owner to organize these visits. At these meetings, Owner representatives are to review performance of systems. If performance is satisfactory, then no further action needs to be taken. If unsatisfactory, then correct deficiencies, as directed by Owner representatives, to satisfaction of Owner's representatives. These site visits to occur:
  - .1 once during 1st month of building operation;
  - .2 once during 3rd month of building operation;
  - .3 once between 4th and 10th month in a season opposite to 1st and 3rd month visits.

#### **1.30 CLOSEOUT SUBMITTALS**

- .1 Prior to application for Substantial Performance of the Work, submit required items and documentation specified, including following as applicable to the project:
  - .1 Operating and Maintenance Manuals;
  - .2 as-built record drawings and associated data;
  - .3 extended warranties for equipment as specified;
  - .4 operating test certificates, i.e. Sprinkler Test Certificate;
  - .5 final commissioning report and TAB report;
  - .6 identified keys for equipment and/or panels for which keys are required, and other items required to be submitted;
  - .7 other data or products specified.



### 1.31 INSTRUCTIONS TO OWNER

- .1 Refer to equipment and system operational and maintenance training requirements specified in Division 01.
- .2 Train Owner's designated personnel in aspects of operation and maintenance of equipment and systems as specified, including temporary mechanical equipment. Demonstrations and training are to be performed by qualified technicians employed by equipment/system manufacturer/supplier. Supply hard copies of training materials to each attendee.
- .3 Provide training to Owner as specified in trade Sections on the operation and maintenance procedures of mechanical systems and equipment.
- .4 For each item of equipment and for each system for which training is specified, prepare training modules as specified below. Use Operating and Maintenance Manuals during training sessions. Training modules include but are not limited to:
  - .1 Operational Requirements and Criteria – equipment function, stopping and starting, safeties, operating standards, operating characteristics, performance curves, and limitations;
  - .2 Troubleshooting – diagnostic instructions, test and inspection procedures;
  - .3 Documentation – equipment/system warranties, and manufacturer's/supplier's parts and service facilities, telephone numbers, email addresses, and the like;
  - .4 Maintenance – inspection instructions, types of cleaning agents to be used as well as cleaning methods, preventive maintenance procedures, and use of any special tools;
  - .5 Repairs – diagnostic instructions, disassembly, component removal and repair instructions, instructions for identifying parts and components, and review of any spare parts inventory.
- .5 Before instructing Owner's designated personnel, submit to the Consultant for review preliminary copy of training manual and proposed schedule of demonstration and training dates and times. Incorporate Consultant's comments in final copy.
- .6 Obtain in writing from the Consultant list of Owner's representatives to receive instructions. Submit to Consultant prior to application for Certificate of Substantial Performance of the Work, complete list of systems for which instructions were given, stating for each system:
  - .1 date instructions were given to Owner's staff;
  - .2 duration of instruction;
  - .3 names of persons instructed;
  - .4 other parties present (manufacturer's representative, consultants, etc.).
- .7 Obtain signatures of Owner's staff to verify they properly understood system installation, operation, and maintenance requirements, and have received operating and maintenance instruction manuals and "as-built" record drawings.
- .8 Submit to the Consultant copy of electronic version of training materials and include in operating and maintenance manuals submission.

### 1.32 FINAL INSPECTION

- .1 Submit to Consultant, written request for final inspection of systems. Include written certification that:
  - .1 deficiencies noted during job inspections have been completed;
  - .2 field quality control procedures have been completed;
  - .3 systems have been tested and verified, balanced, and adjusted, and are ready for operation;
  - .4 maintenance and operating data have been completed and submitted to, reviewed with the Consultant and accepted by Owner;

- .5 tags and nameplates are in place and equipment identifications have been completed;
- .6 clean-up is complete;
- .7 spare parts and replacement parts specified have been provided and acknowledged by the Consultant;
- .8 as-built and record drawings have been completed and submitted to and reviewed with the Consultant and accepted by Owner;
- .9 Owner's staff has been instructed in operation and maintenance of systems;
- .10 commissioning procedures have been completed.

## **PART 2 - PRODUCTS – NOT USED**

## **PART 3 - EXECUTION**

### **3.1 CLEANING**

- .1 During construction, keep site reasonably clear of rubbish and waste material resulting from work on a daily basis to the satisfaction of Owner and Consultant. Before applying for a Certificate of Substantial Performance of the Work, remove rubbish and debris, and be responsible for repair of any damage caused as a result of work.
- .2 Clean equipment and devices installed as part of this project.

**END OF SECTION**



## PART 1 - GENERAL

### 1.1 SECTION INCLUDES

- .1 Motors and starters for all equipment specified in Mechanical Divisions.

### 1.2 RELATED REQUIREMENTS

- .1 Section 26 05 83 – Wiring Connections.

### 1.3 SUBMITTALS

- .1 Submit shop drawings/product data sheets for:
  - .1 electric motors (submit with equipment they are associated with).
- .2 Submit a list of equipment identification nameplates indicating proposed wording and sizes.

## PART 2 - PRODUCTS

### 2.1 EQUIPMENT BELT DRIVES

- .1 ANSI/RMA Standard V-belt type rated at minimum 1.5 times motor nameplate rating, and in accordance with following requirements:
  - .1 belts are to be reinforced cord and rubber, and multiple belts are to be matched sets;
  - .2 sheaves are to be cast iron or steel, secured to shafts with removable keys unless otherwise specified, standard adjustable pitch ( $\pm 10\%$  range) for motors under 10 hp, fixed pitch type with split tapered bushing and keyway for motors 10 hp and larger, and, if required, replaced as part of mechanical work to suit system air/water quantity testing and balancing work;
  - .3 motor slide rail adjustment plates are to allow for centre line adjustment.
- .2 Supply a spare belt set (tagged and identified) for each belt drive and hand to Owner upon Substantial Performance of the Work.

### 2.2 EQUIPMENT DRIVE GUARDS AND ACCESSORIES

- .1 For V-belt drives – removable, 4-sided, fully enclosed, galvanized sheet steel guards to OSHA standards, cleaned, factory primed and painted with yellow equipment enamel, complete with a 2-piece full length hinged front panel to permit belt maintenance or replacement without removing guard, and 40 mm (1-1/2") diameter tachometer openings at each shaft location.
- .2 For flexible couplings – removable "U" shaped galvanized steel guards to OSHA Standards with a 2.3 mm (3/32") thick frame and expanded mesh face.
- .3 For unprotected fan inlets and outlets – unless otherwise specified, removable 20 mm (3/4") galvanized steel wire mesh with galvanized steel frames, all to OSHA Standards.

### 2.3 ELECTRIC MOTORS

- .1 Unless otherwise specified, motors are to conform to NEMA Standard MG 1, applicable IEEE Standards, and applicable CSA C22.2 standards, and are to meet NEMA standards for maximum sound level ratings under full load. Confirm motor voltages prior to ordering.
- .2 Vertically mounted and submersible motors are to be purposely designed for mounting in this attitude.
- .3 Efficiency of 1-phase motors to 1 hp is to be in accordance with CAN/CSA C747. Efficiency of 3-phase motors 1 hp and larger is to be in accordance with CAN/CSA C390 or IEEE 112B.

- .4 Unless otherwise specified, 1-phase motors smaller than ½ hp are to be 115 V, continuous duty capacitor start type with an NEMA 48 or 56 frame size, solid base, heavy-gauge steel shell with solid die-cast end shields, dynamically balanced die-cast rotor, integral automatic reset thermal overload protection, Class "B" insulation, and a 1.15 service factor at 40°C (105°F) ambient temperature.
- .5 Explosion-proof 1-phase motors are to be totally enclosed, fan cooled, 115 V continuous duty capacitor start type in accordance with CSA C22.2 No. 145, as specified for standard 1-phase motors but suitable for use in Class 1 Group D hazardous locations and complete with a rolled steel shell and a 1.0 service factor at 40°C (105°F) ambient temperature.
- .6 Unless otherwise specified, motors ½ hp and larger are to be totally enclosed, fan cooled, 3-phase, T-frame, squirrel cage continuous duty induction motors suitable for voltages indicated on Drawings, NEMA Design "B" for normal starting torque or Design "C" for high starting torque as required by the application, each complete with Class "B" insulation, a 1.15 service factor at 40°C ambient temperature, grease lubricated open ball bearings with grease fittings to permit re-lubrication without dismantling motor, a cast iron frame with cast iron feet where required, cast iron end bracket and precision machined bearing fit, and balanced carbon steel shaft assembly with die-cast aluminum rotor windings.
- .7 Explosion-proof 3-phase motors are to be totally enclosed fan cooled motors in accordance with CSA C22.2 No. 145, generally as specified above for standard 3-phase motors but suitable for use in Class 1 Group D hazardous locations and with a 1.0 service factor at 40°C (105°F) ambient temperature.
- .8 Motor(s) for 2-speed fan(s) are to be as above but 2-speed double winding type.
- .9 Motors for equipment with variable frequency drives are to be generally as specified above but inverter duty type to NEMA Standard MG 1 Part 31, quantified by CSA for operation from a variable frequency drive of type specified, and complete with Class "H" insulation. Motors are to be equipped with AEGIS, or approved equal, shaft grounding ring system to protect bearings from damage by diverting harmful shaft voltages and bearing currents to ground.
- .10 Manufacturers:
  - .1 TECO-Westinghouse Motors (Canada) Inc.;
  - .2 Canadian General Electric;
  - .3 Baldor Electric Co.;
  - .4 U.S. Electrical Motors;
  - .5 Weg Electric Corp.;
  - .6 Marathon Electric;
  - .7 Toshiba Corp.;
  - .8 Leeson Canada.

## 2.4 MOTOR STARTERS AND ACCESSORIES

- .1 Motor starters must be capable of starting associated motors under the imposed loads. Confirm starter voltage matches motor prior to ordering.
- .2 Unless otherwise specified, starters for 1-phase motors are to be 115 V, thermal overload protected manual starting switches with a neon pilot light, a surface or recessed enclosure to suit the application, and, where automatic operation is required, a separate H-O-A switch in an enclosure to match starter enclosure.
- .3 Unless otherwise specified, starters for 3-phase motors less than 50 hp are to be combination "quick-make" and "quick-break" fused disconnects and full voltage non-reversing across-the-line starters, each complete with and overload relay per phase, an enclosure to suit the application, and,

- a H-O-A switch, pilot lights, control transformer, auxiliary contacts, and other accessories as per motor starter schedule.
- .4 Unless otherwise specified, starters for 3-phase motors 50 hp to 150 hp are to be reduced voltage, non-reversing, auto-transformer type starters complete with one overload relay per phase, an enclosure to suit the application, and, a H-O-A switch, pilot lights, control transformer, auxiliary contacts, and other accessories as per motor starter schedule.
  - .5 Unless otherwise specified, starters for 3-phase motors 150 hp and larger are to be reduced voltage, non-reversing, closed transition "wye-delta" starters complete with one overload relay per phase, an enclosure to suit the application, and, a H-O-A switch, pilot lights, control transformer, auxiliary contacts, and other accessories as per motor starter schedule.
  - .6 Starters for 2-speed double winding motors are to be generally as specified above but suitable for motor and equipped with a 45 second time delay to permit equipment to coast down to low speed before it is operated at low speed.
  - .7 Starters for 2-speed single winding motors are to be generally as specified above but suitable for motor and equipped with a 45 second time delay to permit equipment to coast down to low speed before it is operated at low speed.
  - .8 Starters for reversible motors for cooling towers are to be generally as specified above but suitable for motor and equipped with a 45 second time delay to allow fan(s) to coast down to a stop before being operated in reverse rotation.
  - .9 Unless otherwise specified, motor starter enclosures are to be in accordance with following NEMA ratings:
    - .1 enclosures located in sprinklered areas – Type 2;
    - .2 enclosures exposed to the elements – Type 3R, constructed of stainless steel;
    - .3 enclosures inside the building in wet areas – Type 3R, constructed of stainless steel;
    - .4 enclosures in explosion rated area – Type 7 with exact requirements to suit the area and application;
    - .5 enclosures except as noted above – Type 1;
    - .6 enclosures located in finished areas – as above but recess type with brushed stainless steel faceplate.
  - .10 Motor control centres are to be multi-unit, 2.28 m (9') high, NEMA Class 1, type "B", factory assembled, dead front, floor mounted, free-standing motor control centre with tin plated copper bus and an NEMA Type 1 or Type 2 enclosure as for loose starters specified above. Each motor control centre is to be complete with starters as specified above, load and control wiring terminal boards, and required facilities for line and load side power wiring connections.
  - .11 Disconnect switches for motor control centres are to be heavy-duty, CSA certified, front operated switches as per motor starter schedule, each complete with a handle suitable for padlocking in "off" position and arranged so that door cannot be opened with handle in "on" position and an NEMA enclosure as specified for loose starters. Fusible units are to be complete with fuse clips to suit fuse types specified below.
  - .12 Fuses are to be, unless otherwise scheduled or specified, English Electric Ltd. HRC fuses, Form I Class "J" for constant running equipment and Form II Class "C" for equipment that cycles on and off.
  - .13 Manufacturers:
    - .1 Rockwell Automation Inc. - Allen-Bradley;
    - .2 Eaton Corp. – Cutler-Hammer;
    - .3 Eaton Corp. – Moeller Electric;
    - .4 Siemens Canada;

- .5 Schneider Electric.

## **2.5 SPRINKLER PROOFING**

- .1 Provide drip shields for protection of surface mounted equipment enclosures from water spray and dripping of liquids. Features of shields include:
  - .1 factory constructed by respective equipment manufacturers;
  - .2 constructed from non-combustible materials (sheet steel);
  - .3 enamel painted to match equipment;
  - .4 surfaces and edges filled/sanded smooth prior to painting;
  - .5 supported from equipment with structural steel rods/metal framing or other method approved by Consultant;
  - .6 structural support finish painted to match shield.
- .2 Include with equipment shop drawings, detailed dimensions of drip shields and methods of supporting.
- .3 Equipment with top cable/conduit entries to include additional sealing of entries with gasketting and/or waterproof sealant to prevent water from entering enclosure.
- .4 Design ventilation louvers such that live components are not exposed to water spray and dripping liquids.
- .5 Above requirements are additional minimum "sprinkler proof" standards for equipment specified as NEMA 1, 2 or 12.
- .6 Obtain CSA approval where required by local governing authorities.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION OF EQUIPMENT DRIVE GUARDS AND ACCESSORIES**

- .1 Provide OHSA guards for exposed accessible rotating parts such as belt drives, couplings, fan wheels, and shaft ends on mechanical equipment.
- .2 Install belt guards to allow movement of motors for adjusting belt tension.
- .3 Provide a means to permit lubrication and use of test instruments with guards in place.
- .4 Secure guards to equipment or equipment base but do not bridge sound or vibration isolation.
- .5 Where equipment oil level gauges, oil reservoirs, grease cups, or grease gun fittings are integral with equipment but are not easily accessible for service, extend to an accessible location using aluminium or copper tubing.

### **3.2 SUPPLY OF MOTOR STARTERS AND ACCESSORIES**

- .1 Unless otherwise shown or specified, supply a starter for each item of motorized equipment. Refer to Motor Starter Schedule.
- .2 Where 3-phase starters are indicated in motor control centres, supply motor control centres with starters and bolt to a concrete housekeeping pad.
- .3 Where package type equipment with integral starters, or equipment with starters integral in loose power and control panels supplied with equipment is fed from a motor control centre, provide a disconnect switch in motor control centre in lieu of a motor starter.

- .4 Where 3-phase starters are indicated and/or scheduled to be mounted on a motor starter panel, starters will be mounted and connected, complete with panels and splitter trough, as part of electrical work. Hand starters to electrical trade at site when they are required.
- .5 Where package type equipment with integral starters, or equipment with starters integral in loose power and control panels supplied with equipment is fed from a motor starter panel, a disconnect switch will be provided on motor starter panel as part of electrical work.
- .6 Unless otherwise specified or shown on drawings, 1-phase motor starters will be mounted adjacent to equipment they serve and connected complete as part of electrical work. Hand starters to electrical trade at site at the proper time.

### 3.3 ELECTRICAL WIRING WORK FOR MECHANICAL WORK

- .1 Unless otherwise specified or indicated, following electrical wiring work for mechanical equipment will be done as part of the electrical work:
  - .1 "line" side power wiring to motor starters or disconnect switches in motor control centres and starters or disconnects on motor starter panels, and "load" side wiring from starters or disconnects to equipment.
  - .2 "line" side power wiring to individual wall mounted starters, and "load" side wiring from starters to equipment.
  - .3 "line" side power wiring to pre-wired power and control panels and variable frequency drives (VFD), and "load" side power wiring from the panels and VFD's to equipment.
  - .4 provision of receptacles for plug-in equipment.
  - .5 provision of disconnect switches for motors in excess of 10 m (30 ft) from starter location, or cannot be seen from starter location, and associated power wiring.
  - .6 motor starter interlocking in excess of 24 V.
  - .7 wiring from motor winding thermistors in motors 30 hp and larger to motor starter contacts.
  - .8 120 V power connections to electrical receptacles integral with small ceiling exhaust fans.
  - .9 120 V power connections to small exhaust fans, and ceiling fans for all line voltage control devices, including but not limited to wiring through toggle switches, line voltage thermostats, countdown timer switches, or line voltage speed controllers. Coordinate requirements with Electrical Division.
  - .10 120 V wiring connections to lighting fixture/switch combinations integral with air handling units.
  - .11 120 V wiring connections to duplex receptacles integral with air handling unit control panels.
  - .12 120 V wiring connections to BAS system controllers/panels and other control system or component requiring 120 V power including, but not limited to, VAV boxes, dampers, low voltage transformers, etc.
- .2 Mechanical wiring work not listed above or specified herein or on drawings to be done as part of electrical work is to be installed in conduit and is to be done as part of mechanical work in accordance with wiring requirements specified for electrical work.

**END OF SECTION**

## **PART 1 - GENERAL**

### **1.1 SECTION INCLUDES**

- .1 Variable Frequency Drives (VFD's) for all equipment specified in Mechanical Divisions.

### **1.2 SUBMITTALS**

- .1 Shop Drawings/Product Data: Submit shop drawings with product data sheets for variable frequency drives (VFDs). Include:
  - .1 construction and performance details;
  - .2 wiring and control schematics;
  - .3 dimensions of units;
  - .4 calculations specific to installation showing total harmonic voltage distortion is less than 5%;
  - .5 certified production test results with serial numbers for harmonic mitigation performance and energy efficiency under actual variable frequency drive loading.

### **1.3 CLOSEOUT SUBMITTALS**

- .1 Certification Letter: Submit a start-up and installation certification letter from supplier of VFDs as specified in Part 3 of this Section;
- .2 Parameters: Prepare list of parameters for uploading for Owner's future use as specified in Part 3 of this Section. Load on USB type flash drive and submit to the Consultant.
- .3 Extended Warranty: Where extended warranty is specified to be included, include a copy of VFD extended warranty in each Operating and Maintenance Manual. Prior to Substantial Performance of Work, submit a copy of warranty to Owner.
- .4 Additionally, coordinate with Prime Contractor and Electrical Contractor to ensure that shop drawings clearly identify that proposed VFDs and connected motors are 100% compatible and Mechanical Contractor to sign off on selected VFDs.

### **1.4 COORDINATION WITH ELECTRICAL DIVISIONS**

- .1 This Section specifies VFD requirements for motors. Ensure that VFDs packaged with various system equipment, complies with specifications of this Section.
- .2 VFDs are each to be approved by respective manufacturers of VFDs and connected motors, as suitable for installation on scheduled motors. VFD output current rating to match or exceed connected motor nameplate full load current rating.
- .3 Coordinate and review with Electrical Divisions, responsibility requirements for supply of VFDs, harmonic filters and requirements for control and power conductors and connections.
- .4 Check that motors are equipped with AEGIS or approved equal, shaft grounding ring system to protect bearings from damage in motors by diverting harmful shaft voltages and bearing currents to ground.
- .5 Additionally, review and confirm responsibilities with Consultant and Prime Contractor.

### **1.5 WARRANTY**

- .1 VFDs to be warranted free from defective labour and materials for period of 36 months from date of Substantial Performance of the Work. Include for initial one year Contract warranty and an additional 2 year extended warranty direct to Owner. Extended warranty terms and conditions are to be identical to one year Contract warranty, and extended warranty period is to commence day Contract warranty expires.



## PART 2 - PRODUCTS

### 2.1 VFD BASIC REQUIREMENTS

- .1 VFDs supplied on project to be products of same manufacturer and be CSA approved, ULC listed and labelled. Base specified product is ABB ACH series units that include compliance with following standards:
  - .1 CSA C22.2 No.14 Industrial Control Equipment;
  - .2 UL 508 - Industrial Control Equipment;
  - .3 UL 508C – Power Conversion Equipment;
  - .4 NEMA ICS 7 - Adjustable-Speed Drives.
- .2 Basis for limiting harmonics is to be provided generally to IEEE Standard 519 - Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems, except intended for user's electrical distribution system with point of common coupling (where harmonic limits are assessed) to be set at input terminals of harmonic mitigating equipment.
- .3 VFDs to include following basic requirements:
  - .1 regardless of horsepower (hp) rating are to be of same VFD model; I/O and control circuit boards as well as keypads are to be identical and interchangeable regardless of hp rating;
  - .2 to be capable of starting into a coasting load (forward or reverse) up to full speed and accelerate or decelerate to set point without safety tripping or component damage (flying start);
  - .3 6-pulse width modulated (PWM) AC to AC converter utilizing latest isolated gate bipolar transistor (IGBT) technology; PWM switching pattern to include a motor flux optimization circuit that automatically reduces applied motor voltage to the motor to optimize energy consumption and audible motor noise;
  - .4 carrier frequency control circuit that reduces the carrier frequency based on actual VFD temperature that allows higher carrier frequency without derating VFD or operating at high carrier frequency only at low speeds;
  - .5 provisions that determine motor torque and flux every 25  $\mu$ s (40,000 times per second);
  - .6 completely assembled and tested by manufacturer in their facility;
  - .7 designed to provide at least 250,000 hours mean time before failure (MTBF) when specified preventative maintenance is performed.
  - .8 bypass system completely factory wired and tested;
  - .9 door interlocked padlockable disconnect switch that disconnects all input power from drive and all internally mounted options;
  - .10 control panel keyboard and display with password protection against parameter changes.
  - .11 fused disconnect integral to VFD enclosure complete with fast acting fuses sized by VFD manufacturer for size of motor connected to VFD.

### 2.2 VFD RATINGS

- .1 VFDs to be rated to operate from 3-phase input voltage of 208 V or 600 V  $\pm$  10%, as scheduled, and frequency range from 48 Hz to 63 Hz. In addition, a tolerated voltage window to allow system to operate from a line of +30% to -35% nominal voltage. System to incorporate circuitry that allows drive or bypass contactor to remain "sealed in" over this voltage tolerance at a minimum.
- .2 VFDs to employ a full wave rectifier to prevent input line notching and operate at a minimum fundamental input power factor of 0.97 at all speeds and loads.
- .3 VFDs efficiency to be 96% or better at full speed and load.

- .4 Output voltage and current ratings to match adjustable frequency operating requirements of standard 3-ph, 60 Hz, NEMA design B inverter-duty motors in compliance with NEMA-MG1, Part 31 Standard. Overload current capacity for variable torque overload capacity to be 110% of rated current for 1 minute out of 10 minutes and 130% for 2 seconds. Output frequency to be adjustable between 0 Hz and 500 Hz.
- .5 Open loop static speed regulation to be 0.1% to 0.3% (10% of motor slip). Dynamic speed accuracy to be 4%-sec. or better open loop.
- .6 When a suitable motor is used, drive provides breakaway torque equal to 200% of rated motor torque. Torque response time to be 5 ms or less.
- .7 Enclosures:
  - .1 in climate controlled areas – minimum NEMA 12 with drip shield;
  - .2 in non-climate controlled areas – NEMA 3R.

## 2.3 HARMONIC FILTERS AND SINE WAVE FILTERS

- .1 VFDs to include internal 5% impedance AC line reactor (or equivalent 5% impedance dual positive and negative DC bus reactors) provided as a standard to reduce input current harmonic content and provide isolation from power line transients and to reduce RFI emissions.
- .2 VFDs serving motors sized 11 kW (15 hp) or more to be provided with harmonic filters to limit harmonics distortion produced by each drive to following maximum levels as measured on input side of drive:
  - .1 Total harmonic distortion (voltage) – 5%;
  - .2 Total harmonic distortion (current) – 10%.
- .3 Harmonic filter to be based on MIRUS International Inc. “LINEATOR AUHF” series, with features as follows:
  - .1 manufactured and tested in accordance with latest applicable standards of ULC, CSA and NEMA;
  - .2 treat characteristic low frequency harmonics generated by a 3-phase, diode bridge rectifier load (5th, 7th, 11th, 13th, etc.);
  - .3 passive inductor/capacitor network;
  - .4 low capacitive reactance (KVAR) of less than 20% of kVA rating, to ensure compatibility with engine generator sets;
  - .5 full load efficiency of harmonic mitigation equipment / VFD combination to be greater than 96%;
  - .6 copper wiring;
  - .7 220°C system insulation class and temperature rise of 130°C;
  - .8 anti-vibration pads between reactor or transformer core and enclosure;
  - .9 manufacturer’s standard ventilated, NEMA-3R enclosure.
  - .10 For fan arrays provide single harmonic filter sized for the entire connected load
- .4 Sine wave filters are to be provided with all VFDs and to be based on MIRUS International Inc. “INVERLINE” series, complete with the following features:
  - .1 manufactured and tested in accordance with latest applicable standards of ULC, CSA and NEMA;
  - .2 no less than 99% efficiency;
  - .3 voltage distortion of 3% typical, max 5% at full load and rated frequency;
  - .4 less than 8% input current distortion at full load;



- .5 Switching frequencies of 1kHz to 16kHz
- .6 overload capacity of 150% for 60 seconds every 60 minutes;
- .7 voltage suitable for motor;
- .8 design maximum operating temperature rise shall be 130 deg C above maximum ambient temperature of 40 deg C.;
- .9 copper wiring wound on magnetic core;
- .10 Inductors shall be air-gapped to control magnetic saturation. The inductance shall remain above 50% of its nominal value for any overload not exceeding 200% of rated current;
- .11 Capacitors shall be AC rated, polypropylene film material, and self-healing technology. Connected in ungrounded neutral Y (wye) or delta configuration;
- .12 manufacturer's standard ventilated, sprinkler proof, NEMA-3R enclosure.
- .13 shall be complete with wiring lugs suitable for wiring size indicated on electrical drawings.

## 2.4 CONTROLS AND ADJUSTMENT FUNCTIONS

- .1 Include for following:
  - .1 programmable critical frequency lockout ranges to prevent VFD from operating load continuously at an unstable speed;
  - .2 proportional integral derivative (PID) speed loop regulators with an auto tune function as well as manual adjustments; PID set point controllers to allow pressure or flow signals to be connected to VFD, using microprocessor in VFD for closed loop control; includes 250 mA of 24 VDC auxiliary power and capability of loop powering a transmitter supplied by others; two parameter sets for first PID that allow sets to be switched via a digital input, serial communications or from keypad for night setback, summer/winter set points, etc.; independent, second PID loop that can utilize second analogue input and modulate analogue outputs to maintain set point of an independent process (i.e. valves, dampers, etc.); set points, process variables, etc. to be accessible from serial communication network;
  - .3 programmable analogue inputs that accept current or voltage signals.
  - .4 programmable analogue outputs (0-20 mA or 4-20 mA), that may be programmed to output proportional to Frequency, Motor Speed, Output Voltage, Output Current, Motor Torque, Motor Power (kW), DC Bus voltage, Active Reference, and other data;
  - .5 programmable digital inputs;
  - .6 programmable digital Form-C relay contact outputs for programmable on and off delay times and adjustable hysteresis; rated for maximum switching current 8 A at 24 VDC and 0.4 A at 250 VAC; maximum voltage 300 VDC and 250 VAC; continuous current rating 2 A RMS;
  - .7 run permissive circuit - for damper or valve control; dry contact closure that will signal damper to open (VFD motor does not operate); when damper is fully open, a normally open dry contact (end-switch) closes; closed end-switch is wired to a VFD digital input and allows motor operation; two separate safety interlock inputs, when either is opened, motor to coast to stop, and damper to close;
  - .8 two independently adjustable accel and decel ramps with 1-1800 seconds adjustable time ramps;
  - .9 fireman's override input - upon receipt of a contact closure from fireman's control station, VFD operates in one of two modes: operate at a programmed predetermined fixed speed or operate in a specific fireman's override PID algorithm that automatically adjusts motor speed based on override set point and feedback; mode overrides all other inputs (analogue/digital, serial communication and keypad commands), except customer defined safety run interlock, and

forces motor to run in one of the two modes; "Override Mode" to be displayed on control panel; upon removal of override signal, VFD resumes normal operation.

.2 Operator Control Panel:

- .1 front mounted plug-in operator control panel consisting of keypad, multi-line backlit LCD display for programming and fault diagnostics;
- .2 keys (switches) for HAND, OFF, AUTO, and manual speed control INCREASE/DECREASE;
- .3 menu navigation and parameter selection keys for custom programming;
- .4 date and time clock - clock to have a battery backup with 10 years minimum life span; clock to be used to date and time stamp faults and record operating parameters at time of fault; if battery fails VFD I automatically reverts to hours of operation since initial power up; clock also to be programmable to control start/stop functions, constant speeds, PID parameter sets and output relays; VFD to have a digital input that allows an override to time clock (when in off mode) for a programmable time frame; four (4) separate, independent timer functions that have both weekday and weekend settings;
- .5 parameter names, fault messages, warnings and other information to be displayed in complete words or standard abbreviations to allow user to understand what is being displayed without use of a manual or cross reference table, as follows:
  - .1 "HAND" position to start drive and modify reference frequency by use of INCREASE/DECREASE keys;
  - .2 "OFF" position stops drive;
  - .3 "AUTO" position allows drive to be started or stopped using whichever remote start/stop command configured; drive speed controlled by external speed reference input or by PID controller.
  - .4 applicable operating values to be capable of being displayed in engineering (user) units; operating displayed include:
    - .1 Output Frequency;
    - .2 Motor Speed (RPM, %, or Engineering units);
    - .3 Motor Current;
    - .4 Drive Temperature;
    - .5 DC Bus Voltage;
    - .6 Output Voltage.

## 2.5 PROTECTIVE FUNCTIONS

- .1 For each programmed warning and fault protection function, keypad displays a message in complete words or standard abbreviations.
- .2 VFDs include metal oxide varistors (MOV's) for phase to phase and phase to ground line voltage transient protection.
- .3 Short circuit current rating of 100,000 amps to be provided per UL 508C without relying on line fuses.
- .4 Ground fault protection, motor phase loss protection and phase unbalance protection to be provided. Single phase protection to be provided on input and output.
- .5 VFDs to provide electronic motor overload protection qualified per UL 508C.
- .6 Protection to be provided for AC line or DC bus overvoltage at 130% of maximum rated or undervoltage at 65% of minimum rated.

- .7 Stall protection to be programmable to provide a warning or stop VFD after motor has operated above a programmable torque level for a programmed time limit.
- .8 Underload protection to be programmable to provide a warning or stop VFD after motor has operated below a selected underload curve for a programmed time limit.
- .9 Overtemperature protection to provide a warning if power module temperature is less than 5°C (9°F) below overtemperature trip level.
- .10 Input terminal to be provided for connecting a motor thermistor (PTC type) to drive's protective monitoring circuitry. An input to also be programmable to monitor an external relay or switch contact.
- .11 VFDs through 56 kW (75 hp) to be protected from damage from input and output power miss-wiring. VFD to sense this condition and display an alarm on control panel.
- .12 EMI / RFI filters to be provided as per standard EN 61800-3.
- .13 dv/dt long lead filter (LRC) to protect power system network.
- .14 Automatic reset feature to automatically reset selected faults and attempt to restart drive based on control parameters such as adjustable time delays, number of restart attempts and duration of restart attempts. Faults include following:
  - .1 Overcurrent;
  - .2 Overvoltage;
  - .3 Undervoltage;
  - .4 Analogue input signal reference loss;
  - .5 External fault.
- .15 Additional built-in protection circuits include:
  - .1 Overcurrent trip limit;
  - .2 Undervoltage trip limit;
  - .3 Microprocessor fault;
  - .4 Keypad control panel loss;
  - .5 Serial communication loss;
  - .6 External fault interlock inputs;
  - .7 Adjustable output frequency and motor speed limits;
  - .8 Pass code parameter change protection;
  - .9 Keypad operator control lockout.

## 2.6 MANUAL BYPASS

- .1 **Manual bypass required for all fans.**
- .2 Bypass system to be a fully operational horsepower rated manual system for full speed operation without VFD, with following components:
  - .1 VFD and By-pass output contactors, mechanically and electrically interlocked to allow only one mode of operation at one time;
  - .2 service switch or contactor to isolate VFD from supply;
  - .3 VFD input fuses;
  - .4 door mounted VFD/OFF/BY-PASS selector switch;
  - .5 VFD ON and BY-PASS ON indicator lights;

- .6 door mounted HAND/OFF/AUTO switch if Hand operation is unavailable at VFD control panel;
- .7 terminals for external customer safety interlocks.
- .3 Bypass designs, which have no VFD only fuses, or that incorporate fuses common to both VFD and bypass are not acceptable.
- .4 Door interlocked padlockable fused disconnect switch that supplies power to VFD and bypass, and disconnects input power from drive, bypass and all internally mounted devices.

## 2.7 COMMUNICATIONS

- .1 VFD to be complete with communications connections of integrated RS-485 port suitable to allow for VFD to be controlled, supervised, monitored and programmed from one remote control panel or PC with VFD system Windows based application software.
- .2 Communications protocol to be industry standard compatible to BAS of building. Coordinate exact requirements with Mechanical Divisions controls contractor and BAS vendor to ensure that appropriate interface module is supplied for drive system to communicate with BAS being used in building with interface capability to include serial communication standard protocols as follows:
  - .1 ModBus;
  - .2 Johnson Controls Metasys N2;
  - .3 Siemens Building Technologies FLN;
  - .4 BACnet.
- .3 Serial communication to be used for drive setup, diagnostic analysis, monitoring and control with capabilities to include, but not be limited to:
  - .1 run-stop control;
  - .2 speed set adjustment;
  - .3 proportional/integral/derivative PID control adjustments;
  - .4 current limit;
  - .5 accel/decel time adjustments;
  - .6 ability to lock and unlock control panel keypad;
  - .7 capability of allowing BAS to monitor feedback such as process variable feedback, output speed / frequency, current (in amps), % torque, power (kW), kilowatt hours (resettable), operating hours (resettable), and drive temperature;
  - .8 monitoring relays output status, and digital input status and analogue output values;
  - .9 transmitting diagnostic warning and fault information over communications bus to BAS or other monitoring system;
  - .10 remote fault reset.

## 2.8 SITE SERVICES, TRAINING, AND MAINTENANCE MANUALS

- .1 Provide onsite inspection, testing, start up and verification work of VFDs and filters by manufacturer's authorized technician. Allow a minimum of 1/2 day per system. Also include for a second visit to site of one (1) day duration to train operating personnel in operation and maintenance of drives. Provide verification reports and supply soft copy of system programming parameters.
- .2 Upon completion of installation, supplier of VFDs to supply minimum one hard copy of complete sets of service and maintenance manuals including wiring and connection diagrams. Include for digital copy loaded onto a USB type flash drive.

- .3 Provide system training and instructions on operating and maintenance procedures. Refer to additional requirements in General Instructions section and Division 01.
- .4 Include for manufacturer's authorized technician to be in attendance to assist Commissioning Agent during commissioning process.

## 2.9 MANUFACTURERS

- .1 Manufacturer List:
  - .1 ABB;
  - .2 Schneider Electric (Square D);
  - .3 Rockwell Automation;
  - .4 Eaton Cutler Hammer;
  - .5 Siemens Electric;
  - .6 Control Techniques.
  - .7 Danfoss.

## PART 3 - EXECUTION

### 3.1 INSTALLATION OF VARIABLE FREQUENCY DRIVES

- .1 Provide variable frequency drives for motorized equipment in accordance with drawing requirements. Coordinate requirements for conductors and connections with Electrical Divisions Contractor.
- .2 Ensure that variable speed drives supplied are products of same manufacturer.
- .3 Ensure wire length between VFD and motor is less than 15 m (50') with properly sized conductors.
- .4 Install VFDs in accordance with manufacturer's instructions. Ensure that VFDs installation include upstream protection, either fuses or circuit breakers in accordance with VFD manufacturer's recommendations and local electrical code requirements. Advise Electrical Divisions Contractor of these requirements in addition to required conductors and connections. Provide required control wiring and connections.
- .5 Review VFD and related connected motor installation. Provide local disconnect to VFD in accordance with local governing code requirements.
- .6 Mount VFDs operating controls/display at approximately 1.5 m (5') above finished floor level, unless otherwise directed by the Consultant. Provide dual back to back C-channel support system from floor to ceiling, complete with cross bracing to form a solid backing for VFD mounting at required locations.
- .7 Properly support VFDs. Coordinate exact locations on site with the Consultant.
- .8 Where VFDs are required for custom made air handling units VFDs to be supplied, factory mounted on fan cabinets, and "load" side connected to fan motors by air handling unit manufacturer. "Line" side power wiring to these VFDs to be provided as part of Electrical Divisions work.
- .9 Where VFDs are required for commercial fans, mount each VFD generally where shown but with exact location to ensure that VFD is accessible in accordance with local governing electrical code requirements. "Line" and "load" side power wiring to these VFD's to be provided as part of Electrical Divisions work.
- .10 Install harmonic mitigation filter equipment as follows:
  - .1 in accordance with manufacturer's recommended installation practices and to comply with applicable local governing codes;

- .2 provide each VFD as specified in per Part 2, with a harmonic filter sized as per manufacturer's rating table to match rating of connected VFD;
- .3 mount harmonic filters sized up to 110 kW (150 hp) typically to wall/ceiling construction using suitable brackets, metal C-channel framework and vibration isolators assemblies, ensuring full support of units acceptable to local governing authorities;
- .4 mount harmonic filters sized greater than 110 kW (150 hp) typically to floor mounted concrete pads with suitable vibration isolators and seismic restraints in accordance with local governing building codes;
- .5 ensure that adequate ventilation and space for access is provided;
- .6 review exact locations with the Consultant prior to installation;
- .7 coordinate with Electrical Division Contractor to ensure units are connected complete to line side supply feed and to VFD in accordance with VFD manufacturer's instructions for standalone VFDs and VFD system with bypass; include required control wiring and connections.
- .11 Ground and bond equipment as per local governing electrical code requirements and manufacturer's instructions.
- .12 Provide engraved lamar nameplate identifying each piece of equipment. Review exact nomenclature with the Consultant.
- .13 Be responsible for ensuring that VFDs, harmonic filters and connected motors are properly installed, connected, tested in proper working order and operation verified.

### **3.2 TESTING, START-UP, AND VERIFICATION**

- .1 When installation of VFDs are complete, arrange for VFD manufacturer/supplier to:
  - .1 supply factory authorized technician at site for minimum of 4 hours per system to examine installation and connection of each VFD, and to perform start-up and set-up procedures in conjunction with equipment start-up and testing procedures;
  - .2 supply factory authorized technician at site for minimum of one 8 hour day to train Owner's personnel on VFD operating and maintenance procedures;
  - .3 prepare and submit letter to certify that VFDs have been properly installed, tested and adjusted, and are in proper operating condition;
  - .4 submit list of start-up and testing parameters for uploading for future use by Owner.
- .2 Start-up data entries to include motor nameplate power, speed, voltage, frequency and current.
- .3 Inspect VFDs and accessories for verification of proper operation and installation.
- .4 Inspect interface wiring to BAS for verification of proper operation and installation.
- .5 Verification of wire terminations to VFDs and bypass and to operational circuitry.
- .6 Installation verification of VFD, bypass and motor being driven for proper operation and reliability.
- .7 Verification that connections and communications to BAS or other monitoring/remote control system are of proper operation and installation and of full communications compatibility.
- .8 Measurement for verification of proper operation on each of following items:
  - .1 Motor voltage and frequency;
  - .2 Verification of proper motor operation;
  - .3 Control input for proper building automation system interface and control calibration.
- .9 Calibration check for following set points (and adjustment as necessary):
  - .1 minimum speed;
  - .2 maximum speed;

- .3 acceleration and deceleration rates.
- .10 Verify harmonic compliance with onsite field measurements of both voltage and current harmonic distortion at point of common coupling-input terminals of harmonic mitigating equipment with and without equipment operating. Utilize recording type Fluke 41 or equivalent harmonics analyser displaying individual and total harmonic currents and voltages.
- .11 Document testing and results in a report signed by a Professional Engineer licensed in the Place of Work and authorized by system manufacturer. Include for minimum 3 hard copies and electronic copy of report to be submitted to the Consultant for review.
- .12 Additionally, refer to applicable installation, testing, coordination, and verification requirements in Electrical Divisions Sections.
- .13 Coordinate procedures specified above to be performed by VFD manufacturer/supplier authorized technician with system commissioning work.

**END OF SECTION**



## **PART 1 - GENERAL**

### **1.1 SECTION INCLUDES**

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

### **1.2 SUBMITTALS**

- .1 Submit a product data sheet and a WHIMIS sheet for each firestopping and smoke seal product.
- .2 Submit for review, full company name and experience of proposed firestopping and smoke seal system applicator.
- .3 Sleeve and Formed Opening Location Drawings
  - .1 Prepare and submit for review, drawings indicating size and location of required sleeves, recesses and formed openings in poured or precast concrete work.
  - .2 Such drawings are to be completely and accurately dimensioned and relate sleeve, recesses, and formed openings to suitable grid lines and elevation datum, and are to take into account structural items such as grade beams, column caps, and column drop slabs.
  - .3 Begin to prepare such drawings immediately upon notification of acceptance of bid and award of Contract.

### **1.3 CLOSEOUT SUBMITTALS**

- .1 Submit a letter of proper firestopping and smoke seal certification as specified in Part 3 of this Section.

### **1.4 QUALITY ASSURANCE**

- .1 Applicator is to have a minimum of 3 years of successful experience on projects of similar size and complexity, and applicator's qualifications are to be reviewed by the Consultant.
- .2 Comply with firestopping and smoke seal product manufacturer's recommendations regarding suitable environment conditions for product installation.

## **PART 2 - PRODUCTS**

### **2.1 PIPE SLEEVES**

- .1 Galvanized Steel or Cast Iron Pipe – Schedule 40 mild galvanized steel, or Class 4000 cast iron.

### **2.2 FIRESTOPPING AND SMOKE SEAL MATERIALS**

- .1 Ensure all sealant and fire stopping is low VOC type in accordance with LEED.
- .2 Asbestos-free elastomeric materials tested, listed and labelled by ULC in accordance with CAN/ULC-S115 and CAN/ULC-S101 for installation in ULC designated firestopping and smoke seal systems to provide a positive fire, water and smoke seal, and a fire-resistance rating (flame, hose stream and temperature) not less than fire resistance rating of surrounding fire rated construction.
- .3 Materials are to be compatible with abutting dissimilar materials and finishes and complete with primers, damming and back-up materials, supports, and anchoring devices in accordance with firestopping manufacturer's recommendations and ULC tested assembly.



- .4 Pipe insulation forming part of a fire and smoke seal assembly is specified in Section entitled Mechanical Insulation.
- .5 Manufacturers:
  - .1 A/D Fire Protection Systems "FIREBARRIER";
  - .2 Tremco Inc. Fire Protection Systems Group "TREMSTOP";
  - .3 3M Canada;
  - .4 Hilti (Canada) Ltd. Firestop Systems;
  - .5 Specified Technologies Inc.

## 2.3 WATERPROOFING SEAL MATERIALS

- .1 Modular, mechanical seal assemblies consisting of interlocking synthetic rubber links shaped to continuously fill annular space between pipe and pipe sleeve or wall opening, assembled with stainless steel bolts and pressure plates and designed so when bolts are tightened the links expand to seal the opening watertight. Select seal assemblies to suit pipe size and sleeve size or wall opening size.
- .2 Manufacturers:
  - .1 Thunderline Corp. (Power Plant Supply Co.) "LINK SEAL" Model S-316;
  - .2 The Metraflex Co. "MetraSeal" type ES.

## 2.4 PIPE ESCUTCHEON PLATES

- .1 One-piece chrome plated brass or #4 finish type 302 stainless steel plates with matching screws for attachment to building surface, each plate sized to completely cover pipe sleeve or building surface opening, and to fit tightly around pipe or pipe insulation.

# PART 3 - EXECUTION

## 3.1 INSTALLATION OF PIPE SLEEVES

- .1 Where pipes pass through concrete and/or masonry surfaces provide pipe sleeves as follows:
  - .1 in poured concrete slabs – unless otherwise specified, minimum 16 gauge flanged galvanized steel or, where permitted by governing authorities, factory fabricated plastic sleeves;
  - .2 in concrete or masonry walls – Schedule 40 galvanized steel pipe or Class 4000 cast iron pipe.
- .2 Sleeves in waterproofed slabs or walls are to be lengths of Schedule 40 mild galvanized steel pipe with a waterstop plate in accordance with drawing detail. Provide waterproof sleeves in following locations:
  - .1 in mechanical room floor slabs, except where on grade;
  - .2 in slabs over mechanical, fan, electrical and telephone equipment rooms or closets;
  - .3 in floors equipped with waterproof membranes;
  - .4 in roof slab;
  - .5 in waterproof walls.
- .3 Size sleeves, unless otherwise specified, to leave 12 mm ( $\frac{1}{2}$ ") clearance around pipes, or where pipe is insulated, a 12 mm ( $\frac{1}{2}$ ") clearance around pipe insulation.
- .4 Pack and seal void between pipe sleeves and pipe or pipe insulation in non-fire rated construction for the length of sleeves as follows:

- .1 pack sleeves in interior construction with mineral wool and seal both ends of sleeves with non-hardening silicone base caulking compound;
- .2 pack sleeves in exterior walls above grade with mineral wool and seal both ends of sleeves water-tight with approved non-hardening silicone base caulking compound unless mechanical type seals have been specified;
- .3 seal sleeves in exterior walls below grade (and any other wall where water leakage may be a problem) with link type mechanical seals as specified.
- .5 Where sleeves are required in masonry work, accurately locate and mark sleeve location, and hand sleeves to mason for installation.
- .6 Terminate piping for sleeves that will be exposed so sleeve is flush at both ends with building surface so sleeve may be completely covered by an escutcheon plate, except for sleeves in waterproof floors which are to terminate 100 mm (4") above finished floor.
- .7 "Gang" type sleeving will not be permitted.
- .8 Where sleeves are provided in non-fire rated construction for future piping, or where piping has been removed from existing sleeves, cap and seal both ends of sleeved opening.

### **3.2 INSTALLATION OF WATERPROOF MECHANICAL SEALS**

- .1 Provide watertight link type mechanical seals in exterior wall openings.
- .2 Assemble and install each mechanical seal in accordance with manufacturer's instructions.
- .3 After installation, periodically check each mechanical seal installation for leakage and, if necessary, tighten link seal bolts until seal is completely watertight.

**END OF SECTION**

## PART 1 - GENERAL

### 1.1 SUBMITTALS

- .1 Submit shop drawings/product data sheets for:
  - .1 pressure gauges and thermometers;

## PART 2 - PRODUCTS

### 2.1 PRESSURE GAUGES AND THERMOMETERS

- .1 Pressure gauges as follows:
  - .1 adjustable, glycerine filled, 100 mm or 115 mm (4" or 4-½") diameter and each accurate to within 1% of scale range;
  - .2 type 304 stainless steel case with relief valve and polished stainless steel bayonet;
  - .3 stainless steel rotary movement with stainless steel bushings and socket;
  - .4 clear acrylic window;
  - .5 dual scale white dial with a scale range such that working pressure of system is at approximate mid-point of scale;
  - .6 black pointer.
- .2 Pressure gauge accessories and additional requirements as follows:
  - .1 a bronze ball type shut-off valve is to be provided in the piping to each pressure gauge;
  - .2 each pressure gauge for piping and equipment with normal everyday flow is to be equipped with a brass pressure snubber;
  - .3 each pressure gauge for steam piping or steam equipment is to be equipped with a steel coil syphon;
  - .4 pressure gauges in fire protection piping must be ULC listed and labelled;
  - .5 pressure gauges in medical gas piping systems are to conform to CSA Z7396.1 and are to be identified with the name of the service it is provided for as well as "USE NO OIL".
- .3 Thermometers as follows:
  - .1 round, 125 mm (5") diameter, adjustable (90°) angle bimetal dial type thermometers, each accurate to within 1% of full scale;
  - .2 hermetically sealed stainless steel case with stainless steel ring;
  - .3 dampened bimetal coil;
  - .4 calibration adjustment screw;
  - .5 white aluminum dual scale dial with black and blue markings and a range such that working temperature of system is approximate mid-point of the scale;
  - .6 black aluminum pointer;
  - .7 double strength glass window;
  - .8 12 mm (½") NPT connection with 6.4 mm (¼") diameter stainless steel stem;
  - .9 suitable thermowell.
- .4 Manufacturers:
  - .1 H.O. Trerice Co.;
  - .2 Weiss Instruments;

.3 Ashcroft.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- .1 Provide pressure gauges in following locations where applicable:
  - .1 in valved tubing across suction, suction strainer (if applicable), and discharge piping of each circulating pump;
  - .2 in supply and return piping connections to main mechanical plant equipment such as boilers, chillers, heat exchangers, main coils, etc.;
  - .3 in expansion tank(s);
  - .4 in separate domestic hot water storage tank(s);
  - .5 at top most outlet in each standpipe fire protection system riser;
  - .6 in piping at each side of a pressure reducing valve;
  - .7 in potable water service piping downstream of meter;
  - .8 wherever else shown and/or specified.
- .2 Provide thermometers in following locations where applicable:
  - .1 in supply and return piping connections to main mechanical plant equipment such as boilers, chillers, cooling towers, heat exchangers, main coils, etc., unless temperature indication is supplied with equipment;
  - .2 wherever else shown and/or specified.
- .3 Conform to following installation requirements where applicable:
  - .1 for installation of thermometers in piping wells, provide a coat of metallic base heat transfer paste or grease in piping well;
  - .2 for pressure gauges in piping at equipment locations, install pressure gauge between equipment and first pipe fitting;
  - .3 locate, mount and adjust instruments so they are easily readable;
  - .4 where pressure gauges and/or thermometers are located at high level or in an area where they cannot be easily seen, provide remote reading instruments.

**END OF SECTION**

## PART 1 - GENERAL

## PART 2 - PRODUCTS

### 2.1 PIPING HANGERS AND SUPPORTS

- .1 Pipe hanger and support materials, including accessories, are to be, unless otherwise specified, in accordance with Manufacturers Standardization Society (MSS) Standard Practice Manual SP-58, Pipe hangers and Supports-Materials, Design and Manufacture, and where possible, MSS designations are indicated with each product specified below. Conform to following requirements:
  - .1 unless otherwise specified, ferrous hanger and support products are to be electro-galvanized;
  - .2 hangers and supports for insulated piping are to be sized to fit around insulation and insulation jacket.
- .2 Hangers and supports for horizontal suspended piping as follows:
  - .1 adjustable steel clevis hanger – MSS Type 1;
  - .2 adjustable swivel ring band hanger – MSS Type 10;
  - .3 adjustable roller hanger – MSS Types 41, 43, and/or 45, with MSS Type 39 steel protection saddle.
- .3 Supports for horizontal pipe on vertical surfaces as follows:
  - .1 steel offset pipe clamp – Anvil Fig. 103 or Myatt Fig. 170;
  - .2 heavy-duty steel pipe clip – MSS Type 26;
  - .3 single steel pipe hook – Myatt Fig. 156;
  - .4 epoxy coated steel pipe stays are not permitted.
- .4 Floor supports for vertical risers as follows:
  - .1 copper tubing riser clamp – MSS Type 8;
  - .2 heavy-duty steel riser clamp – MSS Type 8.
- .5 Supports for vertical piping on vertical surfaces as follows:
  - .1 steel offset pipe clamp – Anvil Fig. 103 or Myatt Fig. 170;
  - .2 heavy-duty steel pipe bracket or soil pipe bracket – MSS Type 26;
  - .3 extension split pipe clamp – MSS Type 12;
  - .4 epoxy coated steel pipe stays are not permitted.
- .6 Base support for vertical risers in excess of 6 m (20') high extending out from base mounted equipment is to consist of a base elbow support with flange.
- .7 For horizontal pipe on racks, Unistrut or equal galvanized steel pipe racks with pipe securing hardware as follows:
  - .1 standard galvanized steel U-bolts/clamps supplied by rack manufacturer;
  - .2 adjustable roller chair – MSS Type 44 with MSS Type 39 steel protection saddle.
- .8 Special hangers and supports for various applications as follows:
  - .1 vibration isolated riser supports – black steel riser clamps as specified above, complete with neoprene–steel–neoprene sandwich type vibration isolation pads between clamp and floor;
  - .2 for groups of pipes having same slope – MSS Type 32 welded steel brackets, Anvil Fig. 46 universal trapeze assemblies, or Unistrut or equal support assemblies, all with U-bolts, clamps, etc., to secure pipes in place;

- .3 for sections of piping connected to vibration isolated equipment – hangers and supports as specified above but complete with MSS Type 48 spring cushions;
- .4 for glass drain and vent piping – special padded hangers supplied by pipe supplier;
- .5 for plastic piping – generally as specified above but in accordance with pipe manufacturer's recommendations;
- .6 for fire protection piping – generally as above but ULC listed and/or FM approved, and in accordance with Chapter requirements of NFPA Standard applicable to piping system;
- .7 for bare horizontal copper piping – generally as above but factory vinyl coated to prevent direct copper/steel contact;
- .8 for bare copper vertical piping – corrosion resistant ferrous clamps with flexible rubber gasket type material (not tape) to isolate pipe from clamp;
- .9 insulation protection shields to and including 40 mm (1-1/2") dia. – MSS Type 40 galvanized steel shields with ribs to keep shield centred on hanger.
- .9 Hanger rods are to be electro-galvanized carbon steel (unless otherwise specified), round, threaded, to ASTM A36, complete with captive machine nuts with washers at hangers, sized to suit loading in accordance with Table 3 in MSS SP-58, but in any case, minimum 9.5 mm (3/8") diameter.
- .10 Manufacturers:
  - .1 E. Myatt & Co. Inc.;
  - .2 Anvil International Inc.;
  - .3 Empire Industries Inc.;
  - .4 Hunt Manufacturing Ltd.;
  - .5 Unistrut Canada Ltd.;
  - .6 Nibco Inc. "Tolco";
  - .7 Taylor Pipe Supports.

## PART 3 - EXECUTION

### 3.1 INSTALLATION OF FASTENING AND SECURING HARDWARE

- .1 Provide fastening and securing hardware required for mechanical work to maintain installations attached to structure or to finished floors, walls, and ceilings in a secure and rigid manner capable of withstanding dead loads, live loads, superimposed dead loads, and any vibration of installed products.
- .2 Use fasteners compatible with structural requirements, finishes and types of products to be connected. Do not use materials subject to electrolytic action or corrosion where conditions are liable to cause such action.
- .3 Where floor, wall or ceiling construction is not suitable to support loads, provide additional framing or special fasteners to ensure proper securement to structure that is to support the products. Provide reinforcing or connecting supports where required to distribute loading to structural components.
- .4 Obtain written consent before using explosive actuated fastening devices. If consent is obtained, comply with requirements of CAN/CSA Z166.1 and CAN/CSA Z166.2.
- .5 Do not attach fasteners to steel deck without written consent from the Consultant.

**3.2 INSTALLATION OF PIPE HANGERS AND SUPPORTS**

- .1 Provide required pipe hangers and supports.
- .2 Provide any additional structural steel channels, angles, inserts, beam chumps and similar accessories required for hanging or supporting pipe. Unless otherwise shown or specified, hang or support pipes from structure only.
- .3 For insulated pipe, size hanger or support to suit diameter of insulated pipe and install hanger or support on outside of insulation and insulation finish.
- .4 Unless otherwise shown or specified, hang and/or support horizontal pipe above ground by means of hangers and/or supports specified in Part 2 of this Section. Unless otherwise shown or specified, hangers for suspended pipe less than or equal to 25 mm (1") dia. are to be clevis type or adjustable ring type, and hangers for suspended pipe greater than or equal to 40 mm (1-½") dia. are to be adjustable clevis type.
- .5 Space hangers and supports in accordance with following:
  - .1 cast iron pipe – hang or support at every joint with maximum 2.4 m (8') spacing;
  - .2 plastic pipe – conform to pipe manufacturer's recommended support spacing;
  - .3 glass pipe – conform to pipe manufacturer's recommended support spacing and support requirements;
  - .4 copper and steel pipe – hang or support at spacing in accordance with following schedule:

Pipe dia.	Max. Spacing Steel	Max. Spacing Copper
to 25 mm (1")	2.4 m (8')	1.8 m (6')
40 mm (1-½")	2.7 m (9')	2.4 m (8')
50 mm (2")	3.0 m (10')	2.7 m (9')
65 mm (2-½")	3.6 m (12')	3.0 m (10')
75 mm (3")	3.6 m (12')	3.0 m (10')
90 mm (3-½")	3.6 m (12')	3.6 m (12')
100 mm (4")	4.2 m (14')	3.6 m (12')
250 mm (10")	6.0 m (20')	
300 mm (12")	6.7 m (22')	

- .5 flexible grooved pipe/coupling joint piping – as above but with not less than one hanger or support between joints;
- .6 Where pipes change direction, either horizontally or vertically, provide a hanger or support on horizontal pipe not more than 300 mm (12") from elbow, and where pipes drop from tee branches, support tees in both directions not more than 50 mm (2") on each side of tee.
- .7 When pipes with same slope are grouped and a common hanger or support is used, space hanger or support to suit spacing requirement of smallest pipe in group and secure pipes in place on common hanger or support.
- .8 Provide roller hangers or supports for heat transfer piping greater than or equal to 150 mm (6") diameter and conveying a material 75°C (170°F) or greater to facilitate pipe movement due to expansion and contraction, and at each hanger or support tack weld a steel protection saddle to pipe to protect piping insulation.
- .9 Unless otherwise shown or specified, support vertical piping by means of supports specified in Part 2 of this Section, spaced in accordance with following:
  - .1 support vertical pipes at maximum 3 m (10') intervals or at every floor, whichever is lesser;

- .2 for sections of vertical piping with a length less than 3 m (10'), support pipe at least once;
- .3 for vertical cast iron plain end pipe (mechanical joint type), secure riser or pipe clamp around pipe under a flange integral with pipe for vertical support purposes, or provide a length of hub and spigot pipe to facilitate proper support;
- .4 for vertical steel pipe risers in excess of 3 m (10'), weld shear lugs to pipe to carry load;
- .5 for vibration isolated piping risers, provide rubber-steel-rubber vibration isolation pads between riser clamps and floor.
- .10 Each hanger, support or securement for horizontal bare copper tubing is to be plastic coated to prevent direct contact between pipe and ferrous hanger. Each wall or floor clamp for vertical bare copper piping is to be isolated from pipe by means of strips of flexible rubber inserts. Use of painted ferrous hangers and supports, including those painted with copper coloured paint, is not acceptable. Site application of tape or other types of isolation is not acceptable.
- .11 For insulated horizontal piping less than or equal to 40 mm (1-1/2") diameter, provide galvanized steel insulation protection shields between insulation and hanger or support. Install shields immediately after pipe is insulated.
- .12 Do not support piping from steel deck without written consent from Consultant.

### 3.3 EQUIPMENT BASES AND SUPPORTS

- .1 Unless otherwise specified or required, set floor mounted equipment on minimum 100 mm (4") high reinforced concrete housekeeping pads 200 mm (8") clear of equipment on each side and end, or a minimum of 200 mm (8") from centreline of equipment anchor bolts to edge of the base, whichever is larger. Conform to following requirements:
  - .1 supply dimensioned drawings and equipment base templates, and provide anchor bolts for proper setting and securing of equipment on pads;
  - .2 place anchor bolts during concrete pour and be responsible for required levelling, alignment, and grouting of equipment;
  - .3 as a minimum, use wire mesh reinforcement, however, for pads for large heavy equipment, use reinforcement as per structural drawing details.
- .2 For equipment not designed for base mounting, where required, provide welded, cleaned and prime coat painted structural steel stands or supports conforming to following requirements:
  - .1 provide stands and supports, except those for small equipment, designed by a structural engineer registered in jurisdiction of the work, and submit stamped and signed design drawings with calculations as shop drawings for review;
  - .2 flange bolt steel stands to concrete housekeeping pads;
  - .3 seismically restrained stands and supports in accordance with applicable requirements.
- .3 Where indicated on mechanical drawings, provide welded, cleaned and prime coat painted structural steel platforms, designed by a structural engineer registered in the jurisdiction of the work, for service access to equipment. Submit stamped and signed design drawings with calculations as shop drawings for review. Conform to following requirements:
  - .1 platforms in accordance with OHS requirements and adequately sized, braced, anchored, and, as required, seismically restrained;
  - .2 flooring equal to Fisher & Ludlow "Tru-Weld" Type 19-4, Borden type W/B (19-W-4), welded steel bar type grating;
  - .3 support legs constructed of welded Schedule 40 black steel pipe with welded steel cross-bracing, securely anchored and sway braced;



- .4 safety guard rails, constructed from minimum 32 mm (1-¼") dia. Schedule 40 black steel pipe, for all platforms and complete with vertical stanchions at maximum 1.2 m (48") centres, top and intermediate horizontal railing, and toe plates at floor;
- .5 vertical ladders constructed of Schedule 40 black steel pipe, 25 mm (1") dia. for equal height rungs, 40 mm (1-½") for stringers, anchored to floors and walls and sway braced as required;
- .6 ships ladders, used wherever space conditions permit, of welded steel construction, climbing at an approximate 60° angle, and complete with channel iron stringers, open grate equal height risers approximately 165 mm (6-½") wide and factory made by grating manufacturer, handrails, and suitable anchoring and support.

### **3.4 CONCRETE WORK FOR MECHANICAL EQUIPMENT BASES AND PADS**

- .1 Concrete work required for mechanical equipment bases/pads will be provided as part of concrete work of Division 03.
- .2 Exactly locate bases/pads at site and be present during concrete pour to ensure anchor bolts, inserts, plates and similar hardware are not damaged or dislodged.
- .3 Coordinate base/pad installations with concrete trade and ensure bases and pads are keyed into structure to meet seismic restraint requirements where applicable.

### **END OF SECTION**

## PART 1 - GENERAL

### 1.1 SUBMITTALS

- .1 Submit heating cable and control shop drawings/product data sheets, complete with control schematics.

### 1.2 CLOSEOUT SUBMITTALS

- .1 Submit a start-up certification letter from cable supplier as specified in Part 3 of this section.
- .2 Submit certified cable megger test reports as specified in Part 3 of this section.

## PART 2 - PRODUCTS

### 2.1 DOMESTIC HOT WATER TEMPERATURE MAINTENANCE CABLE

- .1 Raychem Canada Ltd. "HWAT-Plus", CSA approved, 120 V, 1 phase heating cable sets to maintain temperature in domestic hot water piping, each set as specified/scheduled on drawings and complete with a Raychem AMC-1B thermostat set at 45°C (115°F), and following:
  - .1 required lengths of "HWAT-P1" self-regulating heating cable;
  - .2 "RayClic-PC" power connection with end seal per circuit;
  - .3 "RayClic-T" tee connections with end seals as required for pipe branches;
  - .4 "RayClic-S" splice connections as required;
  - .5 GT-66 glass tape to secure cable on pipe, and "Electric Traced" adhesive labels to be secured to pipe insulation.
  - .6 Complete with integral ground fault protection.
- .2 Manufacturers:
  - .1 Raychem Canada Ltd.;
  - .2 Dimplex/Chromalox Inc.;
  - .3 Tyco Thermal Controls/Pyrotenax.

### 2.2 PIPE FREEZE PROTECTION HEATING CABLE

- .1 Raychem Canada Ltd. "XL-Trace-CR" CSA certified, self-regulating piping freeze protection cable sets as specified and/or scheduled on drawings, each set complete with:
  - .1 required lengths of "XL-TRACE" self-regulating heating cable;
  - .2 power connection with end seal per circuit;
  - .3 tee connections with end seals as required for pipe branches;
  - .4 splice connections as required;
  - .5 GT-66 glass tape to secure cable on pipe, and "Electric Traced" adhesive labels to be secured to pipe insulation;
  - .6 pipe temperature sensing thermostat.
  - .7 Complete with integral ground fault protection.
  - .8 C910-485 microprocessor-based, single-point commercial heating cable control system with integrated equipment ground-fault protection, BACnet gateway, dry contact alarm output, NEMA 4X fiber reinforced plastic enclosure, 120-277 V 30 A double pole relay.

- .2 Manufacturers:
  - .1 Raychem Canada Ltd.;
  - .2 Dimplex/Chromalox Inc.;
  - .3 Tyco Thermal Controls/Pyrotenax.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION OF DOMESTIC WATER TEMPERATURE MAINTENANCE CABLE**

- .1 Supply electric tracing cable sets to maintain temperature of domestic hot water piping.
- .2 Hand cable sets and accessories and cable manufacturer's installation instructions to electrical trade at site for installation on piping. Clearly identify piping to be traced. Ensure piping has been pressure tested prior to cable installation and manufacturer's installation instructions are observed.
- .3 After cable installation but before application of piping insulation, megger test and commission cable in presence of the Consultant and in accordance with cable manufacturer's installation and operation manual. Replace any damaged or faulty cable, and when satisfactory results have been obtained, submit signed test reports to the Consultant.
- .4 When traced piping has been insulated, install "Electrically Traced" labels on opposite sides of pipe at 3 m (10') intervals and in accordance with requirements specified in Section 20 05 00 – Common Work Results for Mechanical.

### **3.2 INSTALLATION OF FREEZE PROTECTION HEATING CABLE**

- .1 Supply electric tracing cable sets to prevent piping from freezing.
- .2 Hand cable sets and accessories and cable manufacturer's installation instructions to electrical trade at site for installation on piping. Clearly identify piping to be traced. Ensure piping has been pressure tested prior to cable installation and manufacturer's installation instructions are observed.
- .3 After cable installation but before application of piping insulation, megger test and commission cable in presence of the Consultant and in accordance with cable manufacturer's installation and operation manual. Replace any damaged or faulty cable, and when satisfactory results have been obtained, submit signed test reports to the Consultant.
- .4 When traced piping has been insulated, install "Electrically Traced" labels on opposite sides of pipe at 3 m (10 ft) intervals and in accordance with requirements specified in Section 20 05 00 – Common Work Results for Mechanical.
- .5 When cable installations are complete, check and test operation of each cable set with heater manufacturer's representative, make any required adjustments, and have cable manufacturer certify in writing that cable sets have been properly installed and operate as intended.

**END OF SECTION**

## PART 1 - GENERAL

### 1.1 SECTION INCLUDES

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

### 1.2 SUBMITTALS

- .1 Submit copies of manufacturer's product data sheets for products specified in this Section. Product data sheets are to include product characteristics, limitations, dimensions, finishes, and installation recommendations.

### 1.3 CLOSEOUT SUBMITTALS

- .1 Submit a letter from vibration isolation manufacturer to certify correct installation of products, as specified in Part 3 of this Section.

## PART 2 - PRODUCTS

### 2.1 GENERAL

- .1 Vibration isolation products are to be in accordance with the most recent edition of the ASHRAE Handbook and/or as indicated on drawings, schedules, details, and as specified below.
- .2 Springs are to be stable, colour coded, selected to operate at no greater than 2/3 solid load, designed in accordance with Society of Automotive Engineers Handbook Supplement 9 entitled Manual on Design and Application of Helical and Spiral Springs, and with spring diameters in accordance with manufacturer's recommendations to suit static deflection and maximum equipment load.
- .3 Steel components of isolation products not exposed to the weather or moisture are to be zinc plated. Steel components of isolation products exposed to the weather or in a damp, moist environment are to be factory painted with rust inhibiting primer and 2 coats of neoprene.
- .4 Where weight of isolated equipment may change significantly due to draining or filling with a liquid, vibration isolators are to be equipped with limit stops to limit spring extensions.
- .5 Flexible piping connections to vibration isolated equipment are specified in the appropriate piping sections of the Specification.

### 2.2 ISOLATION PADS

- .1 Sandwich type pads, 20 mm (3/4") nominal thickness, selected for 3.2 mm (1/8") static deflection unless otherwise specified, consisting of 2 waffle type or ribbed 50 durometer neoprene pads permanently bonded to a minimum 10 gauge steel plate, and complete with rubber bushed bolt holes and equipment anchor bolts with neoprene isolation grommets.
- .2 Manufacturers:
  - .1 Vibro-Acoustics Ltd. Type NSN;
  - .2 The VMC Group Vibration Mounting & Controls Inc. (Korfund-Dynamics) "SHEAR-FLEX PLATES";
  - .3 Kinetics Noise Control Vibron Products Group Type NGS/NGD;
  - .4 Mason Industries Inc. Type SW/S/SW with HG Bolt Insertion Washers;
  - .5 J. P. America Inc. Type JSJ.

## 2.3 RUBBER FLOOR ISOLATORS

- .1 Captive, bridge bearing quality neoprene mount selected for a minimum 4 mm (0.15") static deflection unless otherwise specified, with an integral ductile iron housing and integral equipment anchor bolt.
- .2 Manufacturers:
  - .1 Vibro-Acoustics Ltd. Type R;
  - .2 The VMC Group Vibration Mounting & Controls (Korfund-Dynamics) Type RSM;
  - .3 Kinetics Noise Control Vibron Products Group Type RQ;
  - .4 Mason Industries Inc. Type BR;
  - .5 J. P. America Inc. Type TRM.

## 2.4 SPRING FLOOR ISOLATORS

- .1 Seismically rated captive spring mount isolator complete with levelling bolts, upper and lower neoprene spring cups, neoprene cushion, ductile iron housing, neoprene sound pads, and neoprene isolation grommets for securing bolts.
- .2 Manufacturers:
  - .1 Vibro-Acoustics Ltd. Type SFS;
  - .2 The VMC Group Vibration Mounting & Controls (Korfund-Dynamics) Type AMSR;
  - .3 Kinetics Noise Control Vibron Products Group Type FLSS;
  - .4 Mason Industries Inc. Type SSLFH;
  - .5 J. P. America Inc. Type TSO-C-SC.

## 2.5 OPEN SPRING MOUNTS

- .1 Base mount free-standing assemblies, each complete with a stable colour coded steel spring welded in place, drilled mild steel mounting plate bonded to a ribbed rubber or neoprene acoustical pad, and an external 16 mm (5/8") diameter level adjustment bolt.
- .2 Manufacturers:
  - .1 Vibro-Acoustics Ltd. Type FS;
  - .2 The VMC Group Vibration Mounting & Controls (Korfund-Dynamics) "Spring-Flex" Type A;
  - .3 Kinetics Noise Control Vibron Products Group Type FDS;
  - .4 Mason Industries Inc. Type SLFH;
  - .5 J. P. America Inc. Type TSO.

## 2.6 CLOSED SPRING MOUNTS

- .1 Base mount free-standing enclosed assemblies, each complete with stable colour coded spring(s), 2 piece cast housing, non-binding rubber horizontal stabilizers, a ribbed rubber or neoprene acoustical pad bonded to base of the closed housing, and an external level adjustment bolt.
- .2 Manufacturers:
  - .1 Vibro-Acoustics Ltd. Type CM;
  - .2 The VMC Group Vibration Mounting & Controls (Korfund-Dynamics) "Spring-Flex" Types B and C;
  - .3 Kinetics Noise Control Vibron Products Group Type FLS;

- .4 Mason Industries Inc. Type C;
- .5 J. P. America Inc. Type TSC.

## **2.7 TOTALLY RETAINED SPRING MOUNTS**

- .1 Base mount free-standing enclosed and retained assemblies to limit both vertical and lateral movement of mounted equipment, each complete with stable colour coded spring(s), drilled welded steel housing and top plate, ribbed rubber or neoprene acoustical pad bonded to bottom of housing, vertical limit adjusting hardware, and a level adjustment bolt.
- .2 Manufacturers:
  - .1 Vibro-Acoustics Ltd. Type CSR;
  - .2 The VMC Group Vibration Mounting & Controls (Korfund-Dynamics) "Spring-Flex" Type MS;
  - .3 Kinetics Noise Control Vibron Products Group Type SM;
  - .4 Mason Industries Inc. Type SLRSO;
  - .5 J. P. America Inc. Type TSR.

## **2.8 SPRING HANGERS**

- .1 Welded steel plate housing with top and bottom rod mounting holes and spring retainer, neoprene double deflection isolation element, stable colour coded spring, and heavy-duty rubber washers.
- .2 Manufacturers:
  - .1 Vibro-Acoustics Ltd. Type SHR-SN;
  - .2 The VMC Group Vibration Mounting & Controls (Korfund-Dynamics) "Spring-Flex" Series HRSA;
  - .3 Kinetics Noise Control Vibron Products Group. Type SRH;
  - .4 Mason Industries Inc. Type 30N;
  - .5 J. P. America Inc. Type TSH.

## **2.9 NEOPRENE HANGER ISOLATORS**

- .1 Neoprene double deflection rod isolators with steel housing and hanger rod bushing, selected for a minimum 4 mm (0.15") static deflection unless otherwise specified.
- .2 Manufacturers:
  - .1 Vibro-Acoustics Ltd. Type NH;
  - .2 The VMC Group Vibration Mounting & Controls (Korfund-Dynamics) Type HR;
  - .3 Kinetics Noise Control Vibron Products Group Type RH;
  - .4 Mason Industries Inc. Type HD or WHD;
  - .5 J. P. America Inc. Type TRH.

## **2.10 CONCRETE INERTIA TYPE EQUIPMENT BASE**

- .1 Welded steel bases, each complete with a structural black steel channel frame, concrete reinforcing rods, and brackets for spring mounts welded to frame.
- .2 Manufacturers:
  - .1 Vibro-Acoustics Ltd. Type CIB;
  - .2 The VMC Group Vibration Mounting & Controls (Korfund-Dynamics) Type CPF;

- .3 Kinetics Noise Control Vibron Products Group. Type CIB;
- .4 Mason Industries Inc. Type KSL;
- .5 J. P. America Inc. Type BCI.

## **2.11 STEEL EQUIPMENT BASE**

- .1 Fully welded structural steel equipment and motor support bases, each complete with a wide flange steel frame, full depth cross members, brackets for spring mounts, and adjustable motor slide rails.
- .2 Manufacturers:
  - .1 Vibro-Acoustics Ltd. Type SB;
  - .2 The VMC Group Vibration Mounting & Controls (Korfund-Dynamics) Type WFB;
  - .3 Kinetics Noise Control Vibron Products Group Type SFB;
  - .4 Mason Industries Inc. Type WFSL;
  - .5 J. P. America Inc. Type BWS (with motor slide rail).

## **2.12 COMBINATION STEEL/CONCRETE INERTIA EQUIPMENT BASE**

- .1 Welded steel bases with a structural black steel channel frame, concrete reinforcing rods, bottom sheet steel pan, brackets for spring mounts welded to frame and adjustable motor slide rails.
- .2 Manufacturers:
  - .1 Vibro-Acoustics Ltd. Type CIB (with motor slide rails);
  - .2 The VMC Group Vibration Mounting & Controls (Korfund-Dynamics) Type WPF (with motor slide rails);
  - .3 Kinetics Noise Control Vibron Products Group Type CIB (with motor slide rails);
  - .4 Mason Industries Inc. Type BMK or K;
  - .5 J. P. America Inc. Type BSI (with motor slide rail).

## **2.13 SLUNG STEEL BASE**

- .1 Slung steel bases of structural members with gusset plates welded to ends and complete with adjustable motor slide rails and vertical section size to suit equipment's motor power output.
- .2 Manufacturers:
  - .1 Vibro-Acoustics Ltd. Type SS;
  - .2 The VMC Group Vibration Mounting & Controls (Korfund-Dynamics) Type CPF;
  - .3 Kinetics Noise Control Vibron Products Group Type CIB-H;
  - .4 Mason Industries Inc. Type MSL.

## **2.14 CONTINUOUS RAIL TYPE ISOLATION FOR ROOF MOUNTED EQUIPMENT**

- .1 Continuous rooftop isolation shipped completely assembled, consisting of:
  - .1 galvanized steel sections formed to fit roof curb and associated equipment with a flexible air and weather seal joining upper and lower rail sections;
  - .2 stable springs, cadmium plated and selected to provide minimum deflection with 50% additional travel to solid;
  - .3 neoprene cushioned and wind restraints allowing 6 mm (¼") movement before engaging and resisting wind loads in any lateral direction.

- .2 Manufacturers:
  - .1 Vibro-Acoustics Ltd. Vibro-Acoustics Type RTR;
  - .2 The VMC Group Vibration Mounting and Controls (Korfund-Dynamics) Type RTIR;
  - .3 Kinetics Noise Control Vibron Products Group Type KSR;
  - .4 Mason Industries Inc. Type RSC;
  - .5 J. P. America Inc. Type BRC.

## PART 3 - EXECUTION

### 3.1 INSTALLATION OF VIBRATION ISOLATION MATERIALS

- .1 Unless otherwise stated in the drawings, schedules and/or typical details, vibration isolation is to be provided for all mechanical equipment as per the recommendations contained within in the most recent edition of the ASHRAE Handbook.
- .2 Supply to vibration isolation product manufacturer or supplier a copy of a "reviewed" shop drawing or product data sheet for each piece of equipment to be isolated and dimensioned pipe layouts of associated piping to be isolated.
- .3 Unless otherwise specified, vibration isolation products are to be product of one manufacturer.
- .4 Ensure vibration isolation manufacturer coordinates material selections with equipment provided in order to ensure adherence to performance criteria. Allow for expansion and contraction when material is selected and installed.
- .5 Unless otherwise indicated, install isolation materials for base mounted equipment on concrete housekeeping pad bases which extend at least over the full base and isolated area of the isolated equipment. Additional requirements are as follows:
  - .1 block and shim bases level so ductwork and piping connections can be made to a rigid system at proper operating level, before isolated adjustment is made, and ensure there is no physical contact between isolated equipment and building structure;
  - .2 steel bases are to clear the sub-base by 25 mm (1");
  - .3 concrete bases are to clear the sub-base by 50 mm (2").
- .6 Isolate piping larger than 25 mm (1") dia. directly connected to motorized and/or vibration isolated equipment with 25 mm (1") static deflection spring hangers at spacing intervals in accordance with following:
  - .1 for pipe less than or equal to 100 mm (4") dia. – first 3 points of support;
  - .2 for pipe 125 mm (5") to 200 mm (8") dia. – first 4 points of support;
  - .3 for pipe equal to or greater than 250 mm (10") dia. – first 6 points of support;
- .7 First point of isolated piping support is to have a static deflection of twice the deflection of the isolated equipment but maximum 50 mm (2").
- .8 Secure top of spring hanger frame rigidly to structure, and do not install spring hangers in concealed locations.
- .9 Where it is impossible to use at least 2 spring hangers, provide Senior Flexonics Ltd. Style 102 (or 102-U as required) or equal, twin sphere, moulded rubber flexible connection assemblies, selected by manufacturer and suitable in all respects for intended application, and complete with required nipples and connections to provide proper vibration isolation.
- .10 For control wiring connections to vibration isolated equipment ensure flexible metallic conduit with 90° bend is used for conduit 25 mm (1") dia. and smaller, and for conduit larger than 25 mm (1") dia., use Crouse Hinds EC couplings. Connections are to be long enough so that conduit will remain intact if equipment moves 300 mm (12") laterally from its installed position, and flexible enough to



transmit less vibration to structure than is transmitted through vibration isolation. Coordinate these requirements with mechanical trades involved. If electrical power connections are not made in a similar manner as part of the electrical work, report this fact to the Consultant.

- .11 Arrange and pay for vibration isolation product manufacturer to visit site to inspect installation of his equipment. Perform revision work required as a result of improper installation. When vibration isolation equipment manufacturer is satisfied with the installation, obtain and submit a letter stating manufacturer has inspected the installation and equipment is properly installed.

**END OF SECTION**

## PART 1 - GENERAL

### 1.1 SECTION INCLUDES

- .1 Nameplates.
- .2 Tags.
- .3 Pipe Markers.

### 1.2 REFERENCES

- .1 ASME A13.1 – Scheme for the Identification of Piping Systems.

### 1.3 SUBMITTALS

- .1 Section 01 33 00: Submittals.
- .2 Submit list of wording, symbols, letter size, and colour coding for mechanical identification.
- .3 Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
- .4 Product Data: Provide manufacturers catalogue literature for each product required.
- .5 Manufacturer's Installation Instructions: Indicate special procedures, and installation.

### 1.4 CLOSEOUT SUBMITTALS

- .1 Section 01 77 00: Project Closeout.
- .2 Record actual locations of tagged valves.

## PART 2 - PRODUCTS

### 2.1 MECHANICAL WORK IDENTIFICATION MATERIALS

- .1 Confirm with the Owner if an existing mechanical work identification system is in place and, if so, match accordingly.
- .2 If an existing mechanical work identification system is not in place, the following is to be used:
  - .1 Equipment nameplates are to be minimum 1.6 mm (1/16") thick 2-ply laminated coloured plastic plates, minimum 12 mm x 50 mm (½" x 2") for smaller items such as damper motors and control valves, minimum 25 mm x 65 mm (1" x 2-½") for equipment, and minimum 50 mm x 100 mm (2" x 4") for control panels and similar items. Additional requirements are as follows:
    - .1 unless otherwise specified or required, each nameplate is to be white, complete with bevelled edges and black engraved wording to completely identify equipment and its use with no abbreviations;
    - .2 wording is generally to be as per drawings, i.e. Fan EF-1, and is to include equipment service and building area/zone served, but must be reviewed prior to engraving;
    - .3 supply stainless steel screws for securing nameplates in place;
    - .4 nameplates for equipment suspended above floor level or generally not within easy viewing from floor level are to be increased in size so as to be easily readable from floor level.
  - .2 Valve tags are to be coloured, 40 mm (1-½") square, 2-ply laminated plastic with bevelled edges, red-white, green-white, yellow-black, etc., to match piping identification colour, each

complete with a 3.2 mm (1/8") diameter by 100 mm (4") long brass plated steel bead chain, and four lines of engraved maximum size identification wording, i.e.:

VALVE V12  
200 mm (8")  
CHILL. WATER  
NORMALLY  
OPEN

- .3 Standard pipe identification is to be equal to Smillie McAdams Summerlin Ltd., Brady or Primark Manufacturing Inc. vinyl plastic with indoor/outdoor type vinyl ink lettering and directional arrows, as follows:
- .1 for pipe less than or equal to 150 mm (6") diameter, coiled type snap-on markers of a length to wrap completely around pipe or pipe insulation;
- .2 for pipe larger than 150 mm (6") diameter, saddle type strap-on markers with 2 opposite identification locations and complete with nylon cable ties.
- .4 Identification wording and colours for pipe identification materials are to be as follows:

Pipe Service	Identification Colour	Legend
domestic cold water	green	DOM. COLD WATER
domestic hot water supply	green	DOM. HW SUPPLY
domestic hot water recirculation	green	DOM. HW RECIRC.
tempered domestic water	green	TEMP. DOM. WATER
chilled drinking water	green	CH. DRINK WTR.
storm drainage	green	STORM
sanitary drainage	green	SAN.
plumbing vent	green	SAN. VENT
acid sanitary drainage	yellow	ACID DRAIN
acid drainage vent	yellow	ACID VENT
fire protection standpipe	red	F.P. STANDPIPE
fire protection sprinklers	red	F.P. SPRINKLER
natural gas	to Code	to Code, c/w pressure
natural gas vent	to Code	to Code
propane gas	to Code	to Code, c/w pressure
propane gas vent	to Code	to Code
fuel oil supply	yellow	FUEL OIL SUPPLY
fuel oil return	yellow	FUEL OIL RETURN
fuel oil vent	yellow	FUEL OIL VENT
heating water supply	yellow	HTG. WTR. SUPPLY
heating water return	yellow	HTG. WTR. RETURN
heating water drain	yellow	HTG. WTR. DRAIN

Pipe Service	Identification Colour	Legend
glycol heating supply	yellow	GLY. HTG. SUPPLY
glycol heating return	yellow	GLY. HTG. RETURN
glycol heating drain	yellow	GLY. HTG. DRAIN
glycol heat reclaim return	yellow	GLY. HTG. RECLAIM R.
glycol heat reclaim supply	yellow	GLY. HTG. RECLAIM S.
heat pump geothermal loop – source side supply	green	GEO. LOOP SOURCE SUPPLY
heat pump geothermal loop – source side return	green	GEO. LOOP SOURCE RETURN
heat pump geothermal loop – load side supply	green	GEO. LOOP LOAD SUPPLY
Heat pump geothermal loop – load side return	green	GEO. LOOP LOAD RETURN
condenser water supply	green	COND. WTR. SUPPLY
condenser water return	green	COND. WTR. RETURN
chilled water supply	green	CH. WTR. SUPPLY
chilled water return	green	CH. WTR. RETURN
chilled water drain	green	CH. WTR. DRAIN
low pressure steam	yellow	...kPa STEAM
medium pressure steam	yellow	...kPa STEAM
high pressure steam	yellow	...kPa STEAM
low pressure condensate	yellow	L.P. CONDENSATE
medium pressure condensate	yellow	M.P. CONDENSATE
high pressure condensate	yellow	H.P. CONDENSATE
pumped condensate	yellow	PUMPED CONDENSATE
steam vent	yellow	STEAM VENT
boiler feedwater	yellow	BLR. FEEDWATER
boiler blowdown	yellow	BLR. BLOW-OFF
refrigerant suction	yellow	REFRIG. SUCTION
refrigerant liquid	yellow	REFRIG. LIQUID
refrigerant hot gas	yellow	REFRIG. HOT GAS
diesel engine exhaust	yellow	ENGINE EXHAUST
gasoline	yellow	GASOLINE
distilled water	green	DISTILL. WATER
demineralized water	green	DEMIN. WATER

Pipe Service	Identification Colour	Legend
compressed air (< 700 kPa)	green	...kPa COMP. AIR
compressed air (>700 kPa)	yellow	...kPa COMP. AIR
control air	green	CONTROL AIR

- .5 Colours for pipe identification legends and directional arrows are to be as follows:

Identification Colour	Legend and Arrow Colour
yellow	black
green	white
red	white

- .6 Medical gas piping identification materials and requirements are specified in Section 22 63 00 - Gas Systems for Laboratory and Healthcare Facilities.
- .7 Duct identification is to be custom made Mylar stencils with 50 mm (2") high lettering to accurately describe duct service, i.e. "AHU-1 SUPPLY", complete with a directional arrow, and coloured ink with ink pads and roller applicators. Ink colour is generally to be black but must contrast with lettering background.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- .1 Degrease and clean surfaces to receive adhesive for identification materials.

### 3.2 INSTALLATION

- .1 Identify new exposed piping and ductwork as per Part 2 of this Section in locations as follows:
- .1 at every end of every piping or duct run;
  - .2 adjacent to each valve, strainer, damper and similar accessory;
  - .3 at each piece of connecting equipment;
  - .4 on both sides of every pipe and duct passing through a floor, wall or partition, unless otherwise specified;
  - .5 at 6 m (20') intervals on pipe and duct runs exceeding 6 m (20') in length;
  - .6 at least once in each room, and at least once on pipe and duct runs less than 6 m (20') in length.
- .2 Unless otherwise specified identify new concealed piping and ductwork as per Part 2 of this Section in locations as follows:
- .1 at points where pipes or ducts enter and leave rooms, shafts, pipe chases, furred spaces, and similar areas;
  - .2 at maximum 6 m (20') intervals on piping and ductwork above suspended accessible ceilings, and at least once in each room;
  - .3 at each access door location;
  - .4 at each piece of connected equipment, automatic valve, etc.
- .3 Provide an identification nameplate for equipment provided as part of this project, including items such as control valves, motorized dampers, instruments, and similar products. Secure nameplates in place, approximately at eye level if possible, with stainless steel screws unless such a practice is

prohibitive, in which case use epoxy cement applied to cleaned surfaces. Locate nameplates in the most conspicuous and readable location.

- .4 Paint new natural and/or propane gas piping with primer and 2 coats of yellow paint in accordance with Code requirements. Identify piping at intervals as specified above.
- .5 Provide an identification nameplate for each motor starter or disconnect switch located in a motor control centre or on a motor starter panel, and on each individually mounted starter provided as part of mechanical work, and on each disconnect switch provided as part of the electrical work for motorized equipment provided as part of mechanical work.
- .6 For electrically traced mechanical work, identification wording is to include "ELECTRICALLY TRACED".
- .7 Tag valves and prepare a valve tag chart in accordance with following requirements:
  - .1 attach a valve tag to each new valve, except for valves located immediately at equipment they control;
  - .2 prepare a digital valve tag chart to list tagged valves, with, for each valve, the tag number, location, valve size, piping service, and valve attitude (normally open or normally closed);
  - .3 if an existing valve tag chart is available at site, valve tag numbering is to be an extension of existing numbering and new valve tag chart is to incorporate existing chart;
  - .4 include a copy of valve tag chart in each copy of operating and maintenance instruction manuals.
- .8 Where shut-off valves, control dampers, sensors, and similar items which will or may need maintenance and/or repair are located above accessible suspended ceilings, provide round coloured ceiling tacks in ceiling panel material, or stickers equal to Brady "Quick Dot" on ceiling grid material to indicate locations of items. Unless otherwise specified, ceiling tack or sticker colours are to be as follows:
  - .1 HVAC piping valves and equipment: yellow
  - .2 fire protection valves and equipment: red
  - .3 plumbing valves and equipment: green
  - .4 HVAC ductwork dampers and equipment: blue
  - .5 control system hardware and equipment: orange

## END OF SECTION

## **PART 1 - GENERAL**

### **1.1 SECTION INCLUDES**

- .1 This Section specifies mechanical system testing, adjusting, and balancing requirements that are common to mechanical work Sections of the Specification and it is a supplement to each Section and is to be read accordingly.

### **1.2 DEFINITIONS**

- .1 "Agency" – means agency to perform testing, adjusting and balancing work.
- .2 "TAB" – means testing, adjusting, and balancing to determine and confirm quantitative performance of equipment and systems and to regulate specified fluid flow rate and air patterns at terminal equipment, e.g., reduce fan speed, throttling, etc.
- .3 "hydronic systems" – includes heating water, chilled water, glycol-water solution, condenser water, and any similar system.
- .4 "air systems" – includes outside air, supply air, return air, exhaust air, and relief air systems.
- .5 "flow rate tolerance" – means allowable percentage variation, minus to plus, of actual flow rate values in Contract Documents.
- .6 "report forms" – means test data sheets arranged for collecting test data in logical order for submission and review, and these forms, when reviewed and accepted, should also form permanent record to be used as basis for required future testing, adjusting and balancing.
- .7 "terminal" – means point where controlled fluid enters or leaves the distribution system, and these are supply inlets on water terminals, supply outlets on air terminals, return outlets on water terminals, and exhaust or return inlets on air terminals such as registers, grilles, diffusers, louvers, and hoods.
- .8 "main" – means duct or pipe containing system's major or entire fluid flow.
- .9 "submain" – means duct or pipe containing part of the systems' capacity and serving 2 or more branch mains.
- .10 "branch main" – means duct or pipe servicing 2 or more terminals.
- .11 "branch" – means duct or pipe serving a single terminal.

### **1.3 SUBMITTALS**

- .1 Within 30 days of work commencing at site, submit name and qualifications of proposed testing and balancing agency in accordance with requirements of article entitled Quality Assurance below.
- .2 Submit sample test forms, if other than those standard forms prepared by Associated Air Balance Council (AABC) or National Environmental Balancing Bureau (NEBB), are proposed for use.
- .3 Submit a report by Agency to indicate Agency's evaluation of mechanical drawings with respect to service routing and location or lack of balancing devices. Include set of drawings used and marked-up by Agency to prepare report.

### **1.4 CLOSEOUT SUBMITTALS**

- .1 Submit a report by Agency after each site visit made by Agency during construction phase of this Project.
- .2 Submit a draft report, as specified in Part 3 of this Section.
- .3 Submit a final report, as specified in Part 3 of this Section.
- .4 Submit a testing and balancing warranty as specified in Part 3 of this Section.

- .5 Submit reports listing observations and results of post construction site visits as specified in Part 3 of this Section.

### 1.5 QUALITY ASSURANCE

- .1 Employ services of an independent testing, adjusting, and balancing agency meeting qualifications specified below, to be single source of responsibility to test, adjust, and balance building mechanical systems to produce design objectives. Agency is to have successfully completed testing, adjusting, and balancing of mechanical systems for a minimum of 5 projects similar to this Project within past 3 years, and is to be certified as an independent agency in required categories by one of following:
  - .1 AABC – Associated Air Balance Council;
  - .2 NEBB – National Environmental Balancing Bureau.
- .2 NBCTA certification in lieu of the above noted organizations is not permitted.
- .3 Testing, adjusting, and balancing of complete mechanical systems is to be performed over entire operating range of each system in accordance with one of following publications:
  - .1 National Standards for a Total System Balance published by Associated Air Balance Council;
  - .2 Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems published by National Environmental Balancing Bureau;
  - .3 Chapter 37, Testing, Adjusting, and Balancing of ASHRAE Handbook HVAC Applications.

## PART 2 - PRODUCTS – NOT USED

## PART 3 - EXECUTION

### 3.1 SCOPE OF WORK

- .1 Perform total mechanical systems testing, adjusting, and balancing. Requirements include measurement and establishment of fluid quantities of mechanical systems as required to meet design specifications and comfort conditions, and recording and reporting results.
- .2 Mechanical systems to be tested, adjusted and balanced include:
  - .1 TAB of medical gas systems is not part of TAB work and is specified in Section entitled Medical Gas Piping Systems.
  - .2 TAB of heating systems is to include piping and equipment fluid temperatures, flows and control, and if TAB is not done during heating season, a follow-up site visit during heating season will be required to confirm proper flows and temperatures, and any required system "fine tuning".
  - .3 TAB of cooling systems is also to include piping and equipment fluid temperatures, flows and control, and if TAB is not done during cooling season, a follow-up site visit during cooling season will be required to confirm proper flows and temperatures, and any required system "fine tuning".
  - .4 TAB of air handling systems is to include equipment and ductwork air temperatures, capacities and flows.
  - .5 Leakage testing of duct work and air handling units where indicated in those respective specification sections



### 3.2 TESTING, ADJUSTING, AND BALANCING

- .1 Conform to following:
  - .1 as soon as possible after award of Contract, Agency is to carefully examine a set of mechanical drawings with respect to routing of services and location of balancing devices, and is to issue a report listing results of the evaluation;
  - .2 set of drawings examined by Agency is to be returned with evaluation report, with red line mark-ups to indicate locations for duct system test plugs, and required revision work such as relocation of balancing devices and locations for additional devices;
  - .3 after review of mechanical work drawings and specification, Agency is to visit site at frequent, regular intervals during construction of mechanical systems, to observe routing of services, locations of testing and balancing devices, workmanship, and anything else that will affect testing, adjusting and balancing;
  - .4 after each site visit, Agency is to report results of site visit indicating date and time of visit, and detailed recommendations for any corrective work required to ensure proper adjusting and balancing;
  - .5 testing, adjusting and balancing is not to begin until:
    - .1 building construction work is substantially complete and doors have been installed;
    - .2 mechanical systems are complete in all respects, and have been checked, started, adjusted, and then successfully performance tested.
  - .6 mechanical systems to be tested, adjusted and balanced are to be maintained in full, normal operation during each day of testing, adjusting and balancing;
  - .7 obtain copies of reviewed shop drawings of applicable mechanical plant equipment and terminals, and temperature control diagrams and sequences;
  - .8 Agency is to walk each system from system "head end" equipment to terminal units to determine variations of installation from design, and system installation trades will accompany Agency;
  - .9 Agency is to check valves and dampers for correct and locked position, and temperature control systems for completeness of installation before starting equipment;
  - .10 wherever possible, Agency is to lock balancing devices in place at proper setting, and permanently mark settings on devices;
  - .11 Agency is to leak test ductwork as specified in Section entitled HVAC Air Distribution in accordance with requirements of SMACNA "HVAC Air Duct Leak Test Manual", coordinate work with work of aforementioned Sections, provide detailed sketch(es) to Sheet Metal Contractor and Consultant identifying ductwork not in accordance with acceptable leakage values specified in aforementioned Sections, and retest corrected ductwork;
  - .12 Agency is to balance systems with due regard to objectionable noise which is to be a factor when adjusting fan speeds and performing terminal work such as adjusting air quantities, and should objectionable noise occur at design conditions, Agency is to immediately report problem and submit data, including sound readings, to permit an accurate assessment of noise problem to be made;
  - .13 Agency is to check supply air handling system mixing plenums for stratification, and where variation of mixed air temperature across coils is found to be in excess of  $\pm 5\%$  of design requirements, Agency is to report problem and issue a detail sketch of plenum baffle(s) required to eliminate stratification;
  - .14 Agency is to perform testing, adjusting and balancing to within  $\pm 5\%$  of design values, and make and record measurements which are within  $\pm 2\%$  of actual values;

- .15 for air handling systems equipped with air filters, test and balance systems with simulated 50% loaded (dirty) filters by providing a false pressure drop;
- .16 test, adjust and balance air conditioning systems during summer season and heating systems during winter season, including at least a period of operation at outside conditions within 2.8°C (5°F) wet bulb temperature of maximum summer design condition, and within 5.5°C (10°C) dry bulb temperature of minimum winter design condition, and take final temperature readings during seasonal operation.
- .2 Prepare reports as indicated below.
  - .1 Upon completion of testing, adjusting, and balancing procedures, prepare draft reports on AABC or NEBB forms. Draft reports may be hand written, but must be complete, factual, accurate, and legible. Organize and format draft reports in same manner specified for final reports and submit for review.
  - .2 Upon verification and approval of draft reports, prepare final reports organized and formatted as specified below. Use units of measurement (SI or Imperial) as used on Project Documents.
  - .3 Report forms are to be those standard forms prepared by the referenced standard for each respective item and system to be tested, adjusted, and balanced. Report forms complete with schematic systems diagrams and other data are to be consolidated in electronic format as a PDF. PDF file to be indexed and organized into sections, as it applies to the project, as follows:
    - .1 General Information and Summary;
    - .2 Air Systems;
    - .3 Hydronic Systems;
    - .4 Temperature Control Systems;
    - .5 Special Systems.
  - .4 Agency is to provide following minimum information, forms and data in report:
    - .1 inside cover sheet to identify Agency, Contractor, and Project, including addresses, and contact names and telephone numbers and a listing of instrumentation used for procedures along with proof of calibration;
    - .2 remainder of report is to contain appropriate forms containing as a minimum, information indicated on standard AABC or NEBB report forms prepared for each respective item and system;
    - .3 Agency is to include for each system to be tested, adjusted and balanced, a neatly drawn, identified (system designation, plant equipment location, and area served) schematic "as-built" diagram indicating and identifying equipment, terminals, and accessories;
    - .4 Agency is to include report sheets indicating building comfort test readings for all rooms.
- .3 After final testing and balancing report has been submitted, Agency is to visit site with Contractor and Consultant to spot check results indicated on balancing report. Agency is to supply labour, ladders, and instruments to complete spot checks. If results of spot checks do not, on a consistent basis, agree with final report, spot check procedures will stop and Agency is to then rebalance systems involved, resubmit final report, and again perform spot checks with Contractor and Consultant.
- .4 When final report has been accepted, Contractor is to submit to Owner, in name of Owner, a certificate equal to AABC National Guaranty Certification or a NEBB Quality Assurance Program Bond, and in addition, Contractor is to submit a written extended warranty from Agency covering one full heating season and one full cooling season, during which time any balancing problems which occur, with exception of minor revision work done during scheduled site visits, will, at no cost, be investigated by Agency and reported on to Owner, and if it is determined that problems are a

result of improper testing, adjusting and balancing, they are to be immediately corrected without additional cost to Owner.

**END OF SECTION**

## PART 1 - GENERAL

### 1.1 SECTION INCLUDES

- .1 This Section specifies insulation requirements common to Mechanical Divisions work Sections and it is a supplement to each Section and is to be read accordingly.

### 1.2 DEFINITIONS

- .1 "concealed" – means mechanical services and equipment above suspended ceilings, in non-accessible chases, in accessible pipe spaces, and furred-in spaces.
- .2 "exposed" – means exposed to normal view during normal conditions and operations.
- .3 "mineral fibre" – includes glass fibre, rock wool, and slag wool.
- .4 "domestic water" or "potable water" – means piping extended from building Municipal supply main.

### 1.3 SUBMITTALS

- .1 Submit a product data sheet for each insulation system product.
- .2 Submit a fabrication drawing for each custom made cover to indicate material and fabrication details, and a 300 mm (12") square sample of proposed cover material.
- .3 Submit a colour chart for coloured lagging adhesive for canvas jacketed insulation.

### 1.4 CLOSEOUT SUBMITTALS

- .1 In accordance with Part 3 of this Section, submit a letter from fire rated duct wrap supplier to certifying duct wrap has been properly installed.

### 1.5 QUALITY ASSURANCE

- .1 Mechanical insulation is to be applied by a licensed journeyman insulation mechanic, or by an apprentice under direct, daily, on-site supervision of a journeyman mechanic.
- .2 Do not apply insulation unless leakage tests have been satisfactorily completed.
- .3 Ensure surfaces to be insulated are clean and dry.
- .4 Ensure ambient temperature is minimum 13°C (55°F) for at least 1 day prior to application of insulation, and for duration of insulation work, and relative humidity is and will be at a level such that mildew will not form on insulation materials.
- .5 Insulation materials must be stored on site in a proper and dry storage area. Any wet insulation material is to be removed from site.

## PART 2 - PRODUCTS

### 2.1 FIRE HAZARD RATINGS

- .1 Unless otherwise specified, insulation system materials inside building must have a fire hazard rating of not more than 25 for flame spread and 50 for smoke developed when tested in accordance with CAN/ULC-S102, Surface Burning Characteristics of Building Materials and Assemblies.

### 2.2 THERMAL PERFORMANCE

- .1 Unless otherwise specified, thermal performance of insulation is to meet or exceed values given in Tables entitled Minimum Piping Insulation Thickness Heating and Hot Water Systems and Minimum

Piping Insulation Thickness Cooling Systems, as stated in ANSI/ASHRAE/IES Standard 90.1 version referenced in Ontario Building Code.

## 2.3 PIPE INSULATION MATERIALS

- .1 Horizontal pipe insulation at hangers and supports are to be equal to Belform Insulation Ltd. "Koolphen K-Block" insulated pipe support inserts consisting of minimum 150 mm (6") long, pre-moulded, rigid, sectional phenolic foam insulation (of same thickness as adjoining insulation) with a reinforced foil and kraft paper vapour barrier jacket and a captive galvanized steel saddle.
- .2 Flexible foam elastomeric is to be closed cell, sleeve type, longitudinally split self-seal, foamed plastic pipe insulation with a water vapour transmission rating of 0.10 in accordance with ASTM E96, Procedure B, and required installation accessories.
  - .1 Manufacturers:
    - .1 Armacell AP/Armaflex SS;
    - .2 IK Insulation Group K-Flex "LS" Self-Seal Pipe Insulation.
- .3 Flexible foam elastomeric is to be closed cell, sleeve type, longitudinally split self-seal, foamed plastic pipe insulation with a water vapour transmission rating of 0.10 in accordance with ASTM E96, Procedure B, and required installation accessories.
  - .1 Manufacturers:
    - .1 Armacell AP/Armaflex SS;
- .4 Premoulded mineral wool is to be rigid, sectional, sleeve type, non-combustible, longitudinally split mineral wool, or basalt pipe insulation with a reinforced vapour barrier jacket.
  - .1 Manufacturers:
    - .1 Roxul "Tecton 1200";
    - .2 IIG (Johns Manville Inc.) MinWool-1200;
    - .3 Paroc 1200.
- .5 Fire rated pre-moulded mineral wool is to be non-combustible, fire-rated, rigid, sectional, longitudinally split mineral wool or basalt pipe insulation with a reinforced vapour barrier jacket and compatible with CAN/ULC-S115 and CAN/ULC-S101 firestopping.
  - .1 Manufacturers:
    - .1 Roxul "Tecton 1200";
    - .2 IIG (Johns Manville Inc.) MinWool-1200;
    - .3 Paroc 1200.
- .6 Pre-moulded mineral fibre is to be rigid, sectional, sleeve type insulation to ASTM C547, with a factory applied vapour barrier jacket.
  - .1 Manufacturers:
    - .1 Johns Manville Inc. "Micro-Lok AP-T Plus";
    - .2 Knauf Fiber Glass "Pipe Insulation" with "ASJ-SSL" jacket;
    - .3 Manson Insulation Inc. "ALLEY K APT";
    - .4 Owens Corning "Fiberglas" Pipe Insulation.
- .7 Blanket mineral fibre is to be blanket type roll insulation to CGSB 51-GP-11M, 24 kg/m<sup>3</sup> (1-½ lb/ft<sup>3</sup>) density, with a factory applied vapour barrier facing.
  - .1 Manufacturers:

- .1 Johns Manville Inc. Microlite FSK Duct Wrap Type 150;
- .2 Knauf Fiber Glass Blanket Insulation FSK Duct Wrap Type III;
- .3 Manson Insulation Inc. ALLEY WRAP FSK Duct Wrap Type III;
- .4 Certainteed Corporation Softtouch FSK Duct Wrap Type 150.

## **2.4 EQUIPMENT INSULATION MATERIALS**

- .1 Blanket mineral fibre is to be blanket type roll form insulation to ASTM C553, 24 kg/m<sup>3</sup> (1-½ lb/ft<sup>3</sup>) density, with a factory applied vapour barrier facing.
  - .1 Manufacturers:
    - .1 Johns Manville Inc. Microlite FSK Duct Wrap Type 150;
    - .2 Knauf Fiber Glass Blanket Insulation FSK Duct Wrap Type III;
    - .3 Manson Insulation Inc. ALLEY WRAP FSK Duct Wrap Type III;
    - .4 Certainteed Corporation Softtouch FSK Duct Wrap Type 150.
  - .2 Semi-rigid mineral fibre board is to be roll form, moulded insulation to ASTM C1393, with a factory applied vapour barrier facing consisting of laminated aluminum foil and kraft paper.
    - .1 Manufacturers:
      - .1 Knauf Fiber Glass Pipe and Tank Insulation;
      - .2 Manson Insulation Inc. "AK FLEX";
      - .3 Johns Manville Inc. Pipe and Tank Insulation "Micro-Flex";
      - .4 Multi-Glass Insulation Ltd. "MULTI-FLEX MF";
      - .5 Owens Corning Pipe and Tank Insulation;
      - .6 Glass-Cell Fabricators Ltd. "R-Flex".
  - .3 Closed cell foamed glass is to be Owens Corning "FOAMGLAS" expanded, rigid board and block type insulation with a liquid or vapour permeability rating (as per ASTM C240) of 0.00.

## **2.5 REMOVABLE/REUSABLE INSULATION COVERS**

- .1 Valve, etc. covers are to be NO SWEAT reusable insulation wraps with vapour barrier jacket and self-sealing ends and longitudinal seam, with a length to suit the application and an insulation thickness equal to adjoining insulation.
- .2 Custom manufactured equipment covers conforming to shape of item to be insulated, designed to be easily removable and replaceable to suit use and maintenance procedures of particular item, and to provide adequate personnel protection. Covers are to be complete with minimum 95 kg/m<sup>3</sup> (6 lb/ft<sup>3</sup>) density ceramic fibre insulation sewn between minimum 542.5 g/m<sup>2</sup> (1.8 oz/ft<sup>2</sup>) weight silicone impregnated fibreglass fabric in a quilted pattern using double stitches made with Kelvar or Teflon coated fibreglass thread. Overlap flaps are to be secured using laces, snaps, or Velcro double stitched in place.
- .3 Manufacturers:
  - .1 Crossby Dewar Inc.;
  - .2 Insufab Systems Inc.;
  - .3 ADL Insulflex Inc.;
  - .4 Firwin Corp.;

.5 GlassCell Isofab Inc.

## 2.6 DUCTWORK SYSTEM INSULATION MATERIALS

- .1 Rigid mineral fibre board is to be pre-formed board type insulation to ASTM C612, 48 kg/m<sup>3</sup> (3 lb/ft<sup>3</sup>) density, with a factory applied reinforced aluminum foil and kraft paper facing.
  - .1 Manufacturers:
    - .1 Knauf Fiber Glass Insulation Board with FSK facing;
    - .2 Manson Insulation Inc. "AK BOARD FSK";
    - .3 Johns Manville Inc. Type 814 "Spin-Glas";
    - .4 Owens Corning 703.
  - .2 Semi-rigid mineral fibre board is to be roll form insulation to ASTM C1393, consisting of cut strips of rigid mineral board insulation glued to an aluminium foil and kraft paper facing.
    - .1 Manufacturers:
      - .1 Multi-Glass Insulation Ltd. "Multi-Flex MKF";
      - .2 Glass-Cell Fabricators Ltd. "R-FLEX";
      - .3 Owens Corning Pipe and Tank Insulation;
      - .4 Johns Manville Inc. Pipe and Tank Insulation.
  - .3 Blanket mineral fibre is to be blanket type roll form insulation to ASTM C553, 24 kg/m<sup>3</sup> (1-½ lb/ft<sup>3</sup>) density, 40 mm (1-½") thick, with a factory applied vapour barrier facing.
    - .1 Manufacturers:
      - .1 Johns Manville Inc. Microlite FSK Duct Wrap Type 150;
      - .2 Knauf Fiber Glass Blanket Insulation FSK Duct Wrap Type III;
      - .3 Manson Insulation Inc. ALLEY WRAP FSK Duct Wrap Type III;
      - .4 Certainteed Corporation Softtouch FSK Duct Wrap Type 150.
  - .4 Flexible foam elastomeric sheet is to be sheet form, CFC free, closed cell, self-adhering elastomeric nitrile rubber insulation with a water vapour permeability rating of 0.08 in accordance with ASTM E96 Procedure A.
    - .1 Manufacturers:
      - .1 Armacell "AP/Armaflex SA";
      - .2 IK Insulation Group "K-Flex Duct Wrap", S2S.
  - .5 Extruded polystyrene tapered insulation – equal to Soprema Sopra-ISO Tapered, closed cell polyisocyanurate foam core with organic facers reinforced with glass fibres, 172 kPa compressive strength as per ASTM D1621, 32 kg/m<sup>3</sup> density, 50 mm minimum thickness, 2% slope. Thickness shall increase if width of duct work is larger than 1200 mm to maintain 2% slope.

## 2.7 FIRE RATED DUCT WRAP

- .1 Flexible, non-combustible, blanket type mineral fibre duct wrap completely encapsulated in reinforced foil, suitable for installation with zero clearance to combustibles (for grease ducts), and ULC tested and listed (ULC Designs FRD-17 & 23 for ventilation ducts, ULC Design FRD-19 for kitchen exhaust/grease duct) to facilitate a 2 hour fire resistance rating (76 mm (3") thick) to kitchen grease exhaust duct in accordance with requirements of NFPA 96, and/or a 1 hour or 2 hour fire



resistance rating (38 mm (1-½") thick) to ventilation or pressurization ductwork in accordance with requirements of ISO 6944.

- .2 Manufacturers:
  - .1 3M Fire Barrier Duct Wrap 615;
  - .2 CL4 Inc. "CL4Fire";
  - .3 Unifrax Corp. "FyreWrap Elite 1.5";
  - .4 Morgan Thermal Ceramics "FireMaster FastWrap XL".

## 2.8 INSULATING COATINGS

- .1 Equal to Robson Thermal Manufacturing Ltd. insulating coatings as follows:
  - .1 anti-condensation coating, "No Sweat-FX";
  - .2 thermal insulating coating, "ThermaLite".

## 2.9 INSULATION FASTENINGS

- .1 Wire – minimum 15 gauge galvanized annealed wire.
- .2 Wire with Mesh – minimum 15 gauge galvanized annealed wire factory woven into 25 mm (1") hexagonal mesh.
- .3 Aluminium Banding – equal to ITW Insulation Systems Canada "FABSTRAPS" minimum 12 mm (½") wide, 0.6 mm (1/16") thick aluminium strapping.
- .4 Stainless Steel Banding – equal to ITW Insulation Systems Canada "FABSTAPS" 0.6 mm (1/16") thick, minimum 12 mm (½") wide type 304 stainless steel strapping.
- .5 Duct Insulation Fasteners – weld-on 2 mm (3/32") diameter zinc coated steel spindles of suitable length, complete with minimum 40 mm (1-½") square plastic or zinc plated steel self-locking washers.
- .6 Tape Sealant – equal to MACtac Canada Ltd. self-adhesive insulation tapes, types PAF, FSK, ASJ, or SWV as required to match surface being sealed.
- .7 Mineral Fibre Insulation Adhesive – clear, pressure sensitive, brush consistency adhesive, suitable for a temperature range of -20°C to 82°C (-4°F to 180°F), compatible with type of material to be secured, and WHMIS classified as non-hazardous.
- .8 Flexible Elastomeric Insulation Adhesive – Armacell "Armaflex" #520 air-drying contact adhesive.
- .9 Closed Cell Foamed Glass Insulation Adhesive – Pittsburgh Corning PC88 multi-purpose 2-component adhesive.
- .10 Lagging Adhesive – white, brush consistency, ULC listed and labelled, 25/50 fire/smoke rated lagging adhesive for canvas jacket fabric, suitable for colour tinting, complete with fungicide and washable when dry.
- .11 Screws – No. 10 stainless steel sheet metal screws.

## 2.10 INSULATION JACKETS AND FINISHES

- .1 Canvas Jacket Material – ULC listed and labelled, 25/50 fire/smoke rated, roll form, minimum 170 g (6 oz).
- .2 Roll Form Sheet and Fitting Covers – minimum 15 mm (1/2") thick white PVC, 25/50 fire/smoke rated tested in accordance with CAN/ULC-S102, complete with installation and sealing accessories.
  - .1 Manufacturers:
    - .1 Proto Corp. "LoSMOKE";



- .2 The Sure-Fit System "SMOKE-LESS 25/50";
- .3 Johns Manville Inc. "Zeston" 300.
- .3 Rigid Aluminium Jacket – equal to ITW Insulation Systems Canada "Lock-on" 0.406 mm (0.016") thick embossed aluminum jacket material to ASTM B209, factory cut to size and complete with polysurlyn moisture barrier and continuous modified Pittsburgh Z-Lock, butt straps with "Fabstraps" to weatherproof the end to end joints, and 2-piece epoxy coated pressed aluminum fittings with weather locking edges.
- .4 Stainless Steel Jacket – equal to ITW Insulation Systems Canada "Lock-on" 0.254 mm (0.010") thick type 304 embossed stainless steel jacket material to ASTM A240, factory cut to size and complete with moisture barrier and continuous modified Pittsburgh Z-Lock, butt straps with "Fabstraps" to cover end to end joints, and 2-piece pressed stainless steel fittings with weather locking edges.
- .5 Adhesive backed flexible aluminium is to be MFM Building Products Corp. "Flex-Clad 400" roll form sheet material with an aggressive rubberized asphalt adhesive backing, high density polyethylene reinforcement, and an embossed aluminum facing.
- .6 Heat resistant, trowel consistency thermal insulating and finishing cement to CAN/CGSB 51.12, and suitable for the application.
- .7 Foamed glass insulation protective coating is to be Pittsburgh Corning "PITTCOTE 300e" flexible acrylic latex weather barrier coating, white unless otherwise specified.
- .8 UV and moisture resistant flexible foam insulation with protective jacket equal to Armacell "ArmaFlex Shield".
- .9 Self adhesive multilayer jacketing - equal to 3M Ventureclad 1577CW. Multi-ply laminate flexible jacketing, acrylic adhesive, zero permeability vapor barrier, 480 N/mm tensile strength, 22N/25 mm peel adhesion strength, 15.2 kPa shear adhesion after 72 hours, 147 N puncture resistance, 0.2 mm thickness.
- .10 Self adhesive multilayer jacketing - equal to 3M Ventureclad 1579GCW series. Multi-ply laminate flexible jacketing, acrylic adhesive, zero permeability vapor barrier.

## PART 3 - EXECUTION

### 3.1 GENERAL INSULATION APPLICATION REQUIREMENTS

- .1 Unless otherwise specified, do not insulate following:
  - .1 factory insulated equipment and piping;
  - .2 heating piping within radiation unit enclosures, including blank filler sections of enclosures;
  - .3 heating piping in soffits and/or overhang spaces and connected to bare element radiation in spaces;
  - .4 branch potable water piping located under counters to serve counter mounted plumbing fixtures and fittings, except barrier-free lavatories;
  - .5 exposed chrome plated potable water angle supplies from concealed piping to plumbing fixtures and fittings, except barrier-free lavatories;
  - .6 heated liquid system pump casings, valves, strainers and similar accessories;
  - .7 heating system expansion tanks;
  - .8 fire protection pump casings;
  - .9 manufactured expansion joints and flexible connections;
  - .10 acoustically lined ductwork and/or equipment;

- .11 factory insulated flexible branch ductwork;
- .12 fire protection system water storage tanks;
- .13 piping unions, except for unions in "cold" category piping.
- .2 Install insulation directly over pipes and ducts, not over hangers and supports.
- .3 Install piping insulation and jacket continuous through pipe openings and sleeves.
- .4 Install duct insulation continuous through walls, partitions, and similar surfaces except at fire dampers.
- .5 When insulating "cold" piping and equipment, extend insulation up valve bodies and other such projections as far as possible, and protect insulation jacketing from the action of condensation at its junction with metal.
- .6 When insulating vertical piping risers 75 mm (3") diameter and larger, use insulation support rings welded directly above lowest pipe fitting, and thereafter at 4.5 m (14.7') centres and at each valve and flange. Insulate as per Thermal Insulation Association of Canada National Insulation Standards, Figure No. 9.
- .7 Where piping and/or equipment is traced with electric heating cable, ensure cable has been tested and accepted prior to application of insulation, and ensure cable is not damaged or displaced during the application of insulation.
- .8 Where existing insulation work is damaged as a result of mechanical work, repair damaged insulation work to Project work standards.
- .9 Where mineral fibre rigid sleeve type insulation is terminated at valves, equipment, unions, etc., neatly cover exposed end of insulation with a purpose made PVC cover on "cold" piping, and with canvas jacket material on "hot" piping.
- .10 Carefully and neatly gouge out insulation for proper fit where there is interference between weld bead, mechanical joints, etc., and insulation. Bevel away from studs and nuts to permit their removal without damage to insulation, and closely and neatly trim around extending parts of pipe saddles.
- .11 Where thermometers, gauges, and similar instruments occur in insulated piping, and where access to heat transfer piping balancing valve ports and similar items are required, create a neat, properly sized hole in insulation and provide a suitable grommet in the opening.

### **3.2 INSULATION FOR HORIZONTAL PIPE AT HANGERS AND SUPPORTS**

- .1 At each hanger and support location for piping 50 mm (2") diameter and larger and scheduled to be insulated, except where roller hangers and/or supports are required, and unless otherwise specified, supply a factory fabricated section of phenolic foam pipe insulation with integral vapour barrier jacket and captive galvanized steel shield. Supply insulation sections to piping installers for installation as pipe is erected.
- .2 For 100 mm (4") diameter and larger heating system piping where roller type hangers and supports are provided, a steel saddle will be tack welded to pipe at each roller hanger or support location. Pack saddle voids with loose mineral wool insulation.

### **3.3 PIPE INSULATION REQUIREMENTS – MINERAL FIBRE**

- .1 Insulate following pipe inside building and above ground with mineral fibre insulation of thickness indicated:
  - .1 domestic cold water piping, less than 100 mm (4") dia. – 25 mm (1") thick;
  - .2 domestic cold water piping, greater than or equal to 100 mm (4") dia. – 40 mm (1-½") thick;
  - .3 domestic hot water piping, less than 40 mm (1-½") dia. – 25 mm (1") thick;

- .4 domestic hot water piping, greater than or equal to 40 mm (1½") dia. – 40 mm (1½") thick;
- .5 tempered domestic water piping, supply and return, less than 40 mm (1½") dia. – 25 mm (1") thick;
- .6 tempered domestic water piping, supply and return, greater than or equal to 40 mm (1½") dia. – 50 mm (2") thick;
- .7 storm drainage piping from roof drains to the point where main vertical risers extend straight down, without offsets, and connect to horizontal underground mains – 25 mm (1") thick;
- .8 condensate drainage piping from fan coil unit or any other air conditioning system/unit drain pans to main vertical drain risers or to indirect drainage point – 25 mm (1") thick;
- .9 drainage piping from refrigerated drinking fountains to nearest 75 mm (3") dia. or larger drain pipe – 25 mm (1") thick;
- .10 chilled water piping, supply and return, less than 100 mm (4") dia. – 25 mm (1") thick;
- .11 chilled water piping, supply and return, greater than or equal to 100 mm (4") dia. – 40 mm (1½") thick;
- .12 chilled glycol solution piping, supply and return, less than 100 mm (4") dia. – 25 mm (1") thick;
- .13 chilled glycol solution piping, supply and return, greater than or equal to 100 mm (4") dia. – 40 mm (1½") thick;
- .14 hot water heating piping, supply and return, less than 40 mm (1½") dia. – 40 mm (1½") thick;
- .15 hot water heating piping, supply and return, greater than or equal to 40 mm (1½") dia. – 50 mm (2") thick;
- .16 glycol solution heating or heat reclaim piping, supply and return, less than 40 mm (1½") dia. – 40 mm (1½") thick;
- .17 glycol solution heating or heat reclaim piping, supply and return, greater than or equal to 40 mm (1½") dia. – 50 mm (2") thick;
- .18 low pressure (to 140 kPa (20 psi)) steam piping, less than 100 mm (4") dia. – 65 mm (2½") thick;
- .19 low pressure (to 140 kPa (20 psi)) steam piping, greater than or equal to 100 mm (4") dia. – 80 mm (3") thick;
- .20 medium pressure (140 kPa to 415 kPa (20 psi to 60 psi)) steam piping, less than 40 mm (1½") dia. – 100 mm (4") thick;
- .21 medium pressure (140 kPa to 415 kPa (20 psi to 60 psi)) steam piping, greater than or equal to 40 mm (1½") dia. – 112 mm (4½") thick;
- .22 low pressure condensate piping, less than 40 mm (1½") dia. – 40 mm (1½") thick;
- .23 low pressure condensate piping, greater than or equal to 40 mm (1½") dia. – 50 mm (2") thick;
- .24 medium pressure condensate piping, less than 40 mm (1½") dia. – 40 mm (1½") thick;
- .25 medium pressure condensate piping, greater than or equal to 40 mm (1½") dia. – 50 mm (2") thick;
- .26 boiler feedwater piping complete – 25 mm (1") thick;
- .27 boiler blowdown piping complete – 40 mm (1½") thick;
- .28 chilled domestic cold water piping from remote water cooler(s) to drinking fountain(s) – 40 mm (1½") thick;
- .29 piping indicated to be traced with electric heating cable – minimum 50 mm (2") thick;
- .30 drum drip(s) in dry zone standpipe and/or sprinkler system piping – 50 mm (2") thick;
- .31 air compressor set fresh air intake piping – 25 mm (1") thick;

- .32 heat pump equipment earthloop piping – 25 mm (1") thick.
- .2 Secure overlap flap of the sectional insulation jacket tightly in place. Cover section to section butt joints with tape sealant.
- .3 Insulate fittings with sectional pipe insulation mitred to fit tightly, and cover butt joints with tape sealant, or, alternatively, wrap fittings with blanket mineral fibre insulation to a thickness and insulating value equal to the sectional insulation, secure in place with adhesive and/or wire, and cover with PVC fitting covers.
- .4 Unless otherwise specified, insulate unions, valves, strainers, and similar piping system accessories in "cold" piping with cut and tightly fitted segments of sectional pipe insulation with joints covered with tape sealant, or, alternatively, wrap piping union, valve, strainer, etc., with blanket mineral fibre and cover with PVC covers as for paragraph above.
- .5 Terminate sectional insulation approximately 50 mm (2") from flange or coupling on each side of flange or coupling. Cover flange or coupling with a minimum 50 mm (2") thickness of blanket mineral fibre insulation wide enough to butt tightly to ends of adjacent sectional insulation. Secure blanket insulation in place and cover with a purpose made PVC coupling cover.
- .6 Drum drips in dry zone sprinkler and/or standpipe system piping will be traced with electric heating cable as part of electrical work, and are generally not shown on drawing(s). Confirm number and size of drum drips required with trade providing piping and include for insulation to suit. Wherever possible drum drips will be located in heated areas.
- .7 Take special care at concealed water rough-in piping at plumbing fixtures to ensure piping is properly insulated. If necessary due to space limitations, use 12 mm (½") thick sectional pipe insulation in lieu of 25 mm (1") thick insulation.
- .8 Insulate seismic restraint hardware such as hanger rods, braces, anchors, etc., directly connected to "cold" category piping and equipment for a distance of 300 mm (12") from piping or equipment with insulation and finish to match pipe or equipment insulation. Coat seismic restraint hardware for a distance of 300 mm (12") from the termination of insulation with Robson Thermal "NO-SWEAT-FX" water based anti-condensation coating.

### 3.4 PIPE INSULATION REQUIREMENTS – MINERAL WOOL

- .1 Insulate following pipe inside building and above ground with high temperature mineral wool insulation of thickness indicated:
  - .1 high pressure (above 415 kPa (60 psi)) steam piping, less than 40 mm (1-½") dia. – 100 mm (4") thick;
  - .2 high pressure (above 415 kPa (60 psi)) steam piping, greater than or equal to 40 mm (1-½") dia. – 115 mm (4-½") thick;
  - .3 high pressure condensate piping – 50 mm (2") thick;
  - .4 engine-generator set exhaust system piping – 75 mm (3") thick.
- .2 Generally, install insulation on piping as specified above for mineral fibre insulation.
- .3 Generally, install insulation on fittings as specified above for mineral fibre insulation but cover with canvas, not PVC fitting covers.

### 3.5 PIPE INSULATION REQUIREMENTS – FLEXIBLE FOAM ELASTOMERIC

- .1 Install flexible elastomeric pipe insulation in strict accordance with manufacturer's published instructions to suit the application, and using adhesive, joint sealants, and finish to produce a water-tight installation. Insulate following pipe with flexible elastomeric pipe insulation of thickness indicated:
  - .1 refrigerant piping inside and outside building – 25 mm (1") thick.

### **3.6 PIPE INSULATION REQUIREMENTS – CLOSED CELL FOAMED GLASS**

- .1 Install closed cell foamed glass insulation in strict accordance with manufacturer's published instructions to suit the application, and using adhesive, joint sealants, and jacketing to produce a water-tight installation. Insulate following pipe with closed cell foamed glass of thickness indicated:
  - .1 piping located outside building and indicated to be heat traced – minimum 50 mm (2") thick.

### **3.7 PIPE INSULATION REQUIREMENTS – FIRE RATED INSULATION**

- .1 Where pipe (inside building and above ground) which is to be insulated as specified above penetrates fire rated construction, provide fire-rated, non-combustible sectional insulation on portion of pipe in fire barrier and for a distance of 50 mm (2") on either side of fire barrier. Insulation thickness is to be as specified, but in any case minimum 25 mm (1").

### **3.8 INSTALLATION OF WEATHER-PROOF JACKETED INSULATION**

- .1 Install sectional weather-proof jacketed pipe insulation in strict accordance with manufacturer's instructions to produce a water-tight weather-proof installation. Insulate fittings with blanket type glass fibre insulation of a thickness and insulating value equal to the sectional insulation and secured in place with adhesive and wire. Jacket fittings with manufactured aluminium fitting covers sealed water-tight. Insulate following pipe with weather-proof jacketed insulation:
  - .1 [ ];
  - .2 [ ].

### **3.9 INSTALLATION OF BARRIER FREE LAVATORY INSULATION KITS**

- .1 Provide manufactured insulation kits to cover exposed drainage and water piping under barrier free lavatories.

### **3.10 EQUIPMENT INSULATION REQUIREMENTS – BLANKET TYPE MINERAL FIBRE**

- .1 Insulate following equipment with mineral fibre blanket type insulation of thickness indicated:
  - .1 chilled water and/or domestic cold water pump casings – 40 mm (1-½") thick;
  - .2 roof drain sumps where inside the building – 25 mm (1") thick;
  - .3 water meter(s) – 40 mm (1-½") thick;
  - .4 top of radiant ceiling panels – per manufacturer's recommendation or minimum 50 mm (2") thick, whichever is greater.
- .2 Unless otherwise noted, wrap equipment to a thickness and insulating value equal to an equivalent thickness of rigid sectional pipe insulation. Laminate insulation in place with a full coverage of adhesive and secure with wire. Apply a jacket of insulation vapour barrier material secured in place with adhesive or sealant tape.
- .3 Cover roof drain sumps with purpose made PVC fitting covers.
- .4 Lay fibreglass blanket on radiant ceiling panels after testing is complete.

### **3.11 EQUIPMENT INSULATION REQUIREMENTS – SEMI-RIGID MINERAL FIBRE**

- .1 Insulate following equipment with semi-rigid mineral fibre board insulation of thickness indicated:
  - .1 refrigeration machine water chiller(s) and suction elbow(s) – 50 mm (2") thick;
  - .2 uninsulated domestic hot water storage tank(s) – 40 mm (1-½") thick;
  - .3 shell and tube type heat exchangers – 40 mm (1-½") thick;

- .4 condensate receiver(s) – 40 mm (1-½") thick;
- .5 flash tanks – 40 mm (1-½") thick;
- .6 hot well tank – 40 mm (1-½") thick;
- .7 deaerating feedwater heater – 40 mm (1-½") thick;
- .8 blow-down tank – 40 mm (1-½") thick;
- .9 chilled water or chilled glycol solution storage tank – 50 mm (2") thick;
- .10 heating main air separator – 40 mm (1-½") thick;
- .11 chilled water expansion tank – 40 mm (1-½") thick.
- .2 Install insulation as required to fit shape and contour of equipment. Secure insulation in place with adhesive, and with aluminum straps on 450 mm (18") centres. Apply a 6 mm (¼") thick skim coat of insulating cement, then, when insulating cement has dried, apply a 6 mm (¼") thick coat of cement trowelled smooth.
- .3 For "cold" equipment, prime insulation with suitable sealer and apply a jacket of glass thread reinforced foil and kraft paper vapour barrier jacket material laminated in place with a full coverage of adhesive.
- .4 Provide removable and replaceable insulated metal covers for equipment with removable heads to permit heads to be removed and replaced without damaging adjacent insulation work.

### 3.12 EQUIPMENT INSULATION REQUIREMENTS – SEMI-RIGID MINERAL WOOL

- .1 Insulate following equipment with calcium silicate equipment insulation of thickness indicated:
  - .1 engine-generator set exhaust system silencer(s) – 75 mm (3") thick;
  - .2 uninsulated boiler breeching where inside the building – 75 mm (3") thick.
- .2 Cut or mitre insulation (or use factory scored type insulation) to fit shape and contour of equipment and secure insulation in place with aluminum straps on 450 mm (18") centres. Point joints, mitres, scores and gaps with insulating cement. Apply a 12 mm (½") thick coat of insulating cement and trowel smooth.

### 3.13 EQUIPMENT INSULATION REQUIREMENTS – CLOSED CELL FOAMED GLASS

- .1 Insulate following equipment with closed cell foam glass insulation of thickness indicated:
  - .1 [ ];
  - .2 [ ].
- .2 Install insulation in strict accordance with manufacturer's published instructions using adhesive, wrap, sealant, etc., to secure insulation in place, to secure and seal joints, and to produce a 100% water-tight installation.

### 3.14 EQUIPMENT INSULATION REQUIREMENTS – REMOVABLE/REUSABLE TYPE

- .1 Provide custom designed and manufactured removable and reusable insulation covers for following:
  - .1 plate type heat exchanger(s);
  - .2 150 mm (6") dia. and larger piping strainers, backflow preventers, etc.;
  - .3 diesel engine exhaust manifolds;
  - .4 150 mm (6") dia. and larger steam traps and similar equipment.
- .2 Provide "wrap type" removable and reusable insulation covers for "cold" circuit balancing valves, backflow preventers, and similar items, and for steam traps and similar items requiring service in piping less than 150 mm (6") dia.



### 3.15 DUCTWORK INSULATION REQUIREMENTS – MINERAL FIBRE

- .1 Insulate following ductwork systems inside building and above ground with mineral fibre insulation of thickness indicated:
  - .1 Outdoor air and combustion air intake ductwork, casings and plenums from fresh air intakes to and including mixing plenums or sections, or, if mixing plenums or sections are not provided, to first heating coil, or if both mixing plenums or sections and heating coil sections are not provided, and fresh air is not tempered, then the fresh air ductwork system complete – minimum 40 mm (1-½") thick as required;
  - .2 mixed supply air or preheated supply air casings, plenums and sections to and including the fan section where not factory insulated – minimum 25 mm (1") thick rigid board or minimum 40 mm (1-½") thick flexible blanket as required;
  - .3 supply air ductwork outward from fans, except for supply ductwork exposed in area it serves – minimum 25 mm (1") thick rigid board or minimum 40 mm (1-½") thick flexible blanket as required;
  - .4 exhaust discharge ductwork for a distance of 3 m (10') downstream (back) from exhaust openings to atmosphere, including any exhaust plenums within the 3 m (10') distance – minimum 25 mm (1") thick rigid board or minimum 40 mm (1-½") thick flexible blanket as required;
  - .5 any other ductwork, casings, plenums, or sections specified or detailed on drawings to be insulated – thickness as specified.
- .2 Provide rigid board type insulation for casings, plenums, and exposed rectangular ductwork. Provide blanket type insulation for round ductwork and concealed rectangular ductwork.
- .3 Liberally apply adhesive to surfaces of exposed rectangular ducts and/or casings. Accurately and neatly press insulation into adhesive with tightly fitted butt joints. Provide pin and washer insulation fasteners at 300 mm (12") centres on bottom and side surfaces. Secure and seal joints with 75 mm (3") wide tape sealant. Additional installation requirements as follows:
  - .1 at trapeze hanger locations, install insulation between duct and hanger;
  - .2 provide drywall type metal corner beads on edges of ductwork, casings and plenums in equipment rooms, service corridors, and any other area where insulation is subject to accidental damage, and secure in place with tape sealant.
- .4 Liberally apply adhesive to surfaces of concealed rectangular or oval ductwork, and wrap insulation around duct with a top butt joint and tight section to section butt joints. Provide pin and washer insulation fasteners at 300 mm (12") centres on bottom surfaces. Secure and seal joints with 75 mm (3") tape sealant. At each trapeze type duct hanger, provide a 100 mm (4") wide full length piece of rigid mineral fibre board insulation between duct and hanger.
- .5 Accurately cut sections of insulation to fit tightly and completely around exposed and concealed round or oval ductwork. Liberally apply adhesive to surfaces of duct, and wrap insulation around duct with a top butt joint and tight section to section butt joints. Seal joints with tape sealant. At duct hanger locations install insulation between duct and hanger. At each hanger location for concealed ductwork where flexible blanket insulation is used, provide a 100 mm (4") wide full circumference strip of semi-rigid board type duct insulation between duct and hanger.
- .6 Insulation application requirements common to all types of rigid ductwork are as follows:
  - .1 at duct connection flanges, insulate flanges with neatly cut strips of rigid insulation material secured with adhesive to side surfaces of flange with a top strip to cover exposed edges of the side strips, then butt the flat surface duct insulation up tight to flange insulation, or, alternatively, increase insulation thickness to depth of flange and cover top of flanges with tape sealant;
  - .2 installation of fastener pins and washers is to be concurrent with duct insulation application;
  - .3 cut insulation fastener pins almost flush to washer and cover with neatly cut pieces of tape sealant;

- .4 accurately and neatly cut and fit insulation at duct accessories such as damper operators (with standoff mounting) and pitot tube access covers;
- .5 prior to concealment of insulation by either construction finishes or canvas jacket material, patch vapour barrier damage by means of tape sealant.

### **3.16 DUCTWORK INSULATION REQUIREMENTS – FLEXIBLE ELASTOMERIC**

- .1 Insulate exposed exterior ductwork (except outdoor air intake ductwork) and associated plenums and/or casings outside building with minimum 75 mm (3") thick flexible elastomeric sheet insulation as required, applied in 2 minimum 40 mm (1 ½") thick layers with staggered tightly butted joints.
- .2 Install with adhesive in strict accordance with manufacturer's instructions to produce a weather-proof installation. Ensure sheet metal work joints are sealed watertight prior to applying insulation.
- .3 Provide Calcium Silicate insulation between ductwork and duct supports. Tightly butt flexible elastomeric insulation to Calcium Silicate insulation. Cover Calcium Silicate insulation with a continuous sheet of self-adhesive multilayer jacketing which overlaps 75 mm past the Calcium Silicate insulation to the adjacent flexible elastomeric insulation.
- .4 Provide extruded polystyrene tapered insulation between flexible elastomeric insulation and jacketing to allow for water runoff on all exterior duct work.

### **3.17 DUCTWORK INSULATION REQUIREMENTS – CALCIUM SILICATE**

- .1 Insulate following kitchen exhaust ductwork with minimum 40 mm (1-½") thick calcium silicate block insulation:
  - .1 kitchen exhaust ductwork from exhaust hood to masonry shaft – 2 hour rating;
  - .2 stairwell pressurization ductwork from fan to stairwell – 1 hour rating;
  - .3 Trauma Room and Operating Room supply and exhaust ductwork complete – 1 hour rating.
- .2 Secure insulation in place with adhesive and with wire on 450 mm (18") centres. Point gaps and joints with insulating cement. Where ductwork is exposed, cover insulation with wire mesh secured to wire and with edges laced together and apply a coat of finishing cement trowelled smooth. Use drywall type metal corner bead for duct edges where finishing cement is applied.

### **3.18 DUCT WRAP REQUIREMENTS – FIRE RATED MATERIAL**

- .1 Provide blanket type fire rated duct wrap system material for following ductwork to produce fire rating indicated:
  - .1 kitchen exhaust ductwork from exhaust hood to masonry shaft – 2 hour rating;
  - .2 stairwell pressurization ductwork from fan to stairwell – 1 hour rating;
  - .3 Trauma Room and Operating Room supply and exhaust ductwork complete – 1 hour rating.
- .2 Install duct wrap material in accordance with ULC design requirements and supplier's/manufacturer's instructions.
- .3 Coordinate installation of duct wrap with installation of ductwork.
- .4 Arrange and pay for duct wrap supplier to examine completed duct wrap system at site. Submit a letter from supplier to certifying duct wrap system has been properly installed.

### **3.19 APPLICATION OF INSULATING COATINGS**

- .1 Apply, in accordance with manufacturer's instruction, insulating coatings to following bare metal surfaces:



- .1 paint bare metal surfaces clear of "cold" piping and/or equipment insulation for a distance of from 300 mm (12") to 600 mm (24") clear of pipe or equipment insulation, with "No Sweat-FX" anti-condensation coating;
- .2 paint bare metal surfaces associated with mechanical systems with an operating temperature 60°C (140°F) with "ThermaLite" insulating coating.
- .2 Apply coatings with a brush. Remove any splatter or excess coating from adjacent surfaces.

### 3.20 INSULATION FINISH REQUIREMENTS

- .1 Unless otherwise shown and/or specified, jacket exposed mineral fibre insulation, and calcium silicate duct insulation work inside building with canvas secured in place with a full covering coat of lagging adhesive. Accurately cut canvas with scissors or a knife. Do not rip or tear canvas to size. Remove lagging adhesive splatter from adjacent uninsulated surfaces.
- .2 Unless otherwise shown or specified, jacket exposed mineral fibre insulation listed below with canvas jacket secured in place with a full covering coat of coloured lagging adhesive. Accurately cut canvas with scissors or a knife. Do not rip or tear canvas to size. Remove lagging adhesive splatter from adjacent surfaces. Insulated services to receive coloured lagging adhesive are as follows:
  - .1 Chilled Water Piping;
  - .2 Chilled Glycol Piping
  - .3 Condenser Water Piping;
  - .4 Domestic Cold Water Piping;
  - .5 Domestic Hot Water Piping;
  - .6 Domestic Hot Water Recirculation Piping;
  - .7 High Temperature Heating Water Piping;
  - .8 High Temperature Heating Glycol Piping;
  - .9 Heating Water Piping;
  - .10 Condensate Drain Piping;
  - .11 Low Pressure Steam Piping;
  - .12 High Pressure Steam Piping;
  - .13 Indoor Ductwork;
  - .14 [ ].
- .3 Jacket exposed pipe insulation work inside building with white sheet PVC and fitting covers. Install sheet PVC and fitting covers tightly in place with overlapped circumferential and longitudinal joints arranged to shed water. Seal joints to produce a neat water-tight installation. Provide slip-type expansion joints where required by manufacturer's instructions.
- .4 Install rigid aluminum jacket material tightly in place with overlapped circumferential joints positioned to shed water and covered with butt straps supplied with the jacket. Provide aluminum jacket for following insulation:
  - .1 Chilled Water Piping;
  - .2 Chilled Glycol Piping
  - .3 Condenser Water Piping;
  - .4 High Temperature Heating Water Piping;
  - .5 High Temperature Heating Glycol Piping;
  - .6 Heating Water Piping;
  - .7 Condensate Drain Piping;

- .8 Refrigerant Piping;
- .9 Outdoor Ductwork;
- .10 [ ].
- .5 Install adhesive backed flexible aluminum to cleaned and primed metal surfaces which are between -23°C and 74°C (-10°F and 165°F) in strict accordance with manufacturer's published instructions and details, including shingle type overlap joints to shed water, and use of a hand roller to concentrate pressure on seams. Provide adhesive backed flexible aluminum jacket for following insulation:
  - .1 Chilled Water Piping;
  - .2 Chilled Glycol Piping
  - .3 Condenser Water Piping;
  - .4 High Temperature Heating Water Piping;
  - .5 High Temperature Heating Glycol Piping;
  - .6 Heating Water Piping;
  - .7 Condensate Drain Piping;
  - .8 Refrigerant Piping;
  - .9 Outdoor Ductwork;
  - .10 [ ].
- .6 Install rigid stainless steel jacket material tightly in place with overlapped circumferential joints positioned to shed water and covered with butt straps supplied with jacket. Provide stainless steel jacket for following:
  - .1 Chilled Water Piping;
  - .2 Chilled Glycol Piping
  - .3 Condenser Water Piping;
  - .4 High Temperature Heating Water Piping;
  - .5 High Temperature Heating Glycol Piping;
  - .6 Heating Water Piping;
  - .7 Condensate Drain Piping;
  - .8 Refrigerant Piping;
  - .9 Outdoor Ductwork;
  - .10 [ ].
- .7 Apply 2 heavy coats of "PITTCOTE 300e" coating with 24 hr between coats to foamed glass insulation exposed above grade.
- .8 Apply 2 coats (with 24 hr between coats) of specified coating to flexible elastomeric insulation outside building.
- .9 Install 3M Ventureclad series [1577CW] [1579GCW] on insulated ductwork and ensure supports are installed on the outside of the jacketing. Jacketing shall be finished as [Flat White] [Aluminum] [Aluminum Embossed]. Provide necessary insulation and jacketing materials at the time of duct work installation. Do not penetrate jacketing or install jacketing around duct supports. Provide 24GA G90 38 mm x 38 mm steel angle to protect all corners of rectangular ductwork and install between insulation and jacketing. Steel angle shall be continuous on entire duct work run. Provide additional steel angle between jacketing and duct support. Ensure jacketing is continuous with minimum 75 mm (or as required by manufacturer) overlapping on all joints. Provide jacketing on the following duct work:

- .1 Exposed exterior duct work including outdoor air intake duct work, plenums and casings installed outside;
- .2 Exposed interior insulated duct work;
- .3 Interior outdoor air intake duct work, plenums, and casings;
- .4 Single wall plenum casings (intake or exhaust) field insulated;
- .5 Wherever indicated on drawings;
- .10 Install 3M Ventureclad series [1577CW] [1579GCW] on exposed piping and ensure supports are installed on the outside of the jacketing. Do not penetrate or install jacketing around pipe supports. Jacketing shall be finished as [Flat White] [Aluminum] [Aluminum Embossed]. Provide galvanized insulation shield between insulation and jacketing at support points. Ensure jacketing is continuous with minimum 75 mm (or as required by manufacturer) overlapping on all joints. Provide jacketing on the following piping:
  - .1 Chilled water;
  - .2 Chilled glycol;
  - .3 High Temperature Heating Water;
  - .4 High Temperature Heating Glycol;
  - .5 Heating Water;
  - .6 Heating glycol;
  - .7 Low pressure steam (<104 kPa);
  - .8 Low pressure steam (<104 kPa) condensate;
  - .9 Domestic cold water piping;
  - .10 Domestic hot water piping;
  - .11 Coil condensate drain piping;
  - .12 Wherever indicated on drawings.

**END OF SECTION**

## **PART 1 - GENERAL**

### **1.1 SECTION INCLUDES**

- .1 This Section specifies commissioning requirements that are common to Mechanical Divisions work Sections and it is a supplement to each Section and is to be read accordingly. When requirements of this Section contradict requirements of Division 00 or Division 01, conditions of Division 00 or Division 01 to take precedence.

### **1.2 COMMISSIONING AGENT INVOLVEMENT VERSUS WARRANTY OBLIGATIONS**

- .1 Involvement of Commissioning Agent performing duties as described in this Section is not in any way to void or alter any Contractual warranty obligations.

### **1.3 SUBMITTALS**

- .1 Submit to Commissioning Agent, at same time as submittal to the Consultant, one copy of each shop drawing or product data sheet associated with equipment or systems to be commissioned.
- .2 Submit for review, a Commissioning Plan with schedule, commissioning procedures for commissioning events, and a copy of Commissioning Agent's commissioning data sheets for equipment/systems to be commissioned.
- .3 Submit a list of commissioning instruments and for each instrument, indicate purpose of instrument and include a recent calibration certificate.
- .4 Submit equipment and system manufacturer's start-up and test report sheets for review a minimum of 1 month prior to equipment and system start-up procedures.

### **1.4 CLOSEOUT SUBMITTALS**

- .1 After start-up and successful pre-functional performance testing and submittal of completed forms, submit, for each system or subsystem, a letter confirming pre-functional performance testing has been successfully completed and system or subsystem is ready for functional performance testing and commissioning process to commence.

### **1.5 DEFINITIONS**

- .1 Commissioning: process of demonstrating to Owner and Consultant, for purpose of final acceptance, by means of successful and documented functional performance testing, that systems and/or subsystems are capable of being operated and maintained to perform in accordance with requirements of Contract Documents, all as further described below.
- .2 Commissioning Agent: commissioning authority who will supervise commissioning process, and who will recommend final acceptance of commissioned mechanical work.
- .3 Start-Up and Adjusting: process of equipment manufacturer's/supplier's technical personnel, with Contractor, starting and operating equipment and systems, making any required adjustments, documenting process, and submitting manufacturer's/supplier's start-up reports to confirm equipment has been properly installed and is operational as intended.
- .4 Pre-Functional Performance Testing: testing, adjusting and operating of components, equipment, systems and/or subsystems, by Contractor, after start-up but before functional performance testing, to confirm components, equipment, systems and/or subsystems operate in accordance with requirements of Contract Documents, including modes and sequences of control and monitoring, interlocks, and responses to emergency conditions, and including submittal of pre-functional performance testing documentation sheets.
- .5 Functional Performance Testing: a repeat of successful pre-functional performance testing by Contractor, in presence of Commissioning Agent and the Consultant with completed Commissioning

Agent's commissioning documentation sheets to document, validate and verify equipment, systems and subsystems are complete in all respects, function correctly, and are ready for acceptance.

- .6 Commissioning Documentation Sheets: prepared sheets for pre-functional performance testing and for functional performance testing supplied by Commissioning Agent for each piece of equipment/system to be commissioned, each sheet or set of sheets complete with Project name and number, date of commissioning, equipment/system involved, equipment/system name and model number, equipment tag in accordance with drawings, and, for each commissioning procedure listed, a column giving expected data in accordance with Contract Documents, a column to fill in observed data during commissioning, and space for signatures of Contractor and Commissioning Agent.
- .7 Systems Operating Manual: a manual prepared by Commissioning Agent to present an overview of building mechanical systems and equipment to be used by building maintenance personnel to assist them in daily operation of systems.
- .8 Validate: to confirm by examination and witnessing tests correctness of equipment and system operation.

## **1.6 COMMISSIONING AGENT**

- .1 Commissioning Agent will be retained and paid by Owner to perform mechanical work commissioning specified in this Section. Cooperate in all respects with Owner's Commissioning Agent.

## **1.7 QUALITY ASSURANCE**

- .1 Commissioning work is to be in accordance with requirements of following:
  - .1 CSA Z320, Building Commissioning Standard and Check Sheets;
  - .2 CSA Z8001, Commissioning of Health Care Facilities;
  - .3 ASHRAE Guideline 0, The Commissioning Process;
  - .4 ASHRAE Guideline 1.1, The HVAC Commissioning Process;
  - .5 ASHRAE Guideline 1.2, The Commissioning Process for Existing HVAC&R Systems;
  - .6 ASHRAE Guideline 1.5, Commissioning Smoke Control Systems;
  - .7 Owner designated Commissioning Agent.

## **1.8 COMMISSIONING OBJECTIVES**

- .1 Objectives of commissioning process:
  - .1 to support quality management by means of monitoring and checking installation;
  - .2 to verify equipment/system performance by means of commissioning of completed installation;
  - .3 to move completed equipment/systems from "static completion" state to "dynamic" operating state so as to transfer a complete and properly operating installation from Contractor to Owner.

## **1.9 TESTING EQUIPMENT**

- .1 Supply instruments and test equipment required to conduct start-up, testing and commissioning procedures.

## **PART 2 - PRODUCTS – NOT USED**

## **PART 3 - EXECUTION**

### **3.1 COMMISSIONING**

- .1 Commission work in accordance with requirements of this Section and as required by Commissioning Agent.
- .2 Prerequisites to successful completion of commissioning:
  - .1 submittal of signed start-up and test reports;
  - .2 completion of system testing, adjusting and balancing (TAB), and acceptance of TAB reports;
  - .3 permanent electrical and control connections of equipment;
  - .4 successful completion and documentation of pre-functional performance testing;
  - .5 submittal of letters to the Consultant certifying systems and subsystems have been started, tested, adjusted, successfully pre-functional performance tested, are ready for functional performance testing, and are in accordance with requirements of Contract Documents.

### **3.2 PHASING OF COMMISSIONING**

- .1 If Project will be constructed in phases, phase commissioning accordingly to suit progress and phases of Work.

### **3.3 DEFICIENCIES LISTED DURING COMMISSIONING**

- .1 Correct deficiencies listed by the Consultant and Commissioning Agent during commissioning process within 15 calendar days of notification unless agreed otherwise with the Consultant, and when deficiencies have been corrected, notify the Consultant and Commissioning Agent immediately.

### **3.4 SYSTEMS TO BE COMMISSIONED**

- .1 Mechanical systems to be commissioned include, but are not to be limited to, systems described below. Specific commissioning procedures are to be as directed by Commissioning Agent.
- .2 Commissioning of drainage systems includes:
  - .1 commissioning of drainage pumps and controls by means of tests recommended by manufacturer to confirm proper operation and performance;
  - .2 commissioning of equipment such as interceptors and backflow preventers.
- .3 Commissioning of fire protection systems will be considered complete upon preparation and submittal by Contractor of completion certificates required by applicable NFPA Standards, demonstration of proper system operation to local Fire Chief and any other authorities, including Owner's insurance underwriter as required, and coordination and cooperation with fire alarm system commissioning procedures, in particular smoke control systems and other such fan system control sequences.
- .4 Commissioning of water systems (all piping extended from Municipal main) includes:
  - .1 commissioning of pumps and controls;
  - .2 commissioning of water heaters;
  - .3 commissioning of piping specialties such as backflow preventers, mixing valves, and similar components;

- .4 commissioning of trap seal primer units, including adjustment of water flows and confirmation of water flow at each connected trap;
- .5 commissioning of plumbing fixtures.
- .5 Commissioning of medical gas systems is not part of mechanical commissioning work and will be done as part of work specified in the Section 22 60 00.70 – Gas and Vacuum Systems for Laboratory and Healthcare Facilities.
- .6 Commissioning of heating systems includes piping, piping specialties, equipment, and control, as well as checking and validating temperature and flow documentation contained in TAB reports. If TAB is not done during heating season, a follow-up site visit during heating season will be required to confirm proper flows and temperatures, and any required system "fine tuning".
- .7 Commissioning of cooling systems includes piping, piping specialties, equipment, and control, as well as checking and validating temperature and flow documentation contained in TAB reports. If TAB is not done during cooling season, a follow-up site visit during cooling season will be required to confirm proper flows and temperatures, and any required system "fine tuning".
- .8 Commissioning of HVAC chemical treatment systems includes feed and monitoring equipment, and testing of system fluids to confirm proper concentration of chemical.
- .9 Commissioning of air handling systems includes equipment, ductwork, ductwork specialties, controls, interlocks, and checking and validating air capacities and flows in accordance with TAB reports.
- .10 Control work commissioning includes confirmation of proper operation of individual control components, and overall operation of controls in conjunction with operation of connected building systems, including heating season/cooling season testing requirements specified above.
- .11 Commissioning of BAS includes confirmation of proper operation of components, input/output points, hardware and software, and demonstration of system performing required procedures.
- .12 Commissioning of special usage room controls includes confirmation of proper operation of individual components, and proper operation of overall control system, all in accordance with governing Codes and Standards.
- .13 Commissioning of noise and vibration control equipment includes noise and vibration measurements to confirm proper operation of equipment.

### 3.5 COMMISSIONING PROCESS

- .1 Perform commissioning process in stages and include, but not be limited to, following:
  - .1 Stage 1: Commissioning of equipment/systems as listed in this Section, which is a prerequisite to an application for Substantial Performance of the Work and includes supervising and validating results of functional performance testing, and submittal of reviewed Systems Operating Manual.
  - .2 Stage 2: Commissioning work performed 12 months after issue of a Certificate of Substantial Performance and which includes supervision of Contractor's "fine tuning" of equipment/systems through seasonal occupancy, and any other such work to achieve optimal comfort and performance conditions.
  - .3 Stage 3: Successful completion of satisfactory equipment/system operation during 1st month after issue of a Certificate of Total Performance of the Work.
  - .4 Stage 4: Successful completion of satisfactory equipment/system operation during 3rd month after issue of a Certificate of Total Performance of the Work.
  - .5 Stage 5: Successful seasonal commissioning of building.



### 3.6 RESPONSIBILITIES OF CONTRACTOR

- .1 During construction phase, Contractor is to:
  - .1 prepare and submit an installation schedule which includes a time schedule for each activity with lead and lag time allowed and indicated, shop drawing and working detail drawing submissions, and major equipment factory testing and delivery dates;
  - .2 prepare and submit a commissioning schedule which is to include a time schedule coordinated with installation schedule referred to above and Commissioning Agent, and allowances for additional time for re-tests as may be required, and update schedule on a monthly basis as required;
  - .3 when requested by Commissioning Agent, arrange site commissioning meetings with Owner, the Consultant, and applicable subcontractors present, to be chaired by Commissioning Agent who will also prepare and distribute meeting minutes;
  - .4 promptly correct reported deficient work, and report when corrective work is complete;
  - .5 where required by Codes and/or Specification, retain equipment manufacturers/suppliers or independent 3rd parties to certify correct installation of equipment/systems;
  - .6 under supervision of equipment manufacturers/suppliers, start-up and adjust equipment to design requirements, and submit start-up sheets which include equipment data such as manufacturer and model number, serial number where applicable, and performance parameters, all signed by equipment manufacturer/supplier and Contractor;
  - .7 complete Commissioning Agent's commissioning data sheets for multiple items of smaller equipment such as air terminal boxes, fan coil units, backflow preventers, etc., submit sheets to Commissioning Agent, accompany Commissioning Agent for an on-site check of 30% of data sheet information for each type of equipment, and perform any corrective action required as a result of site checks;
  - .8 perform system testing, adjusting and balancing and, when complete, issue a copy of final report to Commissioning Agent for review and a site check of results, and perform any corrective work required as a result of site checks by Commissioning Agent;
  - .9 in accordance with updated commissioning schedule and actual progress at site, certify in writing to the Consultant and Commissioning Agent that equipment and/or systems are complete, have been checked, started and adjusted, successfully pre-functional performance tested and documented, and are ready for functional performance testing and commissioning procedures, giving the Consultant and Commissioning Agent a minimum of 5 working days' notice;
  - .10 perform system and subsystem functional performance testing under supervision of Commissioning Agent, and submit to the Consultant and Commissioning Agent, completed and signed functional performance testing and commissioning data sheets (issued by Commissioning Agent) and also signed by Commissioning Agent.
- .2 During post construction phase, Contractor is to:
  - .1 optimize system operation in accordance with building occupant's needs and comments using System Operation Manual prepared by Commissioning Agent as reference;
  - .2 complete commissioning procedures, activities, and performance verification procedures that were delayed or not concluded during construction phase;
  - .3 accompanied by Commissioning Agent, complete system checks and "fine tuning" with signed documentation as follows:
    - .1 once during 1st month of building operation;
    - .2 once during 3rd month of building operation;



- .3 once between 4th and 10th months in a season opposite to 1st and 3rd month visits.
- .4 correct deficiencies revealed by system checks described above, and, where required, involve equipment manufacturers/suppliers during corrective actions, and report completion of corrective work;
- .5 3 months after Substantial Completion conduct a question and answer session(s) at building with Owner's operating and maintenance personnel, with duration of session(s) dictated by number of questions and concerns that have to be addressed.

**END OF SECTION**

## **PART 1 - GENERAL**

### **1.1 REFERENCES**

- .1 Domestic water piping and valves are to comply with following codes, regulations, and standards (as applicable):
  - .1 applicable local codes and regulations;
  - .2 CAN/CSA B64, Backflow Preventers and Vacuum Breakers;
  - .3 CAN/CSA B125.1, Plumbing Supply Fittings;
  - .4 CAN/CSA B125.3, Plumbing Fittings;
  - .5 CAN/CSA B137 Series, Thermoplastic Pressure Piping Compendium;
  - .6 NSF/ANSI 14, Plastics Piping System Components and Related Materials;
  - .7 NSF/ANSI 61, Drinking Water System Components – Health Effects;
  - .8 NSF/ANSI 372, Drinking Water System Components – Lead Content.

### **1.2 SUBMITTALS**

- .1 Submit shop drawings/product data sheets for all products specified in Part 2 of this Section except for pipe, fittings, and chlorine solution.

### **1.3 CLOSEOUT SUBMITTALS**

- .1 Submit laboratory water purity test results indicating chlorine residual prior to application for Substantial Performance of the Work.
- .2 Prior Substantial Performance of the Work, submit a minimum of 3 identified keys for key operated hydrants.

## **PART 2 - PRODUCTS**

### **2.1 PIPE, FITTINGS, AND JOINTS**

- .1 Copper - Solder Joint
  - .1 Type "L" hard drawn seamless copper to ASTM B88, complete with copper solder type fittings to ASME/ANSI B16.18 and soldered joints using The Canada Metal Co. Ltd. "SILVABRITE 100" or equal lead-free solder for cold water pipe, and 95% tin / 5% Antimony or "SILVABRITE 100" solder for other services.

### **2.2 SHUT-OFF VALVES**

- .1 Ball Valves
  - .1 Class 600, 4140 kPa (600 psi) WOG rated, lead-free, full port ball type valves, each complete with a forged brass body with solder ends, forged brass cap, blowout-proof stem, 304 stainless steel ball, "Teflon" or "PTFE" seat, and a removable lever handle. Valves in insulated piping are to be complete with stem extensions.
  - .2 Manufacturers:
    - .1 Toyo Valve Co.
    - .2 Milwaukee Valve Co.
    - .3 Kitz Corporation.

- .4 Apollo Valves.
- .5 Watts Industries (Canada) Inc.
- .2 Butterfly Valves – Grooved End
  - .1 Equal to Victaulic Series 608N, for copper pipe rated to 300 psi and be both bi-directional and dead-end service capable to full rated pressure. Seat material shall be EPDM UL Classified in accordance with ANSI/NSF 61 for ambient +86°F and hot +180°F potable water service and ANSI/NSF 372.
  - .2 Victaulic Series 461, for stainless steel pipe rated to 300 psi and be both bi-directional and dead-end service capable to full rated pressure. Seat material shall be EPDM UL Classified in accordance with ANSI/NSF 61 for ambient +86°F and hot +180°F potable water service and ANSI/NSF 372.

## 2.3 CHECK VALVES

- .1 Horizontal
  - .1 Lead-free, Class 125, bronze, 1380 kPa (200 psi) WOG rated horizontal swing type check valves with solder ends.
  - .2 Manufacturers:
    - .1 Toyo Valve Co. Fig. 237A-LF;
    - .2 Milwaukee Valve Co. #UP1509;
    - .3 Kitz Corporation Code 823;
    - .4 Apollo Valves #61LF Series.
- .2 Vertical
  - .1 Equal to Kitz Corp. Code 826, lead-free, 1725 kPa (250 psi) WOG rated vertical lift check valve with soldering ends.

## 2.4 DRAIN VALVES

- .1 Minimum 2070 kPa (300 psi) water rated, 20 mm ( $\frac{3}{4}$ ") dia., straight pattern full port bronze ball valves, each complete with a threaded outlet suitable for coupling connection of 20 mm ( $\frac{3}{4}$ ") dia. garden hose, and a cap and chain. Ball material to be 304 stainless steel.
- .2 Manufacturers:
  - .1 Toyo Valve Co.
  - .2 Dahl Brothers Canada Ltd.
  - .3 Kitz Corporation.
  - .4 Apollo Valves.
  - .5 Watts Industries (Canada) Inc.

## 2.5 DOMESTIC HOT WATER PIPING BALANCING VALVES

- .1 Equal to Victaulic Series 76X Low Lead Balancing Valve, lead-free and compliant with NSF-61 and NSF-372 for use in potable water applications, automatic flow limiting balancing valve (+/-5% over rated operating pressure range), complete with removable flow cartridge.
- .2 Equal to Victaulic TA Series 78BL, solder or flange end type as required, ball valve style, lead-free and compliant with NSF-61 and NSF-372 for use in potable water applications, circuit balancing valves designed to facilitate precise flow measurement, precision flow balancing, and positive shut-

off, complete with capped and valved drain connection, and valved ports for connection to a differential pressure meter.

## 2.6 PRESSURE REDUCING VALVES

- .1 For piping less than or equal to 50 mm (2") diameter, lead-free, non-corrosive, non-ferrous direct spring acting pressure reducing valves to CAN/CSA B356, each factory set at 345 kPa (50 psi) unless otherwise specified or required, each field adjustable from 175 kPa (25 psi) to 520 kPa (75 psi) and each complete with an integral inlet strainer.
  - .1 Manufacturers:
    - .1 Apollo Valves #36HLF Series;
    - .2 Zurn/Wilkins #600XL Series;
    - .3 Watts Industries (Canada) Inc. #LF25AUB-Z3 Series;
    - .4 Cash-Acme EB-25 Series;
    - .5 Bermad Series 935-H.
  - .2 For piping greater than or equal to 65 mm (2-½") diameter, lead-free, non-corrosive pilot operated pressure reducing valve to CAN/CSA B356, factory set at required pressure, field adjustable, and complete with screwed or flanged connections, and brass body pilot valve with stainless steel seat.
    - .1 Manufacturers:
      - .1 Singer Valve #106 PR;
      - .2 Zurn/Wilkins #ZW209;
      - .3 Watts Industries (Canada) Inc. #LFM115 Series;
      - .4 Bermad Series 972.

## 2.7 CHLORINE

- .1 Sodium hypochlorite to AWWA B300.

## 2.8 FLOOR DRAIN TRAP SEAL PRIMERS

- .1 Primer Valve Type
  - .1 Precision Plumbing Products Inc. Model P2-500 trap primer valve, constructed of brass, adjustable to high or low water pressures and complete with "O" ring seals, 12 mm (½") threaded inlet and outlet connections, and, for priming two traps from the same primer, a DU-2 dual outlet distribution unit.
- .2 Primer Valve Type with Manifold
  - .1 Precision Plumbing Products Inc. Model P1-500 trap primer valve constructed as specified above for the Model P2-500 primer valve, complete with a Model DU-3 or DU-4, 3 or 4 outlet distribution unit for priming 3 or 4 traps, and at Model "YS-8" supply tube with combinations of Model DU-3 and DU-4 distribution units for priming from 5 to 6 traps.
- .3 Electronic Type
  - .1 Precision Plumbing Products #PT Series surface wall mounting, CSA certified, 115 volt, 1-phase, 60 Hz., electronic, automatic trap priming manifolds, each sized to suit the number of drain traps or interceptors serviced, and each complete with:
    - .1 galvanized steel cabinet with door;
    - .2 20 mm (¾") dia. NPT copper pipe inlet with shut-off valve and water hammer arrestor;

- .3 solenoid valve, an atmospheric vacuum breaker, and a discharge manifold with 12 mm (½") dia. compression type copper tube connections on 40 mm (1-½") centres with quantity to suit the number of items to be primed;
- .4 control panel with circuit breaker, 5 ampere fuse, 24 hour timer, and manual override toggle switch.

## 2.9 SHOCK ABSORBERS

- .1 Type 304 stainless steel piping shock absorbers, each complete with a nesting type bellows and a casing of sufficient displacement volume to dissipate kinetic energy generated in piping system, and each sized to suit connecting water pipe and equipment it is provided for.
- .2 Manufacturers:
  - .1 Watts Industries (Canada) Inc. "SG" Series.
  - .2 Jay R. Smith 5000 Series "HYDROTROL";
  - .3 Zurn #Z1700 "SHOKTROL";
  - .4 Mifab "HAMMERGUARD" WHB Series;

## 2.10 WATER HAMMER ARRESTORS

- .1 Piston type, sealed, all stainless steel construction, pressurized water hammer arrestors suitable for either vertical or horizontal installation, each complete with a pressurized compression chamber, welded nesting-type expansion bellows surrounded by non-toxic mineral oil, and a male treaded nipple connection.
- .2 Manufacturers:
  - .1 Jay R. Smith 5000 Series;
  - .2 Precision Plumbing Products "SS" Series.

## 2.11 BACKFLOW PREVENTERS

- .1 Reduced Pressure Zone Assembly
  - .1 Lead-free reduced pressure zone assembly backflow preventer in accordance with CAN/CSA B64 (including supplements), each of bronze or epoxy coated cast iron bronze fitted construction depending on size, and complete with inlet strainer, inlet and outlet shut-off valves, an intermediate relief valve, ball valve type test cocks, and a proper air gap fitting.
  - .2 Manufacturers:
    - .1 Watts Industries #LF009QT-S for 12 mm (½") size, #LF909QT-S for 20 mm to 50 mm (¾" to 2") size, and #LF909-NRS-S for 65 mm (2-½") and larger size;
    - .2 Zurn/Wilkins 975XL2 and 375 Series;
    - .3 "Apollo" Valves manufactured by Conbraco Industries Inc. Series 4ALF;
    - .4 Danfoss Flomatic Corp. Series RPZ.

## 2.12 PIPING EXPANSION COMPENSATORS AND GUIDES

- .1 Pressurized type, selected to withstand system pressure and to suit calculated movement from -5°C (23°F) to maximum operating temperature plus 25% safety factor, complete with stainless steel bellows and shroud, copper tube sweat type female ends, anti-torque device, and proper and suitable alignment guides for both sides of each compensator.
- .2 Manufacturers:

- .1 Senior Flexonics Series HB;
- .2 Hyspan Precision Products Series 8500.

### **2.13 PIPE ANCHORS**

- .1 Welded structural black steel anchors of a design, size, and type to securely anchor pipe at point shown. Each anchor is to withstand 150% axial thrust, and is to be designed and detailed by a professional structural engineer registered and licensed in jurisdiction of the work. Submit anchor design and fabrication shop drawings, stamped by design engineer.

### **2.14 AIR VENTS**

- .1 Equal to ITT Hoffman Specialty No. 78 cast brass, 1035 kPa (150 psi) rated, 20 mm (¾") straight water main vent valves, each tapped at the top for a 3.2 mm (1/8") safety drain connection.

### **2.15 DOMESTIC WATER THERMAL EXPANSION TANK**

- .1 Pre-charged domestic water thermal expansion tank in accordance with Section VIII of the ASME Boiler and Pressure Code, carbon steel outer shell construction and complete with fixed butyl rubber bladder to prevent water from contacting shell interior, top NPT stainless steel system connection, 7.6 mm to 813 mm (0.301" to 32") charging valve connection and prime painted exterior.
- .2 Manufacturers:
  - .1 Watts Industries (Canada) Inc. Series DETA;
  - .2 Zurn/Wilkins Model WTTA.
  - .3 Amtrol.

## **PART 3 - EXECUTION**

### **3.1 DEMOLITION**

- .1 Refer to demolition requirements specified in Section 20 05 05 – Selective Demolition for Mechanical.

### **3.2 PIPING INSTALLATION REQUIREMENTS**

- .1 Provide required domestic water piping.
- .2 Piping, unless otherwise specified, is as follows:
  - .1 for pipe inside building and aboveground in sizes to 100 mm (4") dia. – Type "L" hard copper with solder joints.
- .3 Slope piping so it can be completely drained.
- .4 Provide cast brass dielectric type adapters/unions at connections between ferrous and copper pipe or equipment.

### **3.3 INSTALLATION OF SHUT-OFF AND CHECK VALVES**

- .1 Refer to Part 3 of Section 20 05 00 – Common Work Results for Mechanical.
- .2 For shut off valves installed on solder joint copper piping up to and including 75 mm (3") diameter, provide ball type valves, and for flanged joints copper or stainless steel piping larger than 75 mm (3") diameter provide butterfly type valves.

### **3.4 INSTALLATION OF DRAIN VALVES**

- .1 Provide a drain valve at the bottom of domestic water piping risers, at other piping low points, and wherever else shown.
- .2 Locate drain valves so they are easily accessible.

### **3.5 INSTALLATION OF DOMESTIC HOT WATER PIPING BALANCING VALVES**

- .1 Provide balancing valves in domestic hot water recirculation piping where shown or required.
  - .1 for pipe 25 mm (3/4") dia. and less ground – equal to Victaulic Series 76X
  - .2 for pipe greater than 25 mm (3/4") dia. – equal to Victaulic TA Series 78BL
- .2 Locate each valve so it is easily accessible.

### **3.6 INSTALLATION OF PRESSURE REDUCING VALVES**

- .1 Provide domestic water pressure reducing valves. Install so each valve is readily accessible. Whenever possible, provide pressure reducing valves factory pre-set to required pressures.
- .2 Check and test operation, and adjust as required.

### **3.7 INSTALLATION OF TRAP SEAL PRIMERS**

- .1 Provide required accessible trap seal primers to automatically maintain a water seal in floor drain traps, whether shown on drawings or not.
- .2 Water closet flush valves may be used for priming washroom floor drain traps if flush tube is properly tapped and primer tubing exposed in washroom is chrome plated.
- .3 Provide trap primer valves to prime single or multiple (1 to 6) traps. Install trap primer valves in domestic cold water piping to frequently used plumbing fixtures. Where from 2 to 6 traps are to be primed from same primer valve, provide appropriate supply and distribution tube assemblies. Ensure primer valves are accessible.
- .4 Provide 115 volt, electronic, surface wall mounting trap primer assemblies for multiple (4 to 30) traps. Include for a 115 volt 15 ampere panel breaker and wiring in conduit from closest panelboards to primer assembly, all to wiring standards of Electrical Division. Adjust primer water flow and timing to suit number of traps served.
- .5 Ensure trap primer piping is secured to floor drain primer tapplings and not terminated through the tapping in the throat of the drain.

### **3.8 INSTALLATION OF SHOCK ABSORBERS**

- .1 Provide accessible shock absorbers in make-up water piping to equipment.
- .2 Ensure size of each shock absorber is properly selected to suit size of water pipe and equipment pipe is connected to.
- .3 Install down stream of backflow preventor.

### **3.9 INSTALLATION OF WATER HAMMER ARRESTORS**

- .1 Provide accessible water hammer arrestors in domestic water piping in locations as follows:
  - .1 in headers at groups of plumbing fixtures;
  - .2 at top of risers;
  - .3 at ends of long horizontal runs of piping;
  - .4 in piping connecting solenoid valves or equipment with integral solenoid valves;

- .5 wherever else shown or required by Code.
- .2 Install each unit in a piping tee either horizontally or vertically in the path of potential water shock in accordance with manufacturer's instructions and details.

### **3.10 INSTALLATION OF BACKFLOW PREVENTERS**

- .1 Provide a reduced pressure zone assembly backflow preventer on incoming DCW service and in each direct domestic water connection to equipment other than plumbing fixtures and fittings.
- .2 Provide a double check valve assembly backflow preventer on incoming DCW service. Provide a reduced pressure zone assembly backflow preventer in each direct domestic water connection to equipment other than plumbing fixtures and fittings.
- .3 Locate each backflow preventer on floor or wall between 765 mm (30") and maximum 1.5 m (60") above floor such that it is easily accessible for maintenance and testing.
- .4 Equip each reduced pressure zone backflow preventer with an air gap fitting and pipe the reduced pressure zone water outlet to drain.
- .5 Test operation of each backflow preventer in accordance with requirements of CAN/CSA B64 by personnel certified for such testing by governing authorities, and submit signed test results and a properly and clearly identified and marked inspection and test record card for each backflow preventer.

### **3.11 INSTALLATION OF EXPANSION COMPENSATORS, GUIDES, AND ANCHORS**

- .1 Provide expansion compensators in domestic water piping.
- .2 Ensure pipe ends are properly aligned. Provide alignment guides on each side of expansion compensators, properly secured to building structure.
- .3 Provide anchors to secure domestic water piping to structure. Locate anchors generally where shown but with exact locations to suit piping as installed and requirements of reviewed anchor shop drawings.
- .4 When installation of anchors is complete, arrange, and pay for anchor design engineer to visit site to review anchor installation. Submit a letter from design engineer confirming each anchor is properly installed.

### **3.12 INSTALLATION OF AIR VENTS**

- .1 Provide accessible air vents in domestic water piping to prevent air binding.
- .2 Extend copper indirect drain piping from top drain connection of each vent to nearest suitable drain.
- .3 Locate exact vent locations on as-built record drawings.

### **3.13 INSTALLATION OF DOMESTIC WATER THERMAL EXPANSION TANKS**

- .1 Provide domestic water thermal expansion tanks.
- .2 Unless otherwise specified, mount at least 450 mm (18") from cold water inlet to domestic water heater.
- .3 Adjust pre-charge to match incoming water pressure after installation.
- .4 Install in accordance with manufacturer's instructions and as per local governing Codes and Regulations.

### **3.14 FLUSHING AND DISINFECTING PIPING**

- .1 Flush and disinfect all new and/or reworked domestic water piping after leakage testing is complete.



- .2 Isolate new piping from existing piping prior to flushing and disinfecting procedures.
- .3 Flush piping until all foreign materials have been removed and flushed water is clear. Provide connections and pumps as required. Open and close valves, faucets, hose outlets, and service connections to ensure thorough flushing.
- .4 When flushing is complete, disinfect the piping with a solution of chlorine in accordance with AWWA C601.
- .5 When disinfecting is complete, submit water samples to a certified laboratory for purity testing and, when testing indicates pure water in accordance with governing standards, submit a copy of test results and fill the systems.

**END OF SECTION**

## **PART 1 - GENERAL**

### **1.1 SUBMITTALS**

- .1 Submit shop drawings/product data sheets for all products specified in this Section except pipe and fittings.

### **1.2 CLOSEOUT SUBMITTALS**

- .1 Submit a copy of plumbing inspection certificate prior to application for Substantial Performance of the Work.

## **PART 2 - PRODUCTS**

### **2.1 PIPE, FITTINGS, AND JOINTS**

- .1 PVC - DWV
  - .1 For High Buildings and Plenums: Equal to IPEX System XFR drain, waste and vent pipe and fittings to CAN/CSA B181.2, complete with a flame spread rating not more than 25 and a smoke developed classification not more than 50 when tested to CAN/ULC S102.2, with solvent weld joints or MJ Grey mechanical joint couplings, and, for fire barrier penetration, approved firestop conforming to CAN/ULC S115.
- .2 Copper - Solder Joint
  - .1 Type DWV hard temper to ASTM B306, with forged copper solder type drainage fittings and 50% lead - 50% tin solder joints.
- .3 Cast Iron
  - .1 Class 4000 cast iron pipe, fittings, and mechanical coupling joints to CAN/CSA B70.
- .4 Copper-Victaulic Coupling Joint
  - .1 Type DWV hard temper to ASTM B306, with factory or site rolled grooved ends (with grooving rolls designed for copper) and Victaulic "Copper Connection" wrought copper or cast bronze fittings and Style 606 gasket type couplings.

### **2.2 CLEANOUTS**

- .1 Horizontal Piping
  - .1 TY pipe fitting with an extra heavy brass plug screwed into the fitting.
- .2 Vertical Piping
  - .1 Bronze or copper cleanout tees in copper piping, each complete with a bronze ferrule, and, for cast iron piping, "BARRETT" type cast iron cleanout tees, each gas and water-tight and complete with a bolted cover.

### **2.3 FLOOR CLEANOUT TERMINATIONS**

- .1 Factory finished cast iron terminations, each adjustable and complete with a cast iron body with neoprene sleeve, solid, gasketed, polished nickel-bronze scoriated top access cover to suit floor finish, a seal plug, and captive, vandal-proof, stainless steel securing hardware.
- .2 Manufacturers:
  - .1 Watts Industries (Canada) Ltd. # CO-200-R-1.
  - .2 Jay R. Smith #4020-F-C Series;

- .3 Zurn # ZN-1602-SP Series;
- .4 Mifab # C1100-XR-1 or #C1000-R-3;
- .3 Cleanout terminations in areas with a tile or sheet vinyl floor finish are to be as above but with a square top in lieu of a round top.

## **2.4 FLOOR DRAINS, FUNNEL FLOOR DRAINS, AND HUB DRAINS**

- .1 Unless otherwise specified or indicated, floor drains are to be vandal-proof drains in accordance with drawing symbol list, each complete with a cast iron body and a trap seal primer connection. Cast iron components are to be factory finished with latex based paint coating.
- .2 Floor drains in areas with a tile or sheet vinyl floor finish are to be as above but with a square grate in lieu of a round grate.
- .3 Manufacturers:
  - .1 Watts Industries (Canada) Ltd.;
  - .2 Jay R. Smith Manufacturing Co.;
  - .3 Zurn Industries Ltd.;
  - .4 Mifab Inc.

## **PART 3 - EXECUTION**

### **3.1 DEMOLITION**

- .1 Refer to demolition requirements specified in Section 20 05 05 – Selective Demolition for Mechanical.

### **3.2 DRAIN AND VENT PIPING INSTALLATION REQUIREMENTS**

- .1 Provide required drainage and vent piping. Pipe, unless otherwise specified, as follows:
  - .1 for pipe inside building and aboveground in sizes less than or equal to 65 mm (2-1/2") dia. – type DWV copper;
  - .2 for pipe inside building and aboveground in sizes greater than or equal to 75 mm (3") dia. – Class 4000 cast iron;
  - .3 for pipe inside building and aboveground in lieu of type DWV copper and cast iron, at your option and where permitted by governing Codes and Regulations – rigid PVC DWV;
  - .4 for drainage pump discharge pipe connections from pump to and including shut-off and check valve connections – Type "DWV" copper with Victaulic "Copper Connection" fittings and couplings, or Schedule 40 galvanized steel with Victaulic fittings and couplings.
- .2 Unless otherwise specified, slope horizontal drainage piping aboveground in sizes to and including 75 mm (3") dia. 25 mm (1") in 1.2 m (4'), and pipe 100 mm (4") dia. and larger 25 mm (1") in 2.4 m (8').
- .3 Unless otherwise specified, slope horizontal branches of vent piping down to fixture or pipe to which they connect with a minimum pitch of 25 mm (1") in 1.2 m (4').
- .4 Provide cast brass dielectric unions at connections between copper pipe and ferrous pipe or equipment.

### **3.3 INSTALLATION OF CLEANOUTS**

- .1 Provide cleanouts in drainage piping in locations as follows:

- .1 in building drain or drains as close as possible to inner face of outside wall, and, if a building trap is installed, locate cleanout on downstream side of building trap;
  - .2 at or as close as practicable to the foot of each drainage stack;
  - .3 at maximum 15 m (50') intervals in horizontal pipe 100 mm (4") dia. and smaller;
  - .4 at maximum 30 m (100') intervals in horizontal pipe larger than 100 mm (4") dia.;
  - .5 wherever else shown on drawings.
- .2 Cleanouts are to be same diameter as pipe in piping to 100 mm (4") dia., and not less than 100 mm (4") dia. in piping larger than 100 mm (4") dia.
  - .3 Where cleanouts in vertical piping are concealed behind walls or partitions, install cleanouts near floor and so cover is within 25 mm (1") of the finished face of the wall or partition.

### **3.4 INSTALLATION OF FLOOR CLEANOUT TERMINATIONS**

- .1 Where cleanouts occur in horizontal inaccessible underground piping, extend cleanout TY fitting up to floor, and provide a cleanout termination set flush with finished floor.
- .2 In waterproof floors, ensure each cleanout termination is equipped with a flashing clamp device. Cleanout terminations are to suit floor finish.
- .3 Where cleanout terminations occur in finished areas, confirm locations prior to rough-in and arrange piping to suit.
- .4 Ensure cleanout termination covers in tiled floor are square in lieu of round.

### **3.5 INSTALLATION OF FLOOR DRAINS, FUNNEL FLOOR DRAINS AND HUB DRAINS**

- .1 Provide floor drains, funnel floor drains and hub drains.
- .2 Coordinate location of floor drains, funnel floor drains and hub drains with equipment provided by Mechanical Division and Owner's supplied equipment. Install in accordance with manufacturer's instructions.
- .3 Equip each drain with a trap.
- .4 In equipment rooms and similar areas, exactly locate floor drains to suit location of mechanical equipment and equipment indirect drainage piping. In washrooms, exactly locate floor drains to avoid interference with toilet partitions.
- .5 Confirm exact location of drains prior to roughing in. Where floor drains occur in washrooms coordinate locations with toilet partition installations.
- .6 Temporarily plug and cover floor drains during construction procedures. Remove plugs and covers during final clean-up work and when requested, demonstrate free and clear operation of each drain. Replace any damaged grates, and refinish any areas of the drain where cast iron finish has been damaged or removed, including rusted areas.

**END OF SECTION**

## **PART 1 - GENERAL**

### **1.1 SECTION INCLUDES**

- .1 Plumbing fixtures and related components.

### **1.2 SUBMITTALS**

- .1 Submit product data sheets (fixture cuts) for all plumbing fixtures and fittings, including accessories.
- .2 Product Data: Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports and indicate materials and finishes, dimensions, construction details, and flow-control rates for each type of fixture indicated.
- .3 Wiring Diagrams: Power, signal, and control wiring.
- .4 Submit fixture manufacturer's standard colour charts for all fixtures where colours are available but a particular colour is not specified.

### **1.3 CLOSEOUT SUBMITTALS**

- .1 Operation and maintenance data.

## **PART 2 - PRODUCTS**

### **2.1 GENERAL RE: PLUMBING FIXTURES AND FITTINGS**

- .1 Fixtures and fittings, where applicable, are to be in accordance with requirements of CAN/CSA-B45 Series, General Requirements for Plumbing Fixtures, including supplements, ASME A112.1.18.1/CSA B125.1, Plumbing Supply Fittings, and CAN/CSA-B125.3, Plumbing Fittings.
- .2 Barrier-free fixtures and fittings are to be in accordance with governing Code requirements.
- .3 Unless otherwise specified, vitreous china, porcelain enamelled, and acrylic finished fixtures are to be white.
- .4 Unless otherwise specified, toilet seats are to be constructed with an anti-microbial compound to inhibit growth of bacteria on seat surface.
- .5 Unless otherwise specified, fittings and piping exposed to view are to be brass, chrome plated and polished.
- .6 Fittings located in areas other than private washrooms are to be vandal-resistant.
- .7 Fixture carriers are to be suitable in all respects for the fixture they support and construction in which they are located.
- .8 Floor flanges for floor mounted water closets are to be cast iron or brass, secured to floor to prevent movement and complete with a wax seal and brass or stainless steel bolts, nuts, and washers. Plastic floor flanges will not be acceptable.
- .9 Proper seal to mate with fixture carrier flange and produce a water-tight installation.
- .10 Exposed traps for fixtures not equipped with integral traps, such as lavatories, are to be adjustable chrome plated cast brass "P" traps with cleanouts, minimum #17 gauge chrome plated tubular extensions, and chrome plated escutcheons, all to suit fixture type and drain connection.
- .11 Concealed traps for fixtures not equipped with integral traps, such as counter sinks, are to be adjustable cast brass with cleanout plugs, all to suit fixture type and drain connection.
- .12 Exposed supplies for fixtures which do not have supply trim/fittings with integral stops, i.e. lavatories, are to be solid chrome plated brass angle vales with screwdriver stops for public areas,

wheel handle stops for private areas, flexible stainless steel risers, and stainless steel or chrome plated steel escutcheons, all arranged and sized to suit fixture.

- .13 Water piping as specified, complete with ball type shut-off valves as specified with water piping or Dahl Bros. Canada Ltd. ¼ turn Mini Ball Valves.

## 2.2 PLUMBING FIXTURES AND FITTINGS

- .1 Plumbing fixtures and fittings are to be in accordance with following:

- .1 'IPAC' - Handwash sink - Foot operated

- .1 American Standard ICU Basin #9118.111, vitreous china with EverClean antimicrobial surface which inhibits the growth of stain and odor causing bacteria mold and mildew, sealed overflow, 65 mm (2-9/16") dia. Faucet perch, back of sink 93 mm (3-11/16") higher than faucet perch, offset grid drain included, integrated mounting brackets, p-trap with Saniguard coating provided, shroud.
- .2 Supply Fitting - Zurn Z821B0-XL-FC2.0 - Polished Chrome-plated brass rigid 137mm [5-3/8"] centerline deck-mounted gooseneck spout. Unit is furnished with a 7.6LPM [2GPM] Plain end spout with control, mounting hardware and 1/2" NPSM coupling for standard lavatory riser. Note: Contractor to remove swivel spacers to not allow spout to swivel.
- .3 Foot Pedal- Zurn Z85500-XL-VC-WM (Self closing double pedal valve). Polished Chrome-plated brass wall mounted, self-closing double pedal mixing valve. Two 1/2" NPT angle stop inlets on 2-1/2" [64mm] centers and one 1/2" NPT male outlet volume control. Assembly to be lead free, pedals with indicators for hot and cold. ASME A112.18.1/CSA B125.1,
- .4 BrassCraft #R19X C, chrome plated polished brass faucet supplies. Multi-Turn Angel Stop, 1/2" Nom. Sweat x 3/8" OD Compression.
- .5 Watts #CA-311 Carrier, mounted on concrete floor, universal steel hangar support plates with integral mounting brackets, heavy gauge epoxy coated steel offset uprights with welded feet, plated hardware.

- .2 EW-1 Eye/Face Wash

- .1 Model 7656WCC barrier-free eye/face wash shall include an AXION® MSR eye/face wash head shall feature inverted directional laminar flow which achieves Zero Vertical Velocity™ supplied by an integral 4.2 gpm flow control, a fully recessed wall mounted 18 Gauge, Type 304 stainless steel deep-drawn cabinet with smooth electro-polished nish, wheelchair accessibility, and polished chrome-plated brass pull-down valve with easy access in-line strainer. Unit shall also include brass pipe and fittings, a drain pan, a front-access maintenance panel, universal sign, 1/2" NPT(M) inlet and 2" NPT(F) drain. Operating pressure is 30 – 90 psi (2.1 – 6.2 bar).
- .2 McGuire #8872C, P-Trap, 32 mm (1-1/4") size, shallow wall flange and seamless tubular wall bend.
- .3 Haws Model 9201EW Axion Thermostatic Mixing Valve: Emergency tempering valve, flow rate of 10 gpm (38.8 L).
- .4 18 Gauge Type 304 Stainless Steel recessed cabinet is a deep-drawn heavy duty structure with smooth electro-polished nish to provide a durable, long lasting product.

- .3 Water Closet Wall Mounted 'WC-1'

- .1 Bowl: Vitreous china, wall hung, syphon jet action, elongated bowl, mounted so that top of seat is 400 mm ± 25 mm (16 in ± 1 in) above finished floor level.

- .1 Standard of Acceptance: -American Standard "AFWALL" #3351.101

- .2 Seat: Open front seatless cover, white in colour, elongated, self-sustaining hinge, heavy duty plastic.
  - .1 Standard of Acceptance: -Centoco 500CC
- .3 Flushometer: with integral stop valve, vacuum breaker, dual filter, and seat bumper.
  - .1 Standard of Acceptance: -Sloan Royal Flush 1.28.YO
- .4 Carrier:
  - .1 Standard of Acceptance: -JR Smith Series 0210/0410-Y-M51-95
- .4 'SS-3 / SS-4' - Single Bowl Sink - Stainless Steel - Double Handle Faucet: (built-in sink)
  - .1 Chicago Faucets #786-GN2FC-XK Faucet, C.P. 203 mm (8") C.C., below deck mounted, cast brass lead-free body, 1/4 turn ceramic disc valve cartridges, 248 mm (9-3/4") high, 133 mm (5-1/4") reach rigid / swing gooseneck spout with integral 6.0 LPM (1.6 GPM) flow laminar (non-aerating) outlet, plain spout end and red and blue indexed cast brass 102 mm (4") blade handles.
  - .2 McGuire #H165LKN3 Supplies, C.P., polished brass, rigid horizontal nipples 9.5 mm (3/8") x 75 mm (3") long I.P.S., heavy all brass angle stops with V.P. loose key, escutcheons, and flexible copper risers.
  - .3 McGuire #8912CB, 'P' Trap, C.P. polished cast brass adjustable body, 38 mm (1-1/2") with cleanout plug, seamless brass wall bend and escutcheon.
- .5 Lavatory Type 'LAV-1' (electronic sink)
  - .1 Basin - Wall Hung - Vitreous China – Hard-Wired Electronic 'No-Touch' Faucet - Recessed Box - Barrier-Free Design and General Use:
    - .1 American Standard #0955.901EC 'Murro' Basin with Sealed Overflow, center hole, 540 mm x 559 mm x 127-191 mm (21-1/4"x 22" x 5- 7-1/2") deep, wall hung, vitreous china, integral back splash, self-draining deck area, sloped front lip, for concealed arm carrier and pedestal support plate. American Standard #0059.020EC Semi-China Pedestal, Everclean Anti-Microbial Finish, to cover exposed piping as per local codes.
    - .2 Sloan #ETF-700-S/ETF687-LT-BDT-VPB 'Optima' Electronic 'No Touch' Faucet, C.P. single hole C.C., solid cast brass surgical bend spout with integral proximity sensor, with 5.7 LPM (1.5 GPM) flow laminar (non-aerating) outlet, control module, solenoid, strainer, circuitry, tempered water supplied by Lawler #570-86821 thermostatic mixing valve with back checks and McGuire #ST18 Supplies C.P. all brass ball valve stops, housed in 305mm (12") sq. recessed metal box with 330 mm (13") sq. V.P., S.S. face, located under basin.
    - .3 Sloan #EL-154 Transformer to match requirements for faucet, 120/24 VAC 50 VA.
    - .4 McGuire #155A-LO Basin Drain, C.P., cast brass 1 pc. top, open grid less overflow holes and 1.5 mm (17ga.), 32 mm (1-1/4") tailpiece.
    - .5 Provide Flexible Copper Supply, with escutcheon (connecting mixing valve to faucet).
    - .6 McGuire #8872C 'p' Trap, C.P., polished, cast brass adjustable body, 32 mm (1-1/4") with cleanout plug, seamless brass wall bend and escutcheon.
    - .7 Watts #TCA-411-HD Floor Mounted Concealed Arm 'Track' Lavatory Carrier, epoxy coated, heavy duty gauge steel offset uprights with welded feet, steel cross plate with integral mounting brackets, sliding adjustable arm brackets, and

adjustable cast iron concealed arms with mounting clips, levelling clips, levelling screws, and basin locking device.

## 2.3 MANUFACTURERS

- .1 Subject to compliance with requirements, manufacturers that may be incorporated into the Work include, but are not limited to, following:
  - .1 Flush Valves:
    - .1 Sloan;
    - .2 Delta Commercial;
    - .3 Zurn Industries.
  - .2 Plumbing Brass:
    - .1 Sloan;
    - .2 Acorn Engineering;
    - .3 American Standard;
    - .4 Delta Commercial;
    - .5 Chicago Faucet.
  - .3 Stainless Steel Sinks:
    - .1 Franke Commercial;
    - .2 Novanni Commercial;
    - .3 Aristaline;
    - .4 Arch Metal Ind.
  - .4 Mop Sinks:
    - .1 Stern Williams;
    - .2 Acorn Engineering;
    - .3 Zurn Industries.
  - .5 Emergency Eye Wash and Emergency Showers:
    - .1 Haws;
    - .2 Speakman;
    - .3 Guardian;
    - .4 Bradley.
  - .6 Bariatric Water Closets:
    - .1 Jay R. Smith;
    - .2 Acorn Engineering;
    - .3 Zurn Industries.
  - .7 Drain Fittings, Angle Supplies, and Traps:
    - .1 McGuire;
    - .2 American Standard;



- .3 Delta Commercial;
- .4 Zurn Industries.
- .8 Fixture Carriers:
  - .1 Watts Industries;
  - .2 Jay R. Smith;
  - .3 Zurn Industries.
- .9 Surgeon Scrub Sinks:
  - .1 Franke Commercial;
  - .2 Acorn Engineering.
- .10 Hose Bibbs:
  - .1 Jay R. Smith;
  - .2 Zurn Industries.
- .11 Water Closets, Lavatories, and Urinal:
  - .1 American Standard;
  - .2 Zurn Industries;
  - .3 Kohler.
- .12 Thermostatic Mixing Valves:
  - .1 Lawler;
  - .2 Delta Commercial;
  - .3 Leonard.
- .13 Shower and Associated Trim:
  - .1 American Standard;
  - .2 Delta Commercial;
  - .3 Zurn Industries.
- .14 Toilet Seats:
  - .1 Olsonite;
  - .2 Centoco;
  - .3 Bemis Commercial.
- .15 Electronic "No Touch" Flush Valves:
  - .1 Sloan;
  - .2 Delta Commerical;
  - .3 Zurn Industries.
- .16 Electronic "No Touch" Faucets:
  - .1 Sloan;
  - .2 Delta Commercial;
  - .3 Zurn Industries.

**2.4 CAULKING**

- .1 General Electric Series SCS-1200 Silicone Construction Sealant or Dow Corning 780 silicone rubber sealant with primers as recommended by sealant manufacturer. Caulking colour(s) for coloured fixtures other than white, if any, will be selected by Consultant from sealant manufacturer's standard colour range.
- .2 Caulking in Mental Health areas shall be pick proof.

**PART 3 - EXECUTION****3.1 DEMOLITION**

- .1 Refer to demolition requirements specified in Section 20 05 05 – Selective Demolition for Mechanical.

**3.2 INSTALLATION OF PLUMBING FIXTURES AND FITTINGS**

- .1 Provide required plumbing fixtures and fittings.
- .2 Where new fixtures and fittings are to be connected to existing piping, include for required piping revisions.
- .3 Connect plumbing fixtures and fittings with piping sized in accordance with drawing schedule. Refer to manufacturer's published connection (rough-in) requirements. Where manufacturer requires piping connection larger than shown below, provide piping accordingly:

Fixture and/or Fitting	Drain Size mm (in)	Vent Size mm (in)	DHW size mm (in)	DCW size mm (in)	Temp Water Size mm (in)
Water Closets Flush Valve Type	100 (4)	38 (1-½)	-	25 (1)	-
Urinals	75 (3)	38 (1-½)	-	25 (1)	-
Lavatories	32 (1-¼)	32 (1-¼)	12 (½)	12 (½)	-
Lavatories (Electronic Faucet)	32 (1-¼)	32 (1-¼)	12 (½)	12 (½)	12 (½)
Counter Sinks	38 (1-½)	32 (1-¼)	12 (½)	12 (½)	-
Shower Valves and Heads	-	-	12 (½)	12 (½)	12 (½)
Shower Stalls	50 (2)	38 (1-½)	12 (½)	12 (½)	12 (½)
Prefab. Mop Sinks with Drain	75 (3)	38 (1-½)	20 (¾)	20 (¾)	-
Surgeon Scrub Sinks	38 (1-½)	32 (1-¼)	20 (¾)	20 (¾)	-
Emergency Eye Wash	-	-	-	-	12 (½)
Emergency Showers	-	-	-	-	25 (1)

Fixture and/or Fitting	Drain Size mm (in)	Vent Size mm (in)	DHW size mm (in)	DCW size mm (in)	Temp Water Size mm (in)
Clinic Service Sinks	100 (4)	38 (1-½)	12 (½)	1 @ 25 (1) 1 @ 12 (½)	-

- .4 Confirm exact location of plumbing fixtures and trim prior to roughing-in. Refer to architectural plan and elevation drawings.
- .5 When installation is complete, check and test operation of each fixture and fitting. Adjust or repair as required.
- .6 For barrier-free fixtures, comply with mounting height and other requirements of governing Code(s).
- .7 For barrier-free water closets utilizing manual flush controls, controls to be installed so that it is operable from the transfer side of the fixture.
- .8 Supply templates for counter mounted fixtures and trim and hand to trades who will cut the counter. Ensure openings in counter are properly located.
- .9 Locate control panels for electronic faucets under lavatories and recessed into wall. Coordinate panel installations with electrical trade who will provide 115 volt power wiring to panels. Install flexible conduit (supplied with box) and extend cord from faucet through the flexible conduit to control box. Connect hot and cold water piping to mixing valve in each box, and tempered water piping from each mixing valve to faucet. Set mixing valve maximum temperature limit stops to 43°C (110°F) after domestic water systems (hot and cold) are complete. Ensure each programmable controller is properly programmed and water off after deactivation is set for 3 seconds.
- .10 For electronic flush valves, locate transformer in ceiling space above electronic units to be served. Coordinate locations with electrical trade who will provide 120 volt line supply to transformers. Provide low voltage wiring from transformers to each electronic flush valve terminal point. Electrical line supply and low voltage wiring is to be concealed and access to transformer must be provided for servicing.
- .11 Protect baths from damage during construction and finishing work. Unless otherwise specified, pack concealed voids under baths with batt type glass fibre insulation as baths are installed.
- .12 Protect shower bases from damage during construction and finishing work.
- .13 Confirm exact mixing valve and shower head locations prior to roughing-in.
- .14 Install refrigerated drinking fountains in accordance with manufacturer's instructions. Plug into a wall receptacle provided as part of electrical work. Coordinate receptacle installation with electrical trade on site.
- .15 For emergency showers, install so bottom of shower head is approximately 2 m (82") above floor, and approximately 400 mm (16") out from wall. Wall mount mixing valve approximately 1.5 m (5') above floor and adjacent shower head. Set valve temperature limit stop to 35°C (95°F). Ensure valve is open, and exposed piping is chrome plated or stainless steel.
- .16 Install eye wash fixtures in accordance with manufacturer's instructions. Ensure exposed piping is painted.
- .17 Wall mount mixing valves for emergency fixtures approximately 1.5 m (5') above floor and secure in place. Check and confirm valve operation and temperature of tempered water supply. Provide cabinets where shown. Identify each cabinet and hand 3 identified cabinet keys to Consultant prior to Substantial Performance of the Work.
- .18 Set mop service basins on floor over drain piping and connect to roughed-in service. Install wall supply trim and any accessories specified.

### **3.3 CAULKING AT PLUMBING FIXTURES AND FITTINGS**

- .1 Caulk around plumbing fixtures and fittings where they contact walls, floors, and any other building surface.
- .2 Clean areas/surfaces to be caulked and prime in accordance with sealant manufacturer's instructions. Where damage to a building surface may occur, mask surface to prevent damage and ensure a clean exact edge to caulking bead.
- .3 Apply caulking using a gun with proper size and shape of nozzle and force sealant into joints to ensure good surface contact and a smooth and even finished bead of sealant.
- .4 If joints have been masked sealant may be tooled in a continuous stroke to obtain complete void filling. Remove masking tape immediately after tooling and before sealant begins to skin.

**END OF SECTION**

## **PART 1 - GENERAL**

### **1.1 SUBMITTALS**

- .1 Submit shop drawings/product data sheets for all products specified in this section except pipe and fittings. Appropriate CRN assigned to each component is to be clearly indicated on component shop drawing/product data sheet.
- .2 Submit product data sheets for motors, and certified wiring diagrams for equipment requiring power, control and/or alarm wiring connections.
- .3 Submit, prior to work commencing on site, a detailed account of your proposed pipe joint brazing procedures including pre and post nitrogen purging.

### **1.2 CLOSEOUT SUBMITTALS**

- .1 Prior to Substantial Performance of the Work, submit 5 identified replacement filters for each type of filter for equipment that requires a replaceable filter.
- .2 Submit written certification by equipment manufacturers/suppliers confirming that equipment is properly installed, has been tested, and is in proper operating condition, all as specified in Part 3 of this section.
- .3 Submit manufacturer's start-up reports as specified in Part 3 of this section.
- .4 For each zone valve box assembly and combination zone valve box and alarm, submit for review a typed list of rooms and areas with medical gas terminal units controlled by the zone valves.
- .5 Record drawings: indicate as-constructed location of all piping governed by this Section.
- .6 Training attendance records.

### **1.3 MAINTENANCE MATERIAL SUBMITTALS**

- .1 Submit 3 identified keys for cabinet/panel lockable doors prior to Substantial Performance of the Work.

### **1.4 DESIGN PRESSURE AND TEMPERATURE REQUIREMENTS**

- .1 System design pressures are as follows:
  - .1 oxygen, carbon dioxide, nitrous oxide, medical air:
    - .1 maximum system pressure, 380 kPa (55 psi);
    - .2 maximum pressure at terminal unit, 345 kPa (50 psi).
  - .2 nitrogen:
    - .1 maximum system pressure, 1400 kPa (200 psi).
  - .3 vacuum:
    - .1 maximum system vacuum, 54 kPa (15.94" Hg);
    - .2 maximum vacuum at terminal unit, 68 kPa (20.08" Hg).
- .2 Design temperature for all services will be ambient temperature.

### **1.5 QUALITY ASSURANCE**

- .1 Products and work must comply in all respects with requirements of CAN/CSA Z7396.1 and related Standards, and, where applicable, requirements of local governing authorities.

- .2 Contractor is responsible for registration, inspection, and/or approval for medical gas system work, as required, with local regulatory authority.
- .3 Medical gas systems work must be performed by journeyman plumber / pipefitter / steamfitter tradesmen completely familiar with requirements of CAN/CSA Z7396.1, and who are qualified and certified (with jurisdictional authority issued Certificate) for silver brazing with nitrogen backing without using flux in accordance with Clause 4.5 in Part 1 of CSA B51. Jurisdictional authority is the authority designated by the province of the work to perform oversight functions cited in Clause 4.5 in Part 1 of CSA B51.
- .4 Consultant reserves the right to ask for and review the Certificate of any tradesman, and only tradesmen with valid Certificates may work on the systems.

## **PART 2 - PRODUCTS**

### **2.1 GENERAL RE: PIPING SYSTEM MATERIALS AND COMPONENTS**

- .1 Pipe, fittings, and piping system components are to be factory washed and degreased. Pipe is to be capped. Fittings and components are to be packaged.
- .2 Piping system components to be site connected with piping are to be complete with factory installed, washed, degreased, and capped Type "K" hard copper piping stubs with joints silver brazed while the component and piping is full of nitrogen.

### **2.2 MANUFACTURERS**

- .1 Unless otherwise specified, acceptable medical gas system product manufacturers / suppliers are:
  - .1 Class 1 Inc.;
  - .2 Amico Corp.;
  - .3 Vitalaire.

### **2.3 PIPE, FITTINGS AND JOINTS**

- .1 Aboveground
  - .1 Type "L" or type "K" (as specified in Part 3) hard temper copper tubing to ASTM B819, "Standard Specification for Seamless Copper Tube for Medical Gas Systems", complete with wrought copper, brass or bronze "Silver Braze" fittings and silver brazed joints made with Silvaloy 15 or equal brazing alloy conforming to ANSI/AWS Standard A5.8 Classification BcuP-5.
- .2 Underground
  - .1 Type "K" soft temper copper tubing to ASTM B88, factory cleaned and capped as for hard temper copper tubing, and supplied in a continuous length with no joints.

### **2.4 SHUT-OFF VALVES**

- .1 Full flow bronze body ball type valves, 4140 kPa (600 psi) rated, ¼ turn on-off from a fully closed to a fully open position, in-line serviceable, blow-out proof, factory pressure tested, and complete with a chrome plated brass or stainless steel ball depending on valve size, a double Teflon seal, a Teflon seat, O-ring packing, lever handle capable of locking in open or closed position, and colour coded permanent identification labels.

## 2.5 ZONE VALVE BOXES

- .1 Wall mounting enamelled steel zone valve boxes with anchor brackets, sized to suit number of valves in the box, designed for vertical ganging type installation and complete with shut-off valves as specified above (less the handle lock feature), securely mounted to the back of the box, and complete with:
  - .1 stainless steel or matte finish extruded aluminium trim;
  - .2 re-installable front panel or window with centre mounted pull ring and silk-screen bilingual wording to read "CAUTION: MEDICAL GAS CONTROL VALVE - CLOSE ONLY IN EMERGENCY";
  - .3 gauge connection brazed onto the pipe stub at the downstream (patient) side of each valve assembly, with a 40 mm (1-½") diameter pressure (or vacuum) gauge conforming to requirements specified in Section 20 05 00 – Common Work Results for Mechanical, and with ranges as follows:
    - .1 vacuum – 0 to 760 kPa (0 to 30" Hg);
    - .2 all other services – 0 to 700 kPa (0 to 100 psi).

## 2.6 LOCAL EMERGENCY ALARM PANEL/ZONE VALVE BOX ASSEMBLIES

- .1 Flush wall mounting combination zone valve box and local emergency alarm panels and zone valve box assemblies incorporating a zone valve box and an area alarm panel in one enclosure. Each assembly is to be complete with:
  - .1 enamelled steel box sized to suit the components installed, complete with adjustable steel mounting brackets to accommodate various wall thicknesses, an anodized aluminium frame, and pull-out removable window with silk-screen bilingual wording to read "CAUTION: MEDICAL GAS CONTROL VALVES - CLOSE VALVES ONLY IN EMERGENCY";
  - .2 ball type shut-off valves as specified in this section but less the handle lock feature, sized as shown, complete with tube extensions, and secured to the back of the box;
  - .3 gauge connection brazed onto the pipe stub at the downstream (patient) side of each valve assembly, with a 40 mm (1-½") diameter pressure (or vacuum) gauge conforming to requirements specified in Section 20 05 00 – Common Work Results for Mechanical, and with ranges as follows:
    - .1 vacuum – 0 to 100 kPa (0 to 28.5" Hg);
    - .2 all other services – 0 to 700 kPa (0 to 100 psi).
  - .4 modular, microprocessor based, gas specific alarm units with large LED universal (psi, kPa, "Hg, Bar) pressure/vacuum displays, LED trend display, high and low alarms with dry contacts for connection to a master alarm panel, 90 dBA audible alarm with silence button and adjustable alarm reminder, alarm history recall, identified sensors with DISS connection located in the back box, and required remote monitoring hardware.

## 2.7 MEDICAL GAS SCAVENGING VACUUM PUMP SET

- .1 Duplex, expandable, modular, oil free, rotary claw type, variable speed, anaesthetic gas medical gas vacuum system, factory assembled and tested and with model number, performance, and characteristics in accordance with drawing schedule.
- .2 Positive displacement vacuum pumps with precision machined hook and claw rotors and a shaft-driven cooling fan and integral cooling air shroud, each direct driven by an inverter duty TEFC motor conforming to requirements specified in Section 20 05 00 – Common Work Results for Mechanical, factory assembled into a pump module, and complete with:
  - .1 bacterial removal inlet air filter with replaceable element;

- .2 vacuum gauge conforming to requirements specified in Section 20 05 00 – Common Work Results for Mechanical;
- .3 bleed valve, silent inlet check valve, inlet and outlet isolation ball valves, and type 316L stainless steel flexible inlet and outlet flexible connections;
- .4 exhaust muffler, outlet check valve, and valved drip leg;
- .5 vibration isolation mounts;
- .6 Type "L" ASTM B819 degreased hard copper interconnecting piping with a main header, main ball type isolation valve, and a DISS demand check valve.
- .3 Stack mounted pump modules, power and control panel, and interconnecting piping and wiring are to be assembled within a powder-coated steel framework.
- .4 Factory pre-wired and mounted, NEMA 12, barriered, powder-coated panel for automatic lead/lag operation of the pumps in sequence to equalize run time, and complete with:
  - .1 main disconnect switch and a door interlock disconnect switch for each pump;
  - .2 thermal overload protected circuit breaker with magnetic short circuit protection and through the door manual disconnect and reset for each pump motor;
  - .3 H-O-A switch for each pump motor;
  - .4 overload protected variable speed drive with soft start function for each motor;
  - .5 control transformer with primary and secondary fusing for each control circuit, and transformer switching relay;
  - .6 vacuum transducer with digital vacuum display, security, and user adjustable set-points;
  - .7 PLC controls;
  - .8 200 mm (8") high resolution colour touch screen display with system status and alarm events, hour meters, user adjustable settings, vacuum level display, and password protection;
  - .9 numbered terminal strip with dry contacts for site connection to medical gas master alarm panel for lag/failure, motor overload, transformer failure, high and low vacuum.
- .5 System settings are to be user adjustable and accessible with the system in operation and the control panel door closed. Programming and control is to include:
  - .1 lead pump is to operate continuously with variable speeds to maintain a constant level of 68 kPa (20" Hg);
  - .2 lead pump is to automatically alternate;
  - .3 lag pump is to start at 54 kPa (16" Hg);
  - .4 lag/failure alarm which requires manual reset;
  - .5 maximum run operation to ensure pump alternation;
  - .6 suitable controls to accommodate emergency generator power transfers;
  - .7 low vacuum alarm set at 50 kPa (15" Hg);
  - .8 lag/failure alarm contacts which open on lag condition, motor overload, power failure, transformer failure, high vacuum, and H-O-A switch not in Auto position.
- .6 Manufacturers:
  - .1 Elmo Rietschle;
  - .2 Busch Corp.



## 2.8 SCAVENGING TERMINAL UNITS

- .1 AGSS evacuation terminal units for low pressure gas scavenging, single, modular, recessed wall or ceiling mounted, surface mounted, or ceiling column mounted as shown, each complete with a permanently colour coded faceplate sealed behind a Lexan faceplate, a 20 mm (¾") diameter Type "L" inlet supply tube, and a 20 mm (¾") diameter and 30 mm (1-3/16") diameter taper fitting for connection to standard anaesthesia gas disposal tubing.

## 2.9 PRESSURE AND VACUUM SWITCHES FOR ALARM SIGNALS

- .1 Factory assembled and set (to suit site requirements) switches, each labelled for the intended service, each suitable for pipeline pressure, medical gas or vacuum involved, and alarm function, and each complete with a NEMA 4 housing, tamper-proof external adjustment, a gas specific DISS inlet, a 50 mm (2") diameter monitoring gauge in accordance with requirements specified in Section 20 05 00- Common Work Results for Mechanical, and instructions for field adjustment.

## 2.10 LOCAL EMERGENCY ALARM PANELS

- .1 Modular, field expandable, 115 volt, solid-state, microprocessor controlled, electronic, flush wall mounting audio-visual alarm panels designed for constant monitoring of piping system pressure or vacuum as applicable, and initiation of an alarm function on any open circuit only. Each panel is to be complete with:
  - .1 minimum #18 gauge steel back box sized to suit gas service modules required and equipped with adjustable mounting brackets to accommodate different wall thicknesses, a 115 volt power connection terminal block, fused 24 volt secondary transformer, a motherboard for plug-in connection of modules, and matte finish extruded aluminium or equal trim;
  - .2 power module with green power on LED, audible alarm with silencing pushbutton, adjustable (2 to 60 minutes) alarm repeater;
  - .3 gas specific colour coded sensors and displays with an error message for incorrect connection, each equipped with a microprocessor, LED digital readout in switch selected psi or kPa to facilitate a constant indication of each service being measured, a bar graph trend indicator to indicate green "NORMAL", yellow "CAUTION", and red "HIGH" or "LOW" alarm condition;
  - .4 red alarm light which flashes and an audible alarm which sounds when an alarm condition occurs, and an "ALARM MUTE" pushbutton to silence audible alarm, however, panel will remain in alarm state until problem is rectified;
  - .5 "TEST" pushbutton to test all panel functions;
  - .6 dry contacts for remote monitoring of high and low alarms;
  - .7 gas specific DISS connection (DISS body with check valve and DISS nut and gland) for each sensor module, supplied loose for field installation;
  - .8 building automation system serial communications interface panel.

## 2.11 TERMINAL UNITS

- .1 DISS type, gas specific, non-interchangeable, modular, flush mounting terminal units, either singular or in groups as shown on drawings, each designed to accommodate mounting surface thickness variations of up to 12 mm (½"), complete with a CRN and following:
  - .1 die-cast outlet box;
  - .2 cartridge type primary check valve and stainless steel ball type secondary check valve;
  - .3 chrome plated brass outlet body with permanently embossed gas identification nameplate with bilingual labelling, all sealed behind a protective cover with chrome plated trim;

- .4 required centreline spacing between multiple terminal units;
- .5 temporary protective covers, and standing pressure test caps.
- .2 Equipment Connection Terminal Units: DISS medical gas specific riser assemblies, factory cleaned and capped, complete with a protective dust cap, brass outlet body, Type "K" inlet supply tube and bulkhead mounting provision.

## **PART 3 - EXECUTION**

### **3.1 DEMOLITION**

- .1 Perform required medical gas system demolition work. For demolition requirements, refer to Section 20 05 05 – Selective Demolition for Mechanical.

### **3.2 GENERAL RE: PIPING INSTALLATION**

- .1 Perform pipe joint brazing work in accordance with CAN/CSA Z7396.1 and reviewed brazing procedures submitted to the Consultant prior to start of work.
- .2 Consultant reserves the right to cut-out and examine piping joints during course of the work or after work is complete, and if interior of cut-out sample and/or fittings are found to be contaminated with oxidation or any other material, piping will be considered unacceptable and must be cleaned or replaced.
- .3 Where low pressure connecting assemblies are used in retractable gas columns, articulating arms, or any other dispensing assembly, DISS body or terminal unit which is used to connect it to copper pipeline must be brazed to the piping system.
- .4 Refer to architectural drawing plans and elevations for exact locations of terminal units, zone valve boxes, alarm panels, and other such items.

### **3.3 INSTALLATION OF MEDICAL GAS SYSTEM PIPING**

- .1 Provide required medical gas system piping. Unless otherwise shown or specified, vacuum piping is to be minimum 20 mm (¾") diameter, and piping for all other services is to be minimum 12 mm (½") diameter.
- .2 Piping aboveground, unless otherwise specified, is to be Type "L" hard copper.
- .3 Provide threaded piping unions at piping connections to source equipment. Do not silver braze unions. Braze a male NPT adaptor on end of pipe, wrap Teflon tape onto the adaptor (2 threads back), and screw union as tight as possible by hand, then with proper wrenches for final tightening. Do not over tighten.
- .4 Perform pipe brazing operations in strict accordance with requirements of CAN/CSA Z7396.1.
- .5 Ensure tools used during erection of piping systems are kept clean and free from oil and grease.
- .6 Support piping by means of support materials specified in Section 20 05 00 – Common Work Results for Mechanical, in accordance with requirements of article entitled "Pipeline Supports" in CAN/CSA Z7396.1 and with support spacing in accordance with table entitled "Spacing of Piping Supports" in CAN/CSA Z7396.1.
- .7 Refer to Section 20 05 00 – Common Work Results for Mechanical. Identify piping system work, including valves, concealed and exposed, on a daily basis in accordance with requirements of CAN/CSA Z7396.1.
- .8 Install vacuum piping sloped to low points. Equip each low point, including the bottom of vertical risers, with drip pockets consisting of a full size pipe tee with one leg capped with a removable cap. Ensure drip points are accessible and indicated on as-built record drawings.

- .9 Provide DISS identified riser outlet piping connections in ceiling and/or wall spaces for connection to terminal outlets integral with manufactured equipment such as articulated arms (with riser plates) provided as part of this section of the work or as part of the work of other Divisions of the Specification. Terminal units will be pre-piped by equipment manufacturer to an accessible location. Carefully rough-in piping and coordinate equipment connections, particularly for flush mounted and/or ceiling mounted equipment.
- .10 Provide identified piping connections to ceiling columns and/or headwalls provided as part of this section or as part of the work of other Divisions.
- .11 Provide valved and capped connections for future extension. Clearly and permanently identify each capped connection and ensure they are exactly located on as-built record drawings.
- .12 In accordance with CAN/CSA Z7396.1, provide a full size branch tee with shut-off valve for each gas source (including vacuum) downstream of main isolation valve.
- .13 Perform revision/retrofit work as shown and in accordance with CAN/CSA Z7396.1.

### **3.4 INSTALLATION OF VALVES**

- .1 Provide shut-off/isolation valves where shown and/or required by CAN/CSA Z7396.1. Shut-off valves, unless otherwise specified, are to be ball type.
- .2 Provide check valves where shown and/or required by CAN/CSA Z7396.1.
- .3 Ensure valves are located for easy access and operation.

### **3.5 INSTALLATION OF ZONE VALVES AND BOXES**

- .1 Provide zone valves in zone valve boxes. Provide a service isolation valve in piping immediately upstream of each zone valve and on same floor.
- .2 Accurately install boxes with reference to wall finish, and confirm exact locations prior to roughing-in.
- .3 At each zone valve box location provide a typed, framed, and glazed list of all rooms and areas controlled by the zone valve. Submit lists and wording for review prior to framing and glazing.

### **3.6 INSTALLATION OF COMBINATION ZONE VALVE/AREA ALARM BOXES**

- .1 Provide combination zone valve box/area alarm assemblies. Provide a service isolation valve in piping immediately upstream of each zone valve and on same floor.
- .2 Accurately install boxes with reference to wall finish, and confirm exact locations prior to roughing-in.
- .3 At each zone valve box location provide a typed, framed, and glazed list of all rooms and areas controlled by the zone valve. Submit lists and wording for review prior to framing and glazing.

### **3.7 INSTALLATION OF MEDICAL GAS SCAVENGING VACUUM PUMP SET**

- .1 Provide a medical scavenging vacuum pump set. Secure the assembly in place, level, and plumb, on a concrete housekeeping pad. Connect the set header to the scavenging vacuum system piping. Refer to the drawing piping schematic and/or flow diagram.
- .2 During start-up as specified in this section, site calibrate the control panel to initiate pump start at required vacuum levels.
- .3 Extend Type "L" copper piping from the discharge header to outside the building. Terminate discharge piping in a "turned down" elbow arrangement with bronze insect screen permanently secured in place. Ensure discharge termination is a minimum of 3 m (10') from any door or window which can be opened, and a minimum of 15 m (50') from any fresh air intake.

- .4 If discharge termination is located above roof, ensure it extends up high enough so as not to be restricted by snow.
- .5 Connect valved drip leg piping and terminate piping over nearest funnel floor drain combination.

### **3.8 INSTALLATION OF SCAVENGING TERMINAL UNITS**

- .1 Provide medical gas scavenging terminal units and mount. Confirm exact locations prior to roughing-in. Refer to architectural drawings.
- .2 Connect each terminal unit assembly with copper tubing extended to zone valve boxes to vacuum pump set.
- .3 Connect scavenging terminal units (with flexible connectors) supplied with articulated arms as for scavenger terminal units specified above.
- .4 \

### **3.9 INSTALLATION OF ALARM PANELS**

- .1 Provide wall mounted medical gas pressure/vacuum alarm panels. Confirm exact panel locations prior to roughing-in. Refer to architectural drawings.
- .2 Provide required hardware and connect each panel with required medical gas/vacuum piping as applicable.
- .3 Carefully check panel pressure/vacuum readings and make any required adjustments.
- .4 When installation is complete, test each panel function, and make any adjustments and corrections necessary.

### **3.10 INSTALLATION OF TERMINAL UNITS**

- .1 Provide wall mounted medical gas terminal units, either singular or in groups as indicated. Leave temporary caps in place.
- .2 Confirm exact locations prior to roughing-in. Refer to architectural drawings.
- .3 Equip each terminal unit with a faceplate.
- .4 Supply medical gas terminal units for factory installation in consoles, headwalls, articulating arms, ceiling service columns, and other such manufactured assemblies, and ship terminal units to manufacturer's plant.

### **3.11 PIPING SYSTEM LEAKAGE TESTING**

- .1 Refer to Section 20 05 00 – Common Work Results for Mechanical. Ensure governing authorities are informed well in advance of scheduled tests so they may witness tests as required.

### **3.12 POWER AND CONTROL WIRING**

- .1 Line voltage power wiring to equipment, unless otherwise specified, will be done as part of the electrical work.
- .2 Control and alarm wiring, unless otherwise specified, is to be installed in conduit as part of medical gas system work in accordance with electrical work wiring requirements, and manufacturer's/supplier's certified wiring schematics.
- .3 Generally, power wiring (part of electrical work) and control and alarm wiring (part of mechanical work) is to be as follows:

Equipment	Line Voltage Power Wiring	Control and/or Alarm Wiring
scavenging pump set	to pre-wired integral panel c/w disconnect and starters	from control panel alarm contacts to master alarm panel as per Code
local alarm panels	115 volt to panel	
combo zone valve and area alarm units	115 volt to panel	

### 3.13 SYSTEM STARTUP

- .1 When installation of medical gas system equipment from source of supply up to but not including outlets is complete, and piping leakage testing is complete, but prior to certification as specified below, and in accordance with article entitled "Commissioning of Supply Systems" in CAN/CSA Z7396.1, arrange for equipment manufacturers/ suppliers to visit site for length of time necessary to:
  - .1 check installation of equipment, and recommend any required adjustments, which are to be done immediately;
  - .2 start-up equipment, test operation, recommend any required adjustments, which are to be done immediately, check and verify safeties, operational sequences, controls, and alarms to ensure they are operating properly, and to ensure equipment performs as intended;
  - .3 obtain a letter or letters from system manufacturers/suppliers to certify above requirements have been successfully completed, have the letter(s) signed by the system supplier, and submit to the Consultant.

### 3.14 MEDICAL GAS SYSTEM CERTIFICATION

- .1 When equipment start-up and certification as specified above is complete, notify Owner and Consultant that the systems are ready for certification as per CAN/CSA Z7396.1.
- .2 Arrange for system installer to be part of the certification team.
- .3 Should Owner's Certification Agency be delayed by your default or by the fact that you are not ready for the certification procedure, or if scheduled certification is cancelled with less than 2 days' notice because systems are not ready, you will be responsible for all costs for Certification Agency to repeat the tests, remain on site longer than could reasonably be expected, or reschedule tests, as applicable.
- .4 Owner's Certification Agency will make interim site visits during construction to review medical gas system work. Cooperate with and reasonably assist the Agency, and immediately correct any deficient work reported by the Agency.

### 3.15 TRAINING

- .1 Include for 2 site training sessions for a minimum of 6 people for 8 hours per session. Training is to be a full review of all components including but not limited to a full operation and maintenance demonstration, with abnormal events.

**END OF SECTION**

## PART 1 - GENERAL

### 1.1 SUBMITTALS

- .1 Submit shop drawings/product data sheets for all products specified in this section except piping and unions.

## PART 2 - PRODUCTS

### 2.1 PIPE, FITTINGS, AND JOINTS

- .1 Black Steel - Screwed Joint
  - .1 Mild black carbon steel, Grade B, ASTM A53, complete with Class 125 cast iron threaded fittings to ANSI/ASME B16.4, and screwed joints.
- .2 Black Steel - Welded Joint
  - .1 Mild black carbon steel, Grade B, ASTM A53, mill or site bevelled, complete with factory made seamless carbon steel butt welding fittings to ASTM A234, Grade WPB, with long sweep pattern elbows unless otherwise specified, and welded joints.
- .3 Black Steel - Grooved End Mechanical Joint
  - .1 Mild black carbon steel, Grade B, ASTM A53, factory or site roll grooved, complete with cast ductile iron grooved end fittings, including full flow elbows, and conforming to ASTM A536.
  - .2 Manufacturers:
    - .1 Equal to Victaulic Style 107 "QuickVic" rigid couplings for sizes 2" to 12", Style 07 "Zero-Flex" rigid couplings, Style W07 AGS rigid couplings for sizes 350 mm (14") to 1525 mm (60");
    - .2 Flexible grooved couplings can be used where system flexibility is desired. Noise and vibration reduction at mechanical equipment connections is achieved by installing three flexible couplings near the vibrations source in lieu of braided flex connectors. Victaulic Style 177 QuickVic or Style 77 flexible couplings for sizes 50 mm (2") to 300 mm (12"). Style W77 AGS flexible couplings for sizes 350 mm (14") to 1525 mm (60").
    - .3 Grooved end fittings shall be cast of ductile iron conforming to ASTM A-536, Grade 65-45-12, forged steel conforming to ASTM A-234, Grade WPB 0.375" wall (9.53 mm wall), or fabricated from Std. Wt. Carbon Steel pipe conforming to ASTM A-53, Type F, E or S, Grade B. Fittings provided with an alkyd enamel finish or hot dip galvanized to ASTM A-153. Branch reductions on 2" (DN50) through 8" (DN200) header piping. Bolted branch outlets shall be manufactured from ductile iron conforming to ASTM A-536, Grade 65-45-12, with synthetic rubber gasket, and heat treated carbon steel zinc plated bolts and nuts conforming to physical properties of ASTM A-183. Victaulic Style 920 / 920N.
- .4 Black Steel – Plain End Mechanical Joint
  - .1 Mild black carbon steel, Grade B, ASTM A53, mill or site bevelled, complete with cast ductile iron end fittings conforming to ASTM A536.
  - .2 Manufacturers:
    - .1 Equal to Victaulic QuickVic SD rigid couplings for sizes 1/2" to 2", rated for a working pressure of 300 psi.
- .5 Soft Copper Pipe
  - .1 Type "L" seamless soft copper to ASTM B77.
- .6 Hard Copper - Solder Joint



- .1 Type "L" hard drawn seamless copper to ASTM B88, complete with wrought copper fittings to ANSI B16.22, and 95% tin / 5% Antimony solder joints.

## **2.2 PIPING UNIONS**

- .1 Screwed Piping
  - .1 Malleable iron, ground joint, bronze or brass to iron or bronze to bronze seat screwed unions and union elbows with a minimum pressure rating of 1725 kPa (250 psi) steam at 260°C (500°F).
- .2 Flanged Piping
  - .1 Forged carbon steel slip-on type raised faced welding flange unions to ASTM A105, 150 lb. Class for steel pipe, and slip-on type 150 lb. Class bronze flanges for copper pipe.

## **2.3 SHUT-OFF VALVES**

- .1 Ball Type
  - .1 Class 600, 4140 kPa (600 psi) WOG rated full port ball valves, each complete with a forged brass or bronze body and cap, blowout-proof stem, solid forged brass chrome plated ball, "Teflon" or "PTFE" seat, threaded ends, and removable lever handle.
  - .2 Manufacturers:
    - .1 Toyo Valve Co. Fig. 5044A;
    - .2 Watts Industries (Canada) Inc. #FBV-3;
    - .3 Kitz Corp. Code 58;
    - .4 Victaulic Co. of Canada Ltd. Series 722;
    - .5 Apollo Valve #77-100.
- .2 Butterfly Type
  - .1 Cast ductile iron, lug body style, 1200 kPa (175 psi) rated butterfly valve, each complete with a neck to permit 50 mm (2") of insulation above the flange, a field replaceable EPDM seat, ductile iron disc, stainless steel shaft with EPDM seal, a lever handle for valves to and including 150 mm (6") diameter, a handwheel and gear type operator for valves larger than 150 mm (6") diameter, and each suitable for bubble-tight dead end service with valve closed and either side of connecting piping removed.
  - .2 Manufacturers:
    - .1 DeZurik of Canada Ltd., Figure No. 632;
    - .2 Victaulic Co. of Canada Ltd. Vic-300 MasterSeal or AGS Vic-300;
    - .3 Apollo Valve 143 Series;
    - .4 Watts Industries (Canada) Inc. #BF-03;
    - .5 Kitz Corp. 6112 Series;
    - .6 Toyo Valve Co. 918DESL/G2.

## **2.4 SWING CHECK VALVES**

- .1 Bronze - Screwed
  - .1 Class 125, 1380 kPa (200 psi) WOG rated horizontal swing check valves, each complete with a "Y" pattern bronze body, hinged brass disc, easy access screw-in cap, and screwed ends.

.2 Manufacturers:

- .1 Toyo Valve Co. Fig. 236;
- .2 Nibco #T-433;
- .3 Kitz Corp. Code No. 22.

.2 Steel - Grooved Ends

- .1 Victaulic Co. of Canada Ltd. Series 716, 779 or W715 grooved end carbon steel check valves suitable for mounting horizontally or vertically.

.3 Cast Iron - Screwed and Flanged

- .1 Cast iron, bronze trim, 1380 kPa (200 psi) rated swing check valves, each complete with a bronze disc and seat, malleable iron hinge, bolted cover, and screwed or flanged ends as required.

.2 Manufacturers:

- .1 Toyo Valve Co. Fig. 435A;
- .2 Watts Industries (Canada) Inc. #F-511;
- .3 Kitz Corp. Code No. 78.

## 2.5 VERTICAL LIFT CHECK VALVES

- .1 Class 150, 1380 kPa (200 psi) WOG rated bronze vertical lift check valves, each complete with screwed ends and a bronze disc.

.2 Manufacturers:

- .1 Toyo Valve Co. Fig. 231;
- .2 Watts Industries (Canada) Inc. #600;
- .3 Kitz Corp. Code No. 36.

## 2.6 WAFER CHECK VALVES

- .1 Threaded lug body type, full bore, ANSI Series 150, 1965 kPa (285 psi) rated at 38°C (100°F), non-slam wafer check valves, each complete with a carbon steel body, stainless steel discs, a shaft, springs, disc stop and thrust bearings constructed of type 316 stainless steel, and seat materials to suit the application. The inside diameter of the valve must equal the inside diameter of the connecting pipe.

.2 Manufacturers:

- .1 Gulf Valve Co. "WAFER CHECK";
- .2 Watts Industries (Canada) Inc. Series ICV-125;
- .3 The Metraflex Co. Style CVXX.

## 2.7 DRAIN VALVES

- .1 Minimum 2070 kPa (300 psi) WOG rated, 20 mm (¾") diameter straight pattern bronze ball valves, each complete with a threaded outlet suitable for coupling connection of 20 mm (¾") diameter hose, and a cap and chain.

.2 Manufacturers:

- .1 Toyo Valve Co. Ltd. Fig. 5046;
- .2 Watts Industries (Canada) Inc. #B-6000-CC;



- .3 Kitz Corp. Code No. 68AC;
- .4 Apollo Valves #78-104-01.

## 2.8 CIRCUIT BALANCING VALVES

- .1 Screwed or flanged as required, globe style, non-ferrous circuit balancing valves designed to facilitate precise flow measurement, precision flow balancing, and positive shut-off, complete with capped and valved drain connection, and valved ports for connection to a differential pressure meter.
- .2 Manufacturers:
  - .1 Equal to Victaulic Co. of Canada Ltd. (Tour & Anderson) Series 787 screwed, Series 788 flanged, and 789 grooved end, and Series 78K "Koil Kit" valves.

## 2.9 RADIATOR SHUT-OFF AND BALANCING VALVES

- .1 Heavy pattern, straight, 1750 kPa (250 psi) rated at 120°C (250°F) bronze radiator valves, each complete with composition disc, spring loaded packing, and union. Equip inlet valves with a handle for shut-off. Equip outlet valves with a lockshield for shut-off and balancing.
- .2 Manufacturers:
  - .1 Dahl Brothers Canada Ltd. #11042 and #13013;
  - .2 Spirax Sarco Ltd. Type R.

## 2.10 PRESSURE RELIEF VALVES

- .1 ASME tested, rated, and certified, bronze or cast iron bronze fitted, 1725 kPa (250 psi) rated pressure relief valves, each capable of relieving full output of equipment it is associated with, and each factory set at 415 kPa (60 psi) unless otherwise specified.
- .2 Manufacturers:
  - .1 ITT Bell & Gossett 3301/4100, or 790/1170;
  - .2 Dresser Industries "CONSOLIDATED";
  - .3 Spirax Sarco Ltd. SVI Series;
  - .4 McDonnell & Miller Models 250 and 260;
  - .5 Conbraco 10-600 Series;
  - .6 Watts Industries (Canada) Inc. 174A or 740.

## 2.11 AIR VENTS

- .1 Manual Air Vents
  - .1 Equal to Conbraco 27 Series, 3.2 mm (1/8") diameter with a key handle.
- .2 Automatic Air Vents
  - .1 Float actuated air vents, each complete with a semi-steel body and cap, a stainless steel float assembly and seat, and a neoprene head.
  - .2 Manufacturers:
    - .1 Spirax Sarco Ltd., Type 13 W for system working pressures to 1035 kPa (150 psi), 13 WH for system working pressures greater than 1035 kPa (150 psi);
    - .2 Armstrong International Inc. No. 1-AV.

## 2.12 STRAINERS

- .1 Cast iron wye shaped strainers, minimum 890 kPa (125 psi) rated and complete with a removable type 304 stainless steel screen with perforations sized to suit the application, and, for strainers 50 mm (2") diameter and larger, a blowdown pipe connection tapping.
- .2 Manufacturers:
  - .1 Spirax Sarco Ltd. Type IF-125 screwed or Type AF-250 flanged;
  - .2 Toyo Valve Co. Ltd. Fig. 380A screwed or Fig. 381 flanged;
  - .3 Victaulic Co. of Canada Style 732 or W732 "Vic-Strainer";
  - .4 Armstrong International Inc. A1 Series;
  - .5 Watts Industries (Canada) Inc. #77SCI;
  - .6 Mueller Steam Specialty Products Model 11M screwed or Model 758 flanged.

## 2.13 PIPING EXPANSION JOINTS

- .1 Steel Piping Mains:
  - .1 Controlled flexing, flanged expansion joints, 2070 kPa (300 psi) rated, with corrugated stainless steel bellows with closely matched neck rings and reinforcing or control rings, and selected for operating pressure plus 25% safety factor.
  - .2 Manufacturers:
    - .1 Senior Flexonics Ltd. Series CSF "High-Corr";
    - .2 Victaulic Co. of Canada Ltd. Style 155 with Style 07 or 107 "Zero-Flex" couplings on each side of assembly and a full length steel "V" shaped support trough with hangers;
    - .3 The Metraflex Co. Model MC.
- .2 Steel or Copper Branch/Runout Piping:
  - .1 Externally pressurized, 1380 kPa (200 psi) rated expansion joints with a stainless steel bellows and shroud, welding or threaded steel nipple ends for steel piping, and copper sweat nipple ends for copper piping.
  - .2 Manufacturers:
    - .1 Senior Flexonics Ltd. Series "H";
    - .2 The Metraflex Co. Model "HP".

## 2.14 PIPING ALIGNMENT GUIDES

- .1 Prime coat painted black carbon steel pipe alignment guides sized and fabricated to suit pipe size and pipe insulation thickness.
- .2 Manufacturers:
  - .1 Senior Flexonics Ltd. Series PGT;
  - .2 E. Myatt & Co. Ltd. Fig. 1267;
  - .3 Empire Tool & Mfg. Inc. Fig 256;
  - .4 The Metraflex Co. Style IV.

## **2.15 PIPE ANCHORS**

- .1 Welded structural black steel anchors of a design, size, and type to securely anchor pipe at point shown. Each anchor is to withstand 150% of axial thrust, and, as specified in Part 1 of this section, is to be designed and detailed by a Professional Structural Engineer.

## **2.16 FLEXIBLE PUMP CONNECTIONS**

- .1 Flexible metal hose assemblies, each complete with annular corrugated unbraided type 321 stainless steel inner core, braided type 321 stainless steel hose, and a collar and flange at each end, all suitable for twice the working pressure of the system.
- .2 Manufacturers:
  - .1 Senior Flexonics Inc. A1 and A6 Series;
  - .2 The Metraflex Co. Model SST and "METRA-MINI".
- .3 Option: Victaulic Series 380, 381 or 382 pump drop assemblies. Includes flow control, vibration-controlling flexible couplings, access ports for gauges and thermowells and an integral flanged pump connection. Rated to the working pressure of Class 150 flange connection. Sizes 2" to 12".

## **2.17 AIR SEPARATORS**

- .1 Vortex type vertical air separator with side tangential inlet and outlet connections, a top air outlet connection, and bottom drain connection. Separator is to be constructed of cast iron or fabricated steel for a pressure of 1105 kPa (160 psi) at 180°C (350°F) in accordance with Section VIII, Division 1 of the ASME Boiler and Pressure Vessel Code.
- .2 Manufacturers:
  - .1 S.A. Armstrong Ltd. Model "VA".
  - .2 ITT Bell & Gossett "Rolairtrol".
  - .3 Taco Canada Ltd. "Vortech".
  - .4 Flo-Fab Inc. "SEP-T" Series.

## **2.18 EXPANSION TANKS**

- .1 Replaceable bladder type, factory pressurized expansion tank with permanent separation of air and water, in accordance with drawing schedule and complete with:
  - .1 steel pressure tank suitable for a working pressure of 870 kPa (125 psi) at 115°C (240°F), constructed and stamped in accordance with the ASME Code for Unfired Pressure Vessels and complete with a system connection, drain connection, air charging valve, and a red oxide primer finish;
  - .2 heavy-duty butyl rubber (EDPM) bladder;
  - .3 tapping for installation of a pressure gauge;
  - .4 For horizontal tanks only, mounting saddles supplied loose;
  - .5 factory secured seismic restraint connection hardware.
- .2 Manufacturers:
  - .1 Hamlet & Garneau Inc. AL Series "Expanflex";
  - .2 S.A. Armstrong Ltd. Series "AX-V" Series "L";
  - .3 ITT Bell & Gossett Series "B" (ASME);
  - .4 Amtrol "Extrol" Series.

- .5 Taco (Canada) Ltd. "CBX" Series.
- .6 Flo-Fab Inc. "WX-C" Series, "ABT" Series

## **2.19 GLYCOL SOLUTION MIXING AND STORAGE TANKS**

- .1 Package type glycol solution mixing, storage and automatic feed assembly designed to maintain minimum system pressure levels and complete with:
  - .1 round, polyethylene or polypropylene tank sized to suit system capacity, complete with a solution level scale in litres and Imperial gallons, removable cover, and a welded steel angle stand assembly with legs, pump shelf, and control panel bracket, all factory finished with enamel;
  - .2 factory pre-piped minimum 1/3 hp, 115 V, 1-phase rotary bronze gear pump with capacity and pressure differential to suit system requirements, factory wired to control panel, mounted on a shelf integral with steel stand assembly, and complete with shut-off valve and strainer;
  - .3 tank pressure relief valve with discharge piped back into tank;
  - .4 tank low level switch;
  - .5 pressure gauge;
  - .6 Honeywell #L404A "Pressurtrol" or equal pipe mounting differential pressure switch with a 100 kPa to 1000 kPa (15 psi to 150 psi) range;
  - .7 115 V, 1-phase, factory mounted and pre-wired control panel with an NEMA 2 enamelled steel enclosure, designed to control and operate glycol gear pump either manually or automatically to pump glycol solution into system, and to stop pump and initiate an audible/visual alarm if a low glycol solution level occurs in tank, and complete with:
    - .1 terminal blocks for power and control wiring connections;
    - .2 H-O-A switch with green "Power On" indicator light;
    - .3 120 volt/12 volt control transformer;
    - .4 low glycol solution level alarm buzzer with silencing switch, an alarm light which remains illuminated until low-level switch is reset, and an alarm push-to-test button;
    - .5 dry contacts for building automation system alarm annunciation.
  - .8 factory secured seismic restraint connection hardware.
- .2 Manufacturers:
  - .1 ITT Bell & Gossett Series GMU;
  - .2 S. A. Armstrong Ltd. GLA Standard Series;
  - .3 HG Spec. Inc.

## **2.20 GLYCOL**

- .1 Propylene glycol blended with Nitrite based corrosion inhibitors.

## **2.21 GENERAL RE: CIRCULATING PUMPS**

- .1 Pumps are to be bronze fitted centrifugal pumps in accordance with drawing schedule, each non-overloading under all operating conditions and factory tested at specified operating conditions.

## PART 3 - EXECUTION

### 3.1 DEMOLITION

- .1 Perform required hydronic piping system demolition/revision work. Refer to demolition requirements specified in Section 20 05 05 – Selective Demolition for Mechanical.

### 3.2 PIPING INSTALLATION REQUIREMENTS

- .1 Provide required hydronic piping. Pipe, unless otherwise specified, is to be:
  - .1 For pipe sizes up to and including 50 mm (2") diameter, Schedule 40 black steel, screwed, or type "L" hard copper with solder joints or pressure coupled joints;
  - .2 For pipe 65 mm (2-½") to 300 mm (12") dia. and larger, Standard weight grooved end black steel pipe, 10 mm (0.375") thickness, with grooved end fittings and couplings, or, Standard weight black steel pipe, 10 mm (0.375") thickness, with welding fittings and welded joints;
  - .3 For short branch connections, 25 mm (1") pipe diameter size and less, to heating equipment where structural obstructions occur and site bending of pipe is advantageous, a single length of type "L" soft copper.
- .2 Slope horizontal piping mains to provide a minimum continuous up-grade of 25 mm (1") in 6 m (20') to high points. Slope branch supply and return piping connections to equipment a minimum of 25 mm (1") in 1.2 m (4'). Leave sufficient room at high points for installation and maintenance of air vents.
- .3 Install automatic control valves, piping wells and similar piping and/or equipment mounted control components required for automatic temperature control systems supplied as part of the control work. Refer to drawing control diagrams and details.
- .4 Connect equipment provided as part of the work of other sections with piping as indicated and/or required. Refer to pipe connection details on drawings.
- .5 Provide screwed unions, removable mechanical joint couplings, or weld-on or solder-on flanges in piping at all connections to valves, strainers and similar piping system components which may need maintenance or repair, at equipment connections, in runs of piping exceeding 9 m (30') at 4.5 m (15') regular intervals to permit removal of sections of piping, and wherever else indicated on drawings.
- .6 Provide shut-off valves in piping connections to equipment, to isolate piping risers, to isolate other sections of systems as shown, and wherever else indicated on drawings. Valves in piping to and including 50 mm (2") dia. are to be ball type. All other shut-off valves are to be ball or butterfly type unless otherwise specified. Locate valves so they are easily accessible. Wherever possible, install valves at uniform height. Provide chain operators for valves which are inaccessible for operation from floor level.
- .7 Provide a check valve in discharge piping of every pump, and elsewhere in piping where shown on drawings. Where check valves are required in vertical piping, ensure they are suitable in all respects for the application. Check valves for vertical in-line and/or base mounted circulating pumps are integral with the discharge accessory.
- .8 Provide a drain valve at base of each piping riser, in drain connections to equipment, in low points of horizontal piping, and wherever else shown and/or specified.
- .9 Provide circuit balancing valves in piping generally where shown on drawings but with exact locations in accordance with instructions of personnel doing system flow balancing work. Confirm locations prior to installation.
- .10 Grooved pipe ends shall be clean and free from indentations, projections and roll marks in the area from pipe end to groove for proper gasket sealing. All couplings will meet Victaulic standards for

visual inspection sizes 2" to 12". The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service as specified. Install in accordance with manufacturer's latest recommendations. A Victaulic factory trained representative shall periodically visit the job site and review the installation for best practices. The installing Contractor shall correct any identified deficiencies. Victaulic product that has been examined and has not met the visual inspection criteria for proper installation must be corrected and re-examined by Victaulic prior to the completion of the project.

### **3.3 INSTALLATION OF PRESSURE RELIEF VALVES**

- .1 Provide factory set pressure relief valves. Pipe discharge of each water piping relief valve to drain unless otherwise shown or specified.
- .2 Pipe discharge of each glycol solution piping relief valve back to system expansion tank or return piping.
- .3 Confirm relief valve settings.

### **3.4 INSTALLATION OF AIR VENTS**

- .1 Provide an air vent in piping mains at all high points, at equipment connections, and wherever else shown and/or specified. Equip each air vent with a ball type shut-off valve. Install vents in 100 mm (4") dia. and larger piping and all vents in mechanical rooms in accordance with drawing detail.
- .2 Provide 9 mm (3/8") dia. copper drain piping from each automatic air vent to nearest suitable drain and terminate so discharge is visible. Identify drain piping.

### **3.5 INSTALLATION OF STRAINERS**

- .1 Provide strainers in piping. Locate strainers so baskets are easily accessible and removable. Clean strainer baskets during and after piping system flushing and cleaning is complete, and before water quantity balancing commences.

### **3.6 INSTALLATION OF EXPANSION COMPENSATORS**

- .1 Provide expansion compensation in piping with exact locations to suit piping as installed.
- .2 Provide double pipe alignment guides in horizontal piping at each side of expansion compensation facilities to permit movement in axial direction only. Secure guides to building structure only.
- .3 Provide a pipe guide at each side of expansion joints in vertical risers.
- .4 When using grooved piping in a riser refer to a Victaulic riser design for anchor and guide locations.

### **3.7 INSTALLATION OF PIPING ANCHORS**

- .1 Provide anchors to secure piping to structure. Locate anchors generally where shown but with exact locations to suit piping as installed and requirements of reviewed anchor shop drawings.
- .2 When installation of anchors is complete, arrange, and pay for anchor design engineer to visit site to review anchor installation. Submit a signed letter with engineer's stamp from design engineer confirming each anchor is properly installed.

### **3.8 INSTALLATION OF AIR SEPARATOR**

- .1 Provide an air separator in piping and connect with valved inlet and outlet piping.
- .2 Extend valved blowdown piping from bottom pipe connection tapping to nearest floor drain location.
- .3 Equip top pipe connection tapping with an automatic air vent, and piping as detailed.

### **3.9 INSTALLATION OF EXPANSION TANK**

- .1 Provide an expansion tank.
- .2 Secure horizontal expansion tank in place from structure by means of properly sized galvanized steel hanger rods and support saddles supplied with tank.
- .3 Secure tank stand to a concrete housekeeping pad by means of machine bolts.
- .4 Connect tank with system piping. Extend a drain line from tank piping and terminate drain line with a drain valve. Provide an air vent.
- .5 Provide a water make-up connection line complete with relief valve and pressure gauge and connect to system piping. Terminate make-up piping for connection to domestic cold water piping as part of the work of Section 22 11 00 – Facility Water Distribution. Check relief valve operation and adjust as required.
- .6 Check tank air charge and adjust to suit system.

### **3.10 INSTALLATION OF GLYCOL SOLUTION MIXING AND STORAGE TANK**

- .1 Provide a mixing and storage tank and feed assembly for each glycol solution circulating system.
- .2 Secure tank stand to a concrete housekeeping pad. Connect with system piping. Refer to drawing detail.
- .3 Fill tank with, unless otherwise specified, a solution of 50% water, 50% propylene glycol, and test solution to confirm proper concentrations.
- .4 When installation is complete, test operation of assembly, including alarms, and adjust as required. Adjust pressure switch to suit glycol solution circulating system pressure.

### **3.11 INSTALLATION OF FLEXIBLE PIPING CONNECTIONS**

- .1 Provide flexible connections in piping connections to equipment.
- .2 Install in accordance with manufacturer's instructions.

### **3.12 FLUSHING AND CLEANING PIPING**

- .1 Flush and clean new piping in accordance with requirements specified in Section 23 25 00 – HVAC Water Treatment.

### **3.13 TESTING, ADJUSTING AND BALANCING**

- .1 When work is complete and equipment is operating as intended, test, adjust and balance water flows in accordance with requirements specified in Section 20 05 93 – Testing, Adjusting, and Balancing for Mechanical Systems, and Section 20 08 00 – Commissioning of Mechanical Systems.

**END OF SECTION**

## **PART 1 - GENERAL**

### **1.1 SECTION INCLUDES**

- .1 HVAC water-treatment systems.
- .2 Chemical treatment test equipment.
- .3 HVAC water-treatment chemicals.

### **1.2 SUBMITTALS**

- .1 Submit shop drawings/product data sheets for all water treatment chemical feed equipment and associated hardware.
- .2 Submit product literature sheets for all chemicals, as well as WHMIS Material Safety Data Sheets for all chemicals.

### **1.3 CLOSEOUT SUBMITTALS**

- .1 Submit water treatment manufacturer/supplier certification letters as specified in Part 3 of this section.
- .2 Training attendance records.

### **1.4 MAINTENANCE MATERIAL SUBMITTALS**

- .1 Submit water treatment test sets and spare chemicals as specified below and in Part 3 of this section.

## **PART 2 - PRODUCTS**

### **2.1 CHARACTERISTICS OF CHEMICALS AND SPARE CHEMICALS**

- .1 Chemicals specified in this section are to be non-toxic when released to atmosphere, non-corrosive, and non-staining if a leak occurs, and compatible with all system components.
- .2 Chemicals must be approved by governing authorities for release into Municipal sewer system.

### **2.2 EXISTING TREATMENT SYSTEMS**

- .1 Owner has a contract with a treatment chemical supplier to maintain proper levels of chemical in building systems. New chemicals and/or treatment delivery hardware are to be supplied by this supplier.
- .2 Use following article for chemically cleaning oil, mill scale, and residue from new piping systems when piping is complete. Do not use for cleaning existing piping unless discussed with Designer and Owner, or unless cleaning existing piping has always been planned. Chemically cleaning existing piping can release considerable amounts of corrosion and scale which could take several weeks of circulating, flushing, filling, circulating, etc., to clean, as well as cleaning strainers and pump seal flush line filters at close intervals. this cleaning is generally not required for small additions to existing systems.



### 2.3 PIPING SYSTEM FLUSHING AND CLEANING CHEMICAL

- .1 Liquid form alkaline type cleaner consisting of a concentrated blend of highly active penetrating agents and detergents with a 12.5 pH and specifically formulated to remove oil, mill scale and oxides from piping and equipment.

### 2.4 CLOSED HEAT TRANSFER SYSTEM TREATMENT

- .1 Chemicals, chemical feed equipment, and test equipment to control corrosion in closed heat transfer circulating systems as indicated on drawings and as specified below.
- .2 Enamelled steel or cast iron by-pass feeders sized as shown, 2060 kPa (300 psi) rated and complete with 20 mm ( $\frac{3}{4}$ ") diameter NPT pipe connection tapings, and a screw-on cast iron cap with "Buna N" "O" ring seal.
- .3 By-pass filter and flow indicator assembly equal to a Shelco Inc. FOS78, 1725 kPa (250 psi) rated replaceable cartridge filter assembly with a stainless steel housing and 20 mm ( $\frac{3}{4}$ ") diameter piping connections, sized for approximately 5% of rated circulating pump flow and complete with a minimum of 6, 20 micron filter cartridges, and a sight flow indicator equal to an Anderson Midwest Model 350SS with 20 mm ( $\frac{3}{4}$ ") diameter piping connections.
- .4 Piping tee mounting coupon holders, each complete with 25 mm (1") diameter NPT plugs with a minimum of one coupon for copper and one coupon for steel.
- .5 Chromate free, nitrite/borate type corrosion inhibitor suitable for use with both ferrous and non-ferrous metals.
- .6 Test kit for measuring inhibitor level.

## PART 3 - EXECUTION

### 3.1 PIPING SYSTEM FLUSHING AND CLEANING

- .1 After new heat transfer system piping has been installed and leakage testing has been satisfactorily completed, but before mechanical equipment start-up and performance tests, flush and chemically clean piping systems.
- .2 Provide required temporary piping connections, including bypass piping to isolate dirt sensitive mechanical plant equipment. Remove instrumentation such as flow meters and switches, orifice plates, meter valves and similar devices and plug pipe openings. Reinstall when flushing and cleaning work has been certified complete by chemical manufacturer/installer. Ensure control valves are operational and fully open during flushing and cleaning.
- .3 Prior to chemical cleaning, flush piping, including dead ends, with water to remove loose solids. Clean all strainers. Replace chemical feeder line filters as required. Flush and drain until water runs clear.
- .4 When flushing with water is complete, fill systems with fresh clean water. Meter amount of water required to fill each system or otherwise calculate system capacity. Ensure all air is vented from systems. Add cleaning chemical as instructed by chemical manufacturer and circulate solution for a period of time and at a temperature as required to produce a clean piping system. Conduct daily pH, conductivity, and total iron tests in accordance with chemical supplier's instructions.
- .5 After chemical cleaning when test results indicate a clean system, drain solution from piping, refill with clean water and circulate water for a minimum of 24 hours to flush out remaining chemical solution, then drain water from piping using all drain points and again clean all system strainers and replace filters. Arrange for chemical supplier to check each system after flushing and cleaning is complete and to certify in writing that flushing and cleaning procedures have been properly performed. Submit a copy of the certification letter. Fill systems.

### **3.2 INSTALLATION OF CLOSED HEAT TRANSFER SYSTEM TREATMENT**

- .1 After flushing and cleaning procedures have been certified complete, provide a by-pass chemical feeder, a cartridge filter assembly, and corrosion test coupons for each closed heat transfer system. Install in accordance with requirements of drawing details.
- .2 Supply and feed into each system sufficient chemical to charge system to proper concentrations of chemical, and maintain proper levels in system until Substantial Performance of the Work.

### **3.3 MANUFACTURER'S CERTIFICATION, START-UP, AND TRAINING**

- .1 For all water treatment equipment include for on-site certification, start-up supervision, and system training by treatment chemical manufacturer's representative as follows:
  - .1 For equipment/system manufacturer certification requirements, refer to Section 20 05 00 – Common Work Results for Mechanical;
  - .2 For equipment/system start-up requirements, refer to Section 20 05 00 – Common Work Results for Mechanical;
  - .3 Include for 4 hours of on-site operation demonstration and training session. Training is to be a full review of all components including but not limited to a full operation and maintenance demonstration, with abnormal events.

**END OF SECTION**

## **PART 1 - GENERAL**

### **1.1 SECTION INCLUDES**

- .1 HVAC ducts and casings.
- .2 Acoustic duct lining material.
- .3 Special systems ductwork.
- .4 Dampers.
- .5 Louvres.
- .6 Other duct work accessories.

### **1.2 SUBMITTALS**

- .1 Submit shop drawings/product data sheets for all products specified in this section except shop fabricated ductwork and fittings.
- .2 Include capacity, throw and terminal velocity, noise criteria, and pressure drops with grille and diffuser shop drawing/product data sheet submission.
- .3 With shop drawing/product data sheet submission, supply evidence that fire rated duct manufacturer is ULC listed to size requirements shows on drawings.
- .4 Submit duct leakage test data prior to ductwork being covered from view.
- .5 Submit manufacturer's colour chart(s) for all items for which a finish colour is to be selected.

### **1.3 CLOSEOUT SUBMITTALS**

- .1 Submit proper installation certification from fire rated duct manufacturer as specified in Part 3 of this section.
- .2 Submit a site inspection and start-up report from fan filter diffuser manufacturer's representative as specified in Part 3 of this section.

### **1.4 MAINTENANCE MATERIAL SUBMITTALS**

- .1 Supply and hand to Owner at Substantial Performance of the Work, a minimum of 10 identified (with tags) grille/diffuser volume control damper adjustment keys.

### **1.5 COORDINATION**

- .1 Supply reviewed copies of ventilator/curb assembly shop drawings or product data sheets to trade who will cut roof openings for ventilators, and ensure openings are properly sized and located.

### **1.6 QUALITY ASSURANCE**

- .1 Grilles and diffusers are to be tested and performance certified to ANSI/ASHRAE 70, Method of Testing the Performance of Air Outlets and Air Inlets.

## **PART 2 - PRODUCTS**

### **2.1 GALVANIZED STEEL DUCTWORK**

- .1 Galvanized steel sheet is to be hot dipped in accordance with requirements of ASTM A653. G60 galvanizing for bare uncovered duct to be finish painted. G90 for all other galvanizing.

- .2 Rectangular
  - .1 Lock forming grade hot dip galvanized steel, ASTM A653, shop fabricated, minimum #26 gauge.
- .3 Round
  - .1 Factory machine fabricated, spiral, mechanically locked flat seam, single wall duct, fittings and couplings.
- .4 Flat Oval
  - .1 Factory machine fabricated, single wall, 4-ply spiral lock seam duct, fittings and couplings.

## **2.2 RECTANGULAR ALUMINUM DUCTWORK**

- .1 Alloy 3003 Temper H14 aluminum, ASTM B209, shop or factory fabricated, water-tight, with metal gauges and fabrication in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible to suit the duct working pressure classification, and type 316 stainless steel support hardware.

## **2.3 ROUND ALUMINUM DUCTWORK**

- .1 Alloy 3003 Temper H14 aluminum, ASTM B209, factory fabricated, water-tight, smooth interior, single wall duct, and fittings of spiral lockseam construction with site sealed beaded sleeve (slip type) joints, all in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible to suit duct working pressure classification, and type 316 stainless steel sheet metal screws and support hardware.

## **2.4 RECTANGULAR STAINLESS STEEL DUCTWORK**

- .1 300 Series stainless steel, type 304 or type 316 as specified in Part 3 of this Section, ASTM A167 and ASTM A480, with a #4 finish where bare (uncovered) and exposed in finished areas and a #2B finish elsewhere, with, unless otherwise specified, metal gauges in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible to suit duct location and working pressure classification, and stainless steel support hardware to match duct material.

## **2.5 ROUND STAINLESS STEEL DUCTWORK**

- .1 Factory made, spiral, mechanically locked flat seam, single wall duct fabricated from type 316 stainless steel to ASTM A240 with metal gauges in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible for 2.5 kPa (0.36 psi) pressure. Type 316 stainless steel fittings equipped with leak-proof stainless steel couplings secured to connecting duct by means of stainless steel sheet metal screws and duct sealer. Duct system performance is to meet SMACNA's Leakage Class 3 requirements at system design static pressure. Stainless steel finish is to be a #2B mill finish where concealed or exposed in unfinished areas and a #4 finish where exposed in finished areas.

## **2.6 FLEXIBLE METALLIC DUCTWORK**

- .1 Bare
  - .1 Spirally wound, semi-rigid, self-supporting corrugated aluminum duct with continuous triple lock seams, SMACNA Form "M-UN", CAN/ULC-S110 listed and labelled as a Class 1 Air Duct, constructed of dead soft aluminum strip, and supplied in 3 m (10') lengths.
- .2 Insulated
  - .1 Spirally wound, semi-rigid, self-supporting corrugated aluminum duct with continuous triple lock seams, SMACNA Form "M-I", CAN/ULC-S110 listed and labelled as a Class 1 Air Duct, constructed of dead soft aluminum strip, supplied in 3 m (10') lengths and factory covered with

40 mm (1-½") thick, 12 kg/m<sup>3</sup> (0.75 lb/ft<sup>3</sup>) density fibreglass insulation with a vinyl jacket meeting 25/50 flame spread and smoke developed requirements tested in accordance with CAN/ULC-S102.

## 2.7 FLEXIBLE CONNECTION MATERIAL

- .1 Waterproof, indoor-outdoor type flexible connection material meeting requirements of NFPA 90A, consisting of woven glass fibre fabric coated on both sides with synthetic rubber.
- .2 Manufacturers:
  - .1 Duro Dyne Canada Inc. "DUROLON";
  - .2 Dyn Air Inc. "HYPALON".
- .3 Waterproof, flameproof, high temperature flexible connection material meeting requirements of NFPA 90A, consisting of a woven glass fibre fabric coated on both sides with silicone rubber.
- .4 Manufacturers:
  - .1 Duro-Dyne Canada Inc. "THERMAFAB";
  - .2 Dyn Air Inc. "SILICON HI-T".

## 2.8 METAL DUCT SYSTEM JOINT SEALANT

- .1 ULC listed and labelled, premium grade, grey colour, water base, non-flammable duct sealer, brush, or gun applied, with a CAN/ULC S102 tested maximum flame spread rating of 5 and smoke developed rating of 0.
- .2 Manufacturers:
  - .1 Johns Manville;
  - .2 Manson Insulation;
  - .3 Knauf Insulation.

## 2.9 CASING AND PLENUM MATERIAL AND ACCESSORIES

- .1 Unless otherwise specified, casing and plenum material is to be same as connecting duct material.
- .2 Accessories such as access doors and drain pans are to be constructed of same material as casing and plenum and are to be in accordance with Chapter 6 of SMACNA HVAC Duct Construction Standards Metal and Flexible.

## 2.10 ACOUSTIC PLENUM PANELS

- .1 Vibro-Acoustics Ltd. type "AP", 100 mm (4") thick panels with acoustic media meeting NFPA 90A requirements sandwiched between minimum #24 gauge galvanized sheet steel, with airside face perforated, access doors where shown, and with acoustic performance as follows:

Octave Bands, (Hz)	125	250	500	1000	2000	4000
Transmission Loss	21	28	39	50	53	56
Absorption Coefficient	0.7	0.9	0.99	0.99	0.9	0.9

- .2 Acoustic plenum media factory encapsulated in sealed DuPont "Tedlar" polyvinyl fluoride film to ensure no media enters the airstream.
- .3 Manufacturers:
  - .1 Vibro-Acoustics Ltd.;
  - .2 Kinetics Noise Control Inc.;

- .3 Carrier Corp. – Racan;
- .4 Haakon Industries;
- .5 Price Industries Inc;
- .6 Alumavent.

## **2.11 PLENUM ACCESS DOORS**

- .1 Factory fabricated, double wall insulated access doors, sized as indicated on drawings, and constructed of same material as connecting ductwork in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible to suit operating pressure of the system.

## **2.12 ROUND TO RECTANGULAR DUCT CONNECTIONS**

- .1 Equal to Flexmaster Canada Ltd. galvanized steel, flared, flanged or notched "Spin-On" round duct take-off collars with locking dampers in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible.

## **2.13 SPLITTER DAMPERS**

- .1 Minimum #20 gauge damper blade constructed of same material as duct, reinforced as required to suit blade size, system velocity, and to prevent "chatter", and complete with operating hardware equal to DynAir Inc. #Q-50 "DYN-A-QUAD S-S" quadrant regulator with RW-50 backup washers to prevent leakage, long square bearing pin, and slide pin.

## **2.14 AIR TURNING VANES**

- .1 For square elbows, multiple-radius turning vanes interconnected with bars, adequately reinforced to suit pressure and velocity of system, constructed of same material as duct they are associated with, and in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible.
- .2 For short branch ducts at grille and diffuser connections, air extractor type each equipped with a matching bottom operated 90° opposed blade volume control damper, constructed of same material as duct it is associated with and in accordance with requirements and details in ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible.

## **2.15 MANUAL BALANCING (VOLUME) DAMPERS**

- .1 Flanged and drilled, single or parallel blade (depending on damper size) manual balancing dampers, each constructed of same material as connecting ductwork unless otherwise specified, each designed to maintain internal free area of connecting duct, and each complete with:
  - .1 hexagonal or square shaft extension through frame;
  - .2 non-stick, non-corrosive synthetic bearings for rectangular dampers, flange stainless steel bearings for round dampers;
  - .3 blade stops for single blade dampers, designed to prevent blade from moving more than 90°;
  - .4 linkage for multiple blade dampers;
  - .5 locking hand quadrant damper operator with, for insulated ducts 50 mm (2") standoff mounting.
- .2 Rectangular Dampers: Nailor Industries Inc. 1800 Series, maximum size 1.2 m x 1.2 m (4' x 4') for a single damper.
- .3 Round Dampers: Nailor Industries Inc. model 1890, maximum 600 mm (24") diameter, equipped with a minimum 200 mm (8") deep frame, and blade stiffeners where required.

- .4 Multiple Rectangular Damper Section Assembly: Rectangular assembly supplied with the dampers or site constructed, of same material as damper and designed for tight and secure mounting of individual dampers.
- .5 Manufacturers:
  - .1 Nailor Industries Inc.;
  - .2 T.A. Morrison & Co. Inc. "TAMCO";
  - .3 Greenheck Fan Corp.;
  - .4 Ruskin Co.

## 2.16 BACKDRAFT DAMPERS

- .1 Nailor Industries Model 1370CB counterbalanced backdraft dampers, vertical or horizontal mounting, 50 mm (2") wide, sized as shown and complete with:
  - .1 extruded 6063-T5 aluminum frame, 2.3 mm (0.090") nominal wall thickness, with mitred corners;
  - .2 extruded 6063-T5 aluminum blades, 1.3 mm (0.050") nominal wall thickness on 92 mm (3-5/8") centres, and with extruded PVC blade seals;
  - .3 corrosion-resistant synthetic bearings;
  - .4 adjustable plated steel counterweights mounted internally in the airstream;
  - .5 concealed blade linkage located out of the airstream.
- .2 Manufacturers:
  - .1 Nailor Industries Inc.;
  - .2 T.A. Morrison & Co. Inc. "TAMCO";
  - .3 Greenheck Fan Corp.;
  - .4 Ruskin Co.

## 2.17 FUSIBLE LINK DAMPERS

- .1 Curtain blade type, dynamic, galvanized steel (unless otherwise specified) fusible link dampers, ULC classified to CAN/ULC S112 and in accordance with NFPA 90A requirements, factory tested for closure under airflow, 1-1/2 hour or 3 hour rated as required, and complete with a constant force type 301 stainless steel closure spring, a blade lock assembly, a steel sleeve, retaining angles, and, unless otherwise specified, a 74°C (165°F) rated standard fusible link.
- .2 Fusible link dampers are to be Type "B" or Type "C" (as required) with folded curtain blade out of air stream except where damper size or location requires use of type "A" dampers with curtain blade in air stream.
- .3 Dampers in ductwork other than galvanized steel are to be as specified above but constructed of type 316 stainless steel.
- .4 Manufacturers:
  - .1 Nailor Industries Inc.;
  - .2 Greenheck Fan Corp.;
  - .3 Ruskin Co.;
  - .4 Price Industries (E.H. Price).



## **2.18 COMBINATION FIRE/SMOKE DAMPERS**

- .1 Nailor Industries Series 1221, ULC listed to CAN/ULC S112 and CAN/ULC S112.1, meeting requirements of NFPA 80, 90A, 92, 101 and 105, consisting of type A, B, or C fusible link fire dampers as required and a fail-safe, opposed blade, normally closed, motor operated smoke damper complete with factory installed and tested 120 V electric actuator.
- .2 ULC 1-1/2 hour fire rated and ULC Class I leakage rated for smoke, and equipped with a 74°C (165°F) ULC classified fusible link that will cause damper to close and lock independent of actuator when duct temperature reaches maximum temperature of damper assembly.
- .3 Supply damper with factory installed sleeves of minimum 400 mm (16") length, field verified by contractor dependent on wall thickness. Caulk sleeves to ULC requirements and constructed of 20 gauge for sizes up to 2.1 m (84") wide and 18 gauge for sizes greater than 2.1 m (84") wide.
- .4 Dampers in ductwork other than galvanized steel are to be as specified above but constructed of type 316 stainless steel.
- .5 Manufacturers:
  - .1 Nailor Industries Inc.;
  - .2 Greenheck Fan Corp.;
  - .3 Ruskin Co.;
  - .4 Price Industries (E.H. Price).

## **2.19 SMOKE DAMPERS**

- .1 Multi-blade type, fail-safe, dynamic, galvanized steel (unless otherwise specified) smoke dampers, ULC classified to CAN/ULC S112.1, ULC Class I leakage rated for smoke, meeting requirements of NFPA 90A, 92, 101 and 105, normally closed, low pressure drop design, dynamically tested, each complete with jamb and blade seals, linkage concealed in the frame, a steel sleeve to suit the opening, and an electric actuator to automatically close damper upon receiving an external signal, and to automatically open damper when system is reset.
- .2 Dampers in ductwork other than galvanized steel are to be as specified above but constructed of type 316 stainless steel.
- .3 Manufacturers:
  - .1 Nailor Industries Inc.;
  - .2 Greenheck Fan Corp.;
  - .3 Ruskin Co.;
  - .4 Price Industries (E.H Price).

## **2.20 ROOF DUCT SUPPORTS**

- .1 Equal to PHP Systems Design Model PHP-D adjustable duct support assemblies sized to suit duct size, each assembly complete with injection moulded recycled plastic and carbon black bases and tubular hot dip galvanized steel framing.

## **2.21 PRESSURE RELIEF DOORS**

- .1 Greenheck model PRAD (positive) or VRAD (negative) pressure relief doors constructed of same material as duct or plenum they are associated with, each complete with a sealing gasket, special latches, cable assembly with spring to limit door opening to maximum 80° and factory set, field adjustable pressure relief magnet assembly.



- .2 Size access doors to match requirements of system so pressure drop through open blow-out door at required flow rate will not exceed rated pressure of duct system.
- .3 Manufacturers:
  - .1 Greenheck Fan Corp.;
  - .2 United Enertech.

## **2.22 DUCT ACCESS DOORS**

- .1 In accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible, with sizes suitable in all respects for purpose for which they are provided, and, unless otherwise specified, constructed of same material as duct they are associated with.

## **2.23 DUCTWORK DRAIN POINTS**

- .1 Equal to Ductmate Canada Ltd. "Moisture Drain", 20 mm ( $\frac{3}{4}$ ") diameter moisture drains with galvanized sheet metal funnel, and chrome plated brass threaded drain, nut, and cap.

## **2.24 INSTRUMENT TEST PORTS**

- .1 Equal to Duro-Dyne of Canada Ltd. #IP1 or #IP2 (to suit insulation thickness where applicable) gasketed, leakproof instrument test ports for round or rectangular ducts as required, each complete with a neoprene expansion plug and a plug securing chain.

## **2.25 WIRE MESH (BIRDSCREEN)**

- .1 Heavy-gauge galvanized steel or aluminum mesh, 12 mm x 12 mm ( $\frac{1}{2}$ " x  $\frac{1}{2}$ ") secured in a rigid galvanized steel or aluminum framework, sized as indicated on drawings, and constructed so as to be removable.

## **2.26 LOUVRES**

- .1 Price Industries Inc. DE439 or DE635, 100 mm (4") or 150 mm (6") deep (to suit wall thickness) factory assembled stationary, drainable, louvres sized as indicated on drawings, each AMCA water penetration and air performance certified, constructed of welded, extruded, alloy 6063-T5 aluminum with drainable blades, mounting and securing hardware to suit the application, and 12 mm ( $\frac{1}{2}$ ") mesh aluminum birdscreen in an aluminum frame.
- .2 Acoustical Louvres: Price Industries Inc. Model QA1245 300 mm (12") deep, welded, extruded alloy 3003-H14 aluminum, storm-proof, stationary, drainable acoustical louvers, AMCA water penetration and air performance certified, with high density mineral wool acoustic media secured to blades and protected by perforated aluminum, sound ratings in accordance with ASTM E90 and ASTM E413, and mounting and securing facilities as required.
- .3 Louvres are to be factory finished with a finish equal to PPG Industries "Duramar" fluoropolymer powder coating over primer with colour as selected from manufacturer's standard colour range.
- .4 Manufacturers:
  - .1 Price Industries Inc.;
  - .2 The Airolite Co. LLC;
  - .3 Construction Specialties;
  - .4 Nailor Industries Inc.;
  - .5 Kinetics Noise Control Inc.
  - .6 Greenheck Fan Corp.

.7 Ventex.

## **2.27 LOUVRE BLANK-OFF PANELS**

- .1 Insulated, framed, sandwich construction panels consisting of 40 mm (1-1/2") thick rigid insulation (meeting NFPA 90A requirements) between minimum #20 gauge galvanized sheet steel with exterior face of panels finished to match finish of exterior wall louvres.

## **2.28 FIRE STOP FLAPS AND THERMAL BLANKET MATERIAL**

- .1 Rectangular or round, ULC listed and labelled, blade type galvanized steel fire stop flaps in accordance with CAN/ULC S112, Standard Methods of Fire Test of Fire-Damper Assemblies and CAN/ULC S112.2, Standard Method of Fire Test of Ceiling Firestop Flap Assemblies, each complete with #22 gauge G60 galvanized steel blade(s) and frame, a 74°C (165°F) fusible link, and, for dampers 300 mm (12") and larger, ceramic fibre insulation on both sides of the blades.
- .2 Ceramic fibre material in accordance with 25/50 flame spread/smoke developed ratings when tested to CAN/ULC S102 and of a thickness to suit required fire rating.

## **2.29 GRILLES AND DIFFUSERS**

- .1 Grilles and diffusers of type, size, capacity, finish, and arrangement as shown on drawings and in accordance with drawing schedule, each equipped with all required mounting and connection accessories to suit mounting location and application.
- .2 Manufacturers:
  - .1 Price Industries Inc.;
  - .2 Anemostat;
  - .3 Krueger Division of Air System Components Inc.;
  - .4 Titus;
  - .5 Nailor Industries Inc.;
  - .6 Tuttle & Bailey.

## **2.30 EXHAUST WALL BOX**

- .1 Equal to Reversomatic SWBL wall boxes leakproof seamless construction, extruded aluminum grille, sized as shown, complete with stainless steel fasteners, neoprene backdraft damper, and all required accessories to suit the application. Contractor to coordinate colour and finish with colour as selected from manufacturer's standard colour range as noted in schedule.

# **PART 3 - EXECUTION**

## **3.1 CLEANLINESS REQUIREMENTS FOR HANDLING AND INSTALLATION OF DUCTWORK**

- .1 Handle and install ductwork in accordance with CSA Z317.2, Special Requirements for Heating, Ventilation, and Air-Conditioning (HVAC) Systems in Healthcare Facilities and SMACNA's Duct Cleanliness for New Construction Guidelines at the Advanced Level.
- .2 Handle and install ductwork in accordance with SMACNA's Duct Cleanliness for New Construction Guidelines at the Advanced Level.

### 3.2 FABRICATION AND INSTALLATION OF GALVANIZED STEEL DUCTWORK

- .1 Provide required ductwork, rectangular, round and/or flat oval. Where rectangular ductwork is shown, round or flat oval ductwork of equivalent cross-sectional area is acceptable.
- .2 It is to be understood that all duct dimensions shown on drawings are clear internal dimensions.
- .3 Unless otherwise specified, construct and install ductwork in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible to suit duct pressure class designation of minimum 500 Pa (2" w.c.) positive or negative as applicable, a minimum velocity of 10 m/s (2000 fpm), and so ductwork does not "drum". Flat surfaces of rectangular ductwork are to be cross-broken or beaded per SMACNA standards. Duct system sealing is to meet ANSI/SMACNA Seal Class A requirements.
- .4 Confirm routing of all ductwork at site and site measure ductwork prior to fabrication. Duct dimensions may be revised to suit site routing and building element requirements, if dimension revisions are reviewed with and approved by the Consultant. Duct routing and/or dimension revisions to suit conditions at site are not grounds for a claim for an extra cost.
- .5 Refer to structural drawings. Where ductwork is to be run within or through open web steel joists, ductwork shown on mechanical drawings is schematic only and is to be altered as required to suit steel joist configuration, spacing, panel points, and cross-bridging at no additional cost.
- .6 Wherever ductwork is required at locations where sprayed fireproofing is applied to building construction, install ductwork only after fireproofing work is complete and do not compromise fire rating of sprayed fireproofing.
- .7 Install (but do not connect) duct system mounted automatic control components supplied as part of the automatic control work.
- .8 Where indicated, provide duct connections to fan powered heat transfer equipment with integral coils.
- .9 Flange connect ductwork to hot water reheat coils in accordance with requirements of ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible. Coils will be suspended independent of connecting ductwork as part of the heat transfer work.
- .10 Support horizontal rectangular ducts inside building in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible, but use trapeze hangers with, unless otherwise specified, galvanized steel channels, and galvanized steel hanger rods for exposed ducts and concealed ducts wider than 500 mm (20"). Support hardware constructed of same material as duct for metal duct, and, unless otherwise specified, type 316 stainless steel for non-metal duct. Supports for "heavy" duct such as cementitious core duct is to be suitable in all respects for the application and approved by the Consultant.
- .11 Support round and flat oval ducts inside building in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible, but, unless otherwise specified, for both uninsulated and insulated ducts exposed in finished areas, use bands and secure at top of duct to a hanger rod, all similar to Ductmate Canada Ltd. type "BA". If duct is insulated, size strap to suit diameter of insulated duct. Unless otherwise specified, duct support hardware for metal duct is constructed of same material as duct, and for non-metal duct, type 316 stainless steel.
- .12 Where flanged duct joints are used, do not locate joints in wall or slab openings, or immediately at wall or slab openings. Do not use flanged joints for exposed uninsulated ducts in finished areas.
- .13 Where watertight horizontal ductwork is required, construct ducts without bottom longitudinal seams. Solder or weld joints of bottom and side sheets. Seal all other joints with duct sealer. Slope horizontal duct to hoods, risers, or drain points. Provide drain points. Provide watertight ductwork for:
  - .1 ductwork outside building or otherwise exposed to the elements;
  - .2 dishwasher exhaust;
  - .3 fresh air intakes;

- .4 wherever else shown.
- .14 Leakage Testing:
  - .1 Ductwork leakage is not to exceed following:
    - .1 ductwork to 2" W.C. Class, 1% of total air quantity handled by respective fans;
    - .2 ductwork exceeding 2" W.C. Class, 2% of total air quantity handled by respective fans.
  - .2 Leakage testing is to be performed by the Testing, Adjusting and Balancing (TAB) agency in accordance with SMACNA HVAC Air Duct Leakage Test Manual and is to be witnessed by the Consultant.
  - .3 Leakage test following ductwork:
    - .1 Exhaust ductwork from Hot Waiting, Barrier Free Washroom and NSD rooms to EF-1 ;
  - .4 Be responsible for following:
    - .1 preparing duct systems for leakage testing prior to installation of external insulation including capping duct runouts and provision of final tap-in for test equipment;
    - .2 schedule testing with TAB agency in advance, be present for all testing and ensure notice is given to the Consultant so they may witness testing;
    - .3 resealing and/or replacement of defective ductwork;
    - .4 bearing all costs associated with retesting ductwork which has failed to pass leakage testing.
- .15 Seal all ductwork in accordance with SMACNA Seal Class "A", except for round duct with self-sealing gasketed fittings and couplings which does not require site applied sealant. Apply sealants by brush or gun to cleaned metal surfaces. Where bare ductwork is exposed apply neat uniform lines of sealant. Randomly brushed, sloppy looking sealant applications will be rejected and must be repaired or replaced with a neat application of sealant.
- .16 Apply sealants by brush or gun to cleaned metal surfaces. Where bare ductwork is exposed apply neat uniform lines of sealant. Randomly brushed, sloppy looking sealant applications will be rejected and must be repaired or replaced with a neat application of sealant.
- .17 Clean exterior exposed (uninsulated) ducts and coat with a heavy full coverage of Bakor #410-02 black metal paint.
- .18 Where dissimilar metal ducts are to be connected, isolate ducts by means of flexible duct connection material.

### **3.3 INSTALLATION OF STAINLESS STEEL DUCTWORK**

- .1 Provide stainless steel ductwork, round or rectangular fully welded on all seams.
- .2 Provide stainless steel ductwork as follows:
  - .1 Exhaust ductwork from Hot Waiting, Barrier Free Washroom and NSD rooms to EF-1;
  - .2 Between EF-1 to Exterior Louver & back draft damper.

### **3.4 INSTALLATION OF FLEXIBLE DUCTWORK**

- .1 For supply air ductwork, provide maximum 1.8 m fully stretched, long lengths of flexible ductwork for connections between galvanized steel duct mains and branches, and necks of ceiling grilles and diffusers. Do not install flexible ductwork through walls, even if shown on drawings.
- .2 At rectangular galvanized steel duct, accurately cut holes and provide flanged or "Spin-in" round flexible duct connection collars. Seal joints with duct sealer.

- .3 Install flexible ducts as straight as possible and support in accordance with requirements of ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible, and secure at each end with nylon or stainless steel gear type clamps, and seal joints. Provide long radius duct bends where they are required.
- .4 Do not penetrate fire barriers with flexible duct.

### **3.5 INSTALLATION OF CASINGS AND PLENUMS**

- .1 Provide required shop or site fabricated casings and plenums. Unless otherwise specified or shown, construct casings and plenums of same material as connecting duct system.
- .2 Construct and install casings and plenums in accordance with Chapter 6 of ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible to suit systems' pressure classification. Ensure plenums and casings secured to building structure are gasketed air-tight and equipped with angle reinforcing.
- .3 Provide drain pans with accessible trapped drains for fresh air intake plenums, and wherever else shown.

### **3.6 INSTALLATION OF CASING AND PLENUM ACCESS DOORS**

- .1 Provide access doors into all site or shop fabricated casings and plenums requiring access, and wherever shown.
- .2 Construct access doors to open in or out to suit positive and negative pressures of system.
- .3 Provide pitot tube openings in access doors where required for system air quantity balancing purposes.
- .4 Provide suitably sized, engraved, red-white laminated Lamacoid warning nameplates on access doors into casings and plenums where equipment is located, i.e. fans.

### **3.7 INSTALLATION OF ROUND TO RECTANGULAR DUCT CONNECTIONS**

- .1 Cut round holes in rectangular ducts and provide round to rectangular lock-in fittings with dampers for connection of flexible round ductwork.

### **3.8 INSTALLATION OF SPLITTER DAMPERS**

- .1 Provide splitter dampers in supply ductwork at branch duct connections off supply air mains, and wherever else shown and/or specified on drawings. Install splitter dampers so they cannot vibrate and rattle and so damper operation mechanisms are in an easily accessible and operable location. Ensure operators for dampers in insulated ducts are equipped with stand-off mounting brackets.

### **3.9 INSTALLATION OF TURNING VANES**

- .1 Provide turning vanes in ductwork elbows where shown on drawings and wherever else required where, due to site installation routing and duct elbow radius, turning vanes are recommended in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible.
- .2 Provide volume extractor type turning vanes in short branch supply duct connections off mains to grilles and diffusers where shown and/or specified.

### **3.10 INSTALLATION OF MANUAL BALANCING (VOLUME) DAMPERS**

- .1 Provide manual balancing dampers as required to provide a fully balanced system, including but not limited to in all open end ductwork, in all duct mains, and wherever else shown and/or specified.

- .2 Install dampers so operating mechanism is accessible and positioned for easy operation, and so dampers cannot move or rattle. Ensure operating mechanisms for dampers in insulated ducts are complete with stand-off mounting brackets.
- .3 Where a duct for which a balancing damper is required has dimensions larger than dimensions of maximum size volume damper available, provide multiple dampers bolted together in a properly sized assembly, or bolted to a heavy-gauge black structural steel angle or channel framework which is properly sized. Seal to prevent air by-pass, and provide connecting linkage.
- .4 Confirm exact damper locations with personnel doing air quantity balancing testing work and install dampers to suit. Include for providing 5 additional dampers at no additional cost.

### **3.11 INSTALLATION OF BACKDRAFT DAMPERS**

- .1 Provide backdraft dampers.
- .2 Install and secure dampers so they cannot move or rattle.

### **3.12 INSTALLATION OF FUSIBLE LINK DAMPERS**

- .1 Provide fusible link dampers. Ensure damper rating (1-½ or 3 hr) is suitable for fire barrier it is associated with.
- .2 Install dampers with retaining angles on all 4 sides of sleeve on both sides of damper and connect with ductwork in accordance with damper manufacturer's instructions and details, and Code requirements.
- .3 Provide expansion clearance between damper or damper sleeve and opening in which damper is required. Ensure openings are properly sized and located, and all voids between damper sleeve and opening are properly sealed to maintain rating of fire barrier.
- .4 Where size of fire barrier opening requires use of a sectionalized fire damper assembly, provide multiple fusible link dampers (sized to CAN/ULC S112) bolted together in a properly sized assembly or bolted to a heavy-gauge black structural steel angle or channel framework.

### **3.13 INSTALLATION OF COMBINATION FIRE/SMOKE DAMPERS**

- .1 Provide combination fire/smoke dampers. Install dampers with retaining angles on all 4 sides of each side of damper, and, where required, connect with ductwork, all in accordance with damper manufacturer's instructions and details, and Code requirements.
- .2 Coordinate damper installation with electrical work where electrical connections to damper actuators are specified.

### **3.14 INSTALLATION OF SMOKE DAMPERS**

- .1 Provide smoke dampers. Install dampers with retaining angles on all 4 sides of sleeve on both sides of damper and connect with ductwork in accordance with damper manufacturer's instructions and details, and Code requirements.
- .2 Coordinate damper installation with electrical work where electrical connections to damper actuators are specified.
- .3 Where size of fire barrier opening requires use of a sectionalized fire damper assembly, provide multiple smoke dampers (sized to CAN/ULC S112) bolted together in a properly sized assembly or bolted to a heavy-gauge black structural steel angle or channel framework.

### **3.15 INSTALLATION OF FLEXIBLE CONNECTION MATERIAL**

- .1 Provide a minimum of 100 mm (4") of flexible connection material where ducts, plenums, and/or easings connect to fans, and wherever else shown or specified.



- .2 Rigidly secure a minimum of 75 mm (3") of duct material (minimum #24 gauge) to each edge of flexible fabric and to fan, duct, plenum, etc., in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible. Ensure connections to flexible fabric material are arranged and supported so as to not impose any external forces on the fabric.

### **3.16 INSTALLATION OF PRESSURE RELIEF DOORS**

- .1 Provide pressure release access doors to prevent duct system explosion or implosion as a result of a duct obstruction, i.e. closed fire damper, which prevents normal air flow through the system. Size access doors in accordance with requirements of Part 2 of this section.
- .2 Where pressure release doors are shown in suction ducts or plenums, mount access door assembly so door swings in and latch mechanism is on the inside of duct or plenum. If latch mechanism is not accessible, provide a standard access door at latch side of the pressure release access door for maintenance purposes.
- .3 Adjust each latch mechanism by means of the adjusting pin to suit static pressure of the particular system in accordance with latch mechanism manufacturer's instructions.

### **3.17 INSTALLATION OF DUCT ACCESS DOORS**

- .1 Provide access doors in ductwork for access to all components which will or may need maintenance and/or repair, including reheat coils. Install in accordance with requirements of ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible.
- .2 Identify access doors provided for fusible link damper maintenance with "FLD" stencil painted or marker type red lettering and ensure doors are properly located for damper maintenance.
- .3 When requested, submit a sample of proposed duct access doors for review.
- .4 Where sectionalized fusible link dampers and/or balancing dampers are provided in large ducts, provide a plenum type access door to suit, and adequately reinforce ductwork to suit access door installed.

### **3.18 INSTALLATION OF INSTRUMENTS TEST PORTS**

- .1 Provide instrument test ports in all main ducts at connections to fans, plenums, or casings, in all larger branch duct connections to mains, and wherever else required for proper air quantity balancing and testing.
- .2 Locate test ports where recommended by personnel performing air quantity testing and balancing work.

### **3.19 INSTALLATION OF WIRE MESH (BIRDSCREEN)**

- .1 Provide framed, removable wire mesh panels over openings in ducts and/or walls where shown and/or specified on drawings. Rigidly secure in place but ensure panels are removable.
- .2 Provide wire mesh panels for open-end return air ducts in ceiling spaces whether shown on drawings or not.

### **3.20 INSTALLATION OF LOUVRES**

- .1 Provide louvres for wall openings.
- .2 Install louver assemblies and secure in place in accordance with manufacturer's instructions and details.
- .3 Confirm exact louver sizes and finish prior to ordering.

### **3.21 INSTALLATION OF BRICK AND BLOCK VENTS**

- .1 Supply brick or block vents for installation in exterior walls.
- .2 Hand assemblies to masonry trade for installation.
- .3 Accurately mark exact locations and coordinate installation.

### **3.22 INSTALLATION OF FIRE STOP FLAPS AND THERMAL BLANKETS**

- .1 Provide fire stop flaps in duct connection necks of grilles and diffusers installed in ULC fire rated suspended ceiling systems where shown on drawings.
- .2 Provide thermal blanket material to completely cover grille and/or diffuser pans above suspended ULC fire rated ceilings. Cut, install, and secure in place in accordance with manufacturer's instructions and ULC requirements.

### **3.23 INSTALLATION OF GRILLES AND DIFFUSERS**

- .1 Provide grilles and diffusers. Wherever possible, grilles and diffusers are to be product of same manufacturer.
- .2 Unless otherwise specified connect grilles and diffusers in accordance with requirements of SMACNA HVAC Duct Construction Standards Metal and Flexible.
- .3 Exactly locate grilles and diffusers to conform to final architectural reflected ceiling plans and detailed wall elevations, and to conform to final lighting arrangement, ceiling layout, ornamental and other wall treatment.
- .4 Equip supply diffusers having a basic 4-way or all round air pattern for operation in 1-, 2-, or 3-way pattern where indicated on drawings.
- .5 Provide sheet metal plenums, constructed of same material as connecting duct, for linear grilles and/or diffusers where shown. Construct and install plenums in accordance with requirements of SMACNA HVAC Duct Construction Standards Metal and Flexible. Where individual sections of linear grilles or diffusers are not equipped with a volume control device, equip duct connection collar(s) with volume control device(s).
- .6 Where linear type diffusers/grilles are installed in suspended T-bar ceilings, clip diffusers/grilles in place using clip supplied by diffuser/grille manufacturer.
- .7 Confirm grille and diffuser finishes prior to ordering.

### **3.24 INSTALLATION OF INTAKE AND EXHAUST WALL BOXES**

- .1 Supply brick or block vents for installation in exterior walls.
- .2 Hand assemblies to masonry trade for installation.
- .3 Accurately mark exact locations and coordinate installation.

### **3.25 DUCT SYSTEM PROTECTION, CLEANING AND START-UP**

- .1 Temporarily cover all open ends of ducts during construction.
- .2 Remove all dirt and foreign matter from entire duct systems and clean duct system terminals and interior of air handling units prior to operating fans.
- .3 Prior to starting any supply air handling system provide 50 mm (2") thick glass fibre construction filters at fan equipment in place of permanent filters.
- .4 Provide cheesecloth over duct system inlets and outlets and run system for 24 hours, after which remove cheesecloth and construction filters, and install new permanent filters.



- .5 Include all labour for a complete site walk-through with testing and balancing personnel following route of all duct systems to be tested, adjusted, and balanced for the purpose of confirming proper position and attitude of dampers, location of pitot tube openings, and any other work affecting testing and balancing procedures. Perform corrective work required as a result of this walk-through.

**END OF SECTION**

## **PART 1 - GENERAL**

### **1.1 SUBMITTALS**

- .1 Submit shop drawings/product data sheets for fans and accessories. Include following:
  - .1 certified fan performance curves at specified operating point with flow, static pressure and HP clearly plotted;
  - .2 certified sound power data that conforms to specified levels;
  - .3 product data sheets for all accessories;
  - .4 product data sheets for fan motors.

### **1.2 CLOSEOUT SUBMITTALS**

- .1 Submit with delivery of each unit a copy of the factory inspection report, and include a copy of each report with O&M Manual project closeout data.
- .2 Submit a site inspection and start-up report from manufacturer's representative as specified in Part 3 of this section.
- .3 Training attendance records.

### **1.3 QUALITY ASSURANCE**

- .1 Fan manufacturers, as applicable, are to be current members of the Air Movement and Control Association International Inc. (AMCA), and fans are to be rated (capacity and sound performance) and certified in accordance with requirements of following standards:
  - .1 ANSI/AMCA Standard 210, Laboratory Method of Testing Fans for Certified Aerodynamic Performance Rating;
  - .2 AMCA Standard 211, Product Rating Manual for Fan Air Performance;
  - .3 ANSI/AMCA Standard 300, Reverberant Room Method for Sound Testing of Fans;
  - .4 AMCA Standard 311, Product Rating Manual for Fan Sound Performance;
  - .5 AMCA Standard 99-2408, Operating Limits for Centrifugal Fans.

## **PART 2 - PRODUCTS**

### **2.1 CENTRIFUGAL INLINE FANS**

- .1 Centrifugal, ULC listed, factory run tested rectangular inline fans in accordance with drawing schedule.
- .2 Heavy-gauge galvanized steel housing with removable side panels to permit removal of power assembly without disturbing duct connections, universal mounting brackets and hardware including spring vibration isolators to accommodate horizontal or vertical mounting as required, a flanged inlet panel with inlet venturi, a flanged outlet panel, both with duct connection collars, and galvanized steel wire grid fan inlet/outlet guard(s).
- .3 Non-overloading aluminium wheel with backward inclined blades with matching inlet venturi, statically and dynamically balanced as an assembly.
- .4 For belt-drive fans only, hot rolled steel shaft, accurately turned, ground, and polished, and sized for a first critical speed of at least 1.25 times maximum rated speed for fan, and heavy-duty, self-aligning pillow block type bearings selected for an AFBMA L-50 minimum average life in excess of 500,000 hours and equipped with lubrication line and fitting, and an adjustable V-belt drive with guard conforming to requirements of Section 20 05 00 – Common Work Results for Mechanical.

- .5 TEFC motor conforming to requirements specified in Section 20 05 00 – Common Work Results for Mechanical, mounted out of the airstream, complete with a cover, and factory pre-wired to a NEMA 4 disconnect switch.
- .6 For fans as scheduled, factory supplied accessories as follows:
  - .1 for fans as scheduled, housing insulation (lining), consisting of neoprene spray coated glass fibre semi-rigid insulation meeting NFPA 90A requirements and 25/50 flame spread/smoke developed ratings when tested in accordance with CAN/ULC S102, permanently secured in place with no exposed edges;
  - .2 for fans as scheduled, a galvanized steel filter box with frame suitable for 25 mm (2") thick disposable panel type filters;
- .7 Manufacturers:
  - .1 Twin City Fan and Blower;
  - .2 Loren Cook Co.;
  - .3 Greenheck Fan Corp.;
  - .4 JencoFan;
  - .5 Carnes Company Inc.

## 2.2 CORROSION RESISTANT CENTRIFUGAL FANS

- .1 Centrifugal FRP fans in accordance with drawing schedule, with drive arrangement and configuration as indicated on drawings, and capable of operating over complete pressure class limits as specified in AMCA Standard 99-2408.
- .2 Aerodynamically designed housing with high efficiency inlet, manufactured from resins, UV inhibited, reinforced with fibreglass, and with bolts holding housing to support plate encapsulated in FRP, and no uncoated metal in contact with corrosive air stream. Each assembly is to be complete with graphite impregnated interior casing, lifting lugs, type 304 stainless steel fasteners, a FRP ridge inside casing to divert condensation from dripping over hub and shaft, a flanged inlet and outlet, and an impeller inspection and service access door.
- .3 Backward curved FRP wheel electronically statically and dynamically balanced after assembly, with an integral metal back plate encapsulated in resin and with hub extended to outside housing, a removable FRP cap to cover impeller end of shaft, and a vacuum hub seal to prevent contaminated air from escaping from fan housing.
- .4 For belt driven fans, type 316 stainless steel shaft, accurately turned, ground, polished, and ring gauged for accuracy, and sized for a first critical speed of at least 1.25 times maximum rated speed for fan, and complete with guard, and heavy-duty, sealed, grease lubricated, ball or roller, self-aligning pillow block type bearings selected for an AFBMA L-10 minimum average bearing life in excess of 200,000 hours, and equipped with extended copper lubrication lines terminated in lubrication fittings at exterior of fan assembly, and an adjustable V-belt drive selected for 50% service factor based on motor nameplate data, with FRP OHSA guard in accordance with requirements of Section 20 05 00 – Common Work Results for Mechanical.
- .5 NEMA Premium TEFC motor conforming to requirements of Section 20 05 00 – Common Work Results for Mechanical.
- .6 Rigid, welded structural steel unitary fan and motor support base, factory cleaned and finished with 4 to 6 mm thick baked powder epoxy enamel.
- .7 Factory secured seismic restraint connection hardware.
- .8 Manufacturers:
  - .1 M. K. Plastics Corp.;
  - .2 New York Blower Co.;

.3 Pasticair Inc.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION OF CENTRIFUGAL INLINE FANS**

- .1 Provide inline centrifugal fans.
- .2 Secure each fan in place from structure with vibration isolation, independent of connecting ductwork and in accordance with fan manufacturer's instructions.
- .3 Brace and secure each unit in accordance with requirements specified in Section 20 05 48.16 – Seismic Controls for Mechanical Systems.
- .4 Ensure duct connections are made using flexible connection material.
- .5 For equipment/system manufacturer certification requirements, refer to Section 20 05 00 – Common Work Results for Mechanical.
- .6 For equipment/system start-up requirements, refer to Section 20 05 00 – Common Work Results for Mechanical.
- .7 Include for a 4 hour on-site operation demonstration and training session. Training is to be a full review of all components including but not limited to a full operation and maintenance demonstration, with abnormal events.

### **3.2 INSTALLATION OF FRP CENTRIFUGAL FANS**

- .1 Provide FRP centrifugal fans.
- .2 Secure suspended units in place from structure, level and plumb, by means of corrosion resistant vibration isolation spring hangers, properly sized type 316 stainless steel hanger rods and a structural type 316 stainless steel angle, or channel support structure.
- .3 For equipment/system manufacturer certification requirements, refer to Section 20 05 00 – Common Work Results for Mechanical.
- .4 For equipment/system start-up requirements, refer to Section 20 05 00 – Common Work Results for Mechanical.

### **3.3 CLOSEOUT ACTIVITIES**

- .1 Include for a 4 hour on-site operation demonstration and training session. Training is to be a full review of all components including but not limited to a full operation and maintenance demonstration.

**END OF SECTION**

## **PART 1 - GENERAL**

### **1.1 SUBMITTALS**

- .1 Submit shop drawings/product data sheets for all products specified in this section.

### **1.2 MAINTENANCE MATERIAL SUBMITTALS**

- .1 Prior to Substantial Performance of the Work, submit a set of spare filters in original identified packaging for each air handling unit requiring filters. Store filters on site where directed by Consultant or Owner.

## **PART 2 - PRODUCTS**

### **2.1 GENERAL**

- .1 Unless otherwise specified or noted, filters are to be synthetic and/or glass fibre disposable media type in accordance with drawing schedule(s).
- .2 Minimum Efficiency Reporting Values (MERV) ratings in accordance with ASHRAE Standard 52.2, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Sizes.
- .3 Unless otherwise specified or noted, filters are to be UL/ULC Class 1 in accordance with UL Standard 900, Air Filter Units, ULC S111, Standard Method of Fire Tests for Air Filter Units, and CAN/CGSB 115.10, Disposable Air Filters for Removal of Particulate Matter from Ventilation Systems.
- .4 Manufacturers:
  - .1 AAF International;
  - .2 Camfil Farr Inc.;
  - .3 Modern Air Filter Corp.

### **2.2 CONSTRUCTION FILTERS**

- .1 Roll type, disposable, MERV 7 to 9 woven glass fibre media, UL Class 2.

### **2.3 HEPA FILTERS**

- .1 HEPA high capacity filters in accordance with drawing schedule and UL Standard 586, High-Efficiency, Particulate, Air Filter Units, 99.995% efficient on 0.12 µm particles, consisting of a continuous pleating of water-proof micro glass fibre media with pleats uniformly separated by aluminum separators, urethane sealant to encapsulate the filter pack in minimum #16 gauge galvanized steel frame with one-piece urethane gasket or neoprene dove-tailed gasket for positive leak-free filter-to-holding mechanism seal.

### **2.4 FILTER FRAMING AND RACKS**

- .1 No. 16 gauge galvanized steel filter framing/racks, sized and arranged to suit filters and filter bank, easily accessible for filter service and replacement, and complete with slide-in tracks or lay-in flanges as required for filter placement, and all required gasketing and facilities to prevent air by-pass.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION OF CONSTRUCTION FILTERS**

- .1 Provide roll type medium efficiency disposable media filter(s) across entire filter bank of each supply air handling unit, either at factory where fan is produced or at site as soon as fan is installed. Secure media in place so it will not be dislodged by fan operation. Replace roll media periodically if it becomes loaded and clogged.
- .2 For exhaust systems, secure filter media across exhaust air openings and ductwork to prevent construction dirt and dust from fouling the fan
- .3 Leave media in place until fan start-up, at which time remove and dispose of construction media.

### **3.2 INSTALLATION OF FILTERS**

- .1 Provide required filter media when fan equipment is ready for start-up and performance testing. Provide any required filter framing/racks.
- .2 Prior to Substantial Performance of the Work, supply a complete spare set of filter media in original packaging and clearly identified as to the applicable system for each air handling system with filters. Store filters at site where directed by Owner.

**END OF SECTION**

## **PART 1 - GENERAL**

### **1.1 RELATED REQUIREMENTS**

- .1 Section 23 23 00 – Refrigerant Piping.

### **1.2 SUBMITTALS**

- .1 Submit shop drawings/product data sheets, complete with control components, and piping and wiring schematics.

### **1.3 CLOSEOUT SUBMITTALS**

- .1 Submit a start-up and certification letter from equipment supplier as specified in Part 3 of this section.
- .2 Prepare and submit a schematic layout of refrigerant piping showing all piping components required for satisfactory operation and maintenance of the system(s), including but not limited to pipe sizes, charging valve, isolating valves, sight glasses, strainers, driers, traps, etc. Schematic diagram must be reviewed with and approved by air conditioning equipment supplier prior to submittal to the Consultant.

### **1.4 QUALITY ASSURANCE**

- .1 Split system air conditioning equipment and installation of equipment are to be in accordance with requirements of following:
  - .1 all applicable Provincial Codes and Standards;
  - .2 ANSI/AHRI Standard 210/240, Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment.
- .2 Split system air conditioning system installation tradesmen are to be journeyman refrigeration mechanics.

## **PART 2 - PRODUCTS**

### **2.1 SPLIT SYSTEM AIR CONDITIONING EQUIPMENT**

- .1 Factory assembled and tested, package type equipment consisting of an indoor evaporator unit and an exterior condensing unit in accordance with drawing schedule, CSA or ETL listed and labelled, AHRI rated and certified and with a minimum system efficiency of 13 SEER.
- .2 Wall mounting evaporator assembly consisting of a white moulded high-strength plastic cabinet with front access panel, a motorized horizontal vane to automatically direct air flow in a horizontal and downward direction and which closes when fan operation is stopped, motorized vertical vanes controlled remotely, and a mounting plate supplied loose. Evaporator complete with:
  - .1 double inlet, forward curve fan(s) direct driven by a single 4-speed motor;
  - .2 removable and washable return air filter;
  - .3 factory pressure tested multi-angled coil of non-ferrous construction with aluminium fins, copper tubes with silver alloy solder joints, and an insulated condensate drain pan sloped to a drain connection for positive drainage.
- .3 Factory run tested, weatherproof condensing unit equipped with a control board to interface with indoor unit and perform all necessary operation functions. Pre-charge unit with R-410a refrigerant for a minimum of 21 m (70') of refrigerant tubing. Unit is to be capable of operation at -18°C (0°F)

without additional low ambient controls, and capable of a height difference between condensing unit and evaporator of 30 m (100'). Each condensing unit complete with:

- .1 galvanized steel plate cabinet with an electrostatically applied thermally fused polyester powder finish, and an ABS plastic fan grille;
  - .2 draw-through direct driven balanced fan with horizontal air discharge, mounted in front of coil, arranged to pull air across coil, and equipped with a raised fan guard;
  - .3 "L" shaped coil with copper tubes and aluminium fins, factory pressure tested, complete with an integral metal guard and refrigerant flow controlled by a linear expansion valve metering orifice controlled by a microprocessor controlled step motor;
  - .4 vibration isolated DC rotary compressor driven by an inverter circuit to dynamically control compressor speed to match room load, complete with an accumulator, high pressure safety switch, and circuitry to permit a minimal amount of current to be applied to motor to maintain enough heat during off cycle to prevent liquid from accumulating.
- .4 System controls consisting of a microprocessor in each indoor and outdoor unit, and an indoor wall mounted controller site connected to indoor evaporator unit. System is to be capable of automatic restart after power interruption, and have self-diagnostics ability and indication of total compressor run time, and following:
- .1 Indoor unit microprocessor is capable of monitoring return air temperature and evaporator coil temperature, receiving and processing commands from wall mounted controller, providing emergency operation, and controlling outdoor unit through its microprocessor and interface board;
  - .2 controller is complete with an integral temperature sensor, able to perform input and output functions necessary to operate system, and equipped with following:
    - .1 large DOT liquid crystal display to indicate diagnostic codes for both indoor and outdoor units, compressor run time, a weekly timer with up to 8 pattern settings per day, set temperature, room temperature, refrigerant piping temperatures, compressor operating conditions, and linear expansion valve opening pulses, sub-cooling and discharge super heat;
    - .2 On/Off button, Increase/Decrease Set Temperature buttons, a Cool/Dry/Fan mode selector, a Timer Menu button, a Timer On/Off button, Set Time buttons, a Fan Speed selector, a Vane Position selector, a Louvre Swing button, a Ventilation button, a Test Run button, and a Check Mode button.
- .5 Suitable anchoring connection hardware factory installed on equipment to suit requirements of Section 20 05 48.16 – Seismic Controls for Mechanical Systems.

## 2.2 MANUFACTURERS

- .1 Mitsubishi Electric Sales Canada Inc.;
- .2 Daikin Industries Ltd.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- .1 Provide split system air conditioning equipment consisting of an exterior condensing unit and an indoor evaporator.
- .2 Secure condensing unit in place, level and plumb, on vibration isolation pads on pressure treated wooden sleepers as indicated.



- .3 Anchor equipment in accordance with requirements specified in Section 20 05 48.16 – Seismic Controls for Mechanical Systems. Provide flexible connections in all piping connections to equipment.
- .4 Mount indoor evaporator unit. Confirm exact location prior to roughing-in.
- .5 Connect condensing unit and indoor evaporator with refrigerant piping in accordance with piping shop drawing schematic. Refer to Section 23 23 00 - Refrigerant Piping. Provide any required additional refrigerant.
- .6 Install loose control components and perform required control wiring (except building automation system connections) between condensing unit and evaporator in conduit in accordance with manufacturer's control wiring schematic and wiring standards of electrical work.

### **3.2 SYSTEM STARTUP**

- .1 For equipment/system manufacturer certification requirements, refer to Section 20 05 00 – Common Work Results for Mechanical.
- .2 For equipment/system start-up requirements, refer to Section 20 05 00 – Common Work Results for Mechanical.

### **3.3 TRAINING**

- .1 Include for 4 hours of on-site operation demonstration and training session. Training is to be a full review of all components including, but not limited to, a full operation and maintenance demonstration, with control set-up and abnormal events.

**END OF SECTION**

## **PART 1 - GENERAL**

### **1.1 REFERENCES**

- .1 AHRI Standard 410-2023, Performance Rating of Forced-circulation Air-cooling and Air-heating Coils.
- .2 CSA C22.2 No. 155-M86 (R2022), Electric duct heaters.
- .3 CSA C22.2 No. 236-15, Heating and cooling equipment.

### **1.2 SUBMITTALS**

- .1 Submit shop drawings/product data sheets for heating coils, including accessories.

## **PART 2 - PRODUCTS**

### **2.1 DUCT MOUNTED HYDRONIC HEATING COILS**

- .1 Hydronic coils in accordance with drawing schedule, 1 or 2 row as indicated, each certified to AHRI Standard 410, Forced-Circulation Air-Cooling and Air-Heating Coils, each factory leakage tested at 2070 kPa (300 psi) under water, drainable, self-venting, and complete with:
  - .1 horizontal, continuous, 15.9 mm (5/8") diameter, 0.050 mm (0.020") wall thickness seamless copper tubes permanently bonded to plate or spirally wound aluminium fins and equipped with threaded female same end connections;
  - .2 flanged galvanized steel casing arranged to prevent air bypass around coil and factory punched for duct connections.
- .2 Where required, coils are to be manufactured as "Registered Fittings" with a Canadian Registration Number (CRN).
- .3 Manufacturers:
  - .1 Aerofin Canada Services Inc.;
  - .2 Carrier Corp.;
  - .3 McQuay International.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION OF DUCT MOUNTED HYDRONIC HEATING COILS**

- .1 Provide duct mounting heating coils in supply ductwork.
- .2 Secure each coil in place from structure by means of hanger rods, independent of connecting ductwork but ready for duct connection and located for easy removal and access to power and control panel.
- .3 Connect with piping in accordance with drawing detail.

**END OF SECTION**

## **PART 1 - GENERAL**

### **1.1 SUBMITTALS**

- .1 Submit shop drawings/product data sheets for following:
  - .1 all control system components;
  - .2 identified schematic control diagrams with component identification, catalogue numbers, and sequence of operation for all systems;
  - .3 certified wiring diagrams for all systems.
- .2 Submit following samples for review:
  - .1 control damper section with linkage, operator, and certified flow and leakage data;
  - .2 each type of thermostat to be used, each identified as to intended use.

### **1.2 CLOSEOUT SUBMITTALS**

- .1 Submit a site inspection and start-up report from manufacturer's representative as specified in Part 3 of this Section.
- .2 Submit written confirmation from control component manufacturer that site installation personnel are qualified and experienced in installation of components, and have parts and service availability on a 24/7 basis.

### **1.3 QUALITY ASSURANCE**

- .1 Control systems are to be installed by control component manufacturer or by licensed personnel authorized by control component manufacturer. Submit written confirmation from control component manufacturer.
- .2 Control wiring work is to be performed by licensed journeyman electricians, or under direct daily supervision of journeyman electricians.

## **PART 2 - PRODUCTS**

### **2.1 EXISTING BUILDING AUTOMATION SYSTEM**

- .1 Building Automation System (BAS) It is the intent of this specification that the BAS and controls specified within this section constitute of expansion of this existing BAS. All controls components supplied shall be fully compatible with the existing BAS

### **2.2 AUTOMATIC CONTROL VALVES AND OPERATORS**

- .1 Each control valve must be suitable in all respects for the application, including system pressure, and must have design output and flow rates with maximum pressure drops as noted in the drawing schedules.
- .2 Body and trim materials selected in accordance with specification for globe valves, ball valves, or high performance butterfly valves, and in accordance with manufacturer's recommendations for design conditions and service.
- .3 Size control valves for pressure drops and heating and cooling loads as scheduled with same pressure rating as globe valves under same service and pressure conditions.
- .4 Size valves for two port and three port, two position service;
  - .1 line size,

- .2 ball valves, sizes NPS 1 ½ and smaller,
- .3 butterfly valves, sizes NPS 2 and larger.
- .5 For two port and three port modulating service;
  - .1 use globe valves for CV rating 160 and smaller,
  - .2 use butterfly valves for CV rating above 160.
- .6 Select butterfly valves based on CV rating at 70° rotation
- .7 Hydronic system valves;
  - .1 two position service;
    - .1 straight through two port type, single seated, with replaceable disc or ball,
    - .2 quick opening linear or equal percentage flow characteristics.
  - .2 modulating service;
    - .1 straight through two port type, single seated,
    - .2 equal percentage flow characteristics.
  - .3 modulating diverting service; three port mixing valves,
    - .1 linear for each port to give constant total flow or,
    - .2 equal percentage flow characteristics with 25% valve authority (valve pressure drop equal to 33% pressure drop through load at full flow).
  - .4 actuator and trim selected for close-off pressure ratings as follows;
    - .1 two-way modulating or two position service; 150% of pump shut off head.
    - .2 three-way modulating service; 300% of pressure differential between ports A and B at design flow or 100% of pump shut off head.
    - .3 shut off head to be based on maximum rpm when pump is fitted with VFD
  - .5 sized as follows;
    - .1 for two-position service; line size.
    - .2 for two-way modulating service unless otherwise shown; pressure drop at design flow equal to greatest of;
      - .1 100% of pressure drop through coil,
      - .2 50% of pressure difference between supply and return mains, or
      - .3 35 kPa (5 psi).
    - .3 for three-way modulating service; pressure drop equal to smaller of;
      - .1 twice pressure drop through coil or heat exchanger, or
      - .2 35 kPa (5 psi).
    - .4 for valves for radiation, terminal units and reheat coils;
      - .1 pressure drop of 7 kPa (1 psig)
  - .6 failed position on isolation from control signal as follows;
    - .1 Heating water and glycol zone valves; fail open.
    - .2 Heating coil valves in AHU; fail open.

- .3 Chilled water control valves; fail closed.
- .4 Chilled water differential pressure by-pass control valves; fail open.
- .5 Hot water and glycol differential pressure by-pass control valves; fail closed.
- .8 Steam valves;
  - .1 globe type, with equal percentage flow characteristics.
  - .2 actuator and trim selected for close-off pressure rating equal to 150% of operating (inlet) pressure.
  - .3 sized as follows;
    - .1 two-position service;
      - .1 pressure drop at design flow equal to 10%-20% of inlet steam gauge pressure.
    - .2 modulating service at inlet steam gauge pressure of 100 kPa (15 psig) or less;
      - .1 pressure drop at design flow equal to 80% of inlet steam gauge pressure.
    - .3 modulating service at inlet steam gauge pressure of 101-350 kPa (16-50 psig);
      - .1 pressure drop at design flow equal to critical pressure drop (45% of absolute inlet pressure).
    - .4 modulating service with inlet steam gauge pressure over 350 kPa (50 psig);
      - .1 pressure drop as scheduled.
    - .5 modulating steam loads greater than 570 kW (2000 lbs./hr) at all pressures;
      - .1 provide two valves, connected in parallel and controlled in sequence, with first valve in opening sequence sized for [a] and second for [b] of steam load.
- .9 Valve actuators for service other than radiation, radiant panel and reheat coil valve applications;
  - .1 sized and selected in accordance with manufacturer's specifications,
  - .2 electric/electronic for two position, or proportional control action, coupled to valves with linkage,
  - .3 electronic interface control board, solid state drive, reversible motor, oil immersed gear train,
  - .4 electronic overload or digital rotation sensing circuitry to protect damper operator through entire range of rotation,
  - .5 span and zero travel adjustment,
  - .6 position feedback signal on actuators used for proportional control,
  - .7 provision for manual positioning of valve when actuator is not powered,
  - .8 spring return mechanism to return valve to "normal" position on power failure (i.e. Normally Open (NO), or Normally Closed (NC)),
  - .9 control signals:
    - .1 0 to 10VDC or 0 to 20 ma,
    - .2 modulate damper position with 2 to 10VDC or 4 to 20 ma input signal operating range when in proportional service.
    - .3 input type and range as suitable for interfacing to output of BAS controller
  - .10 feedback signals:
    - .1 two independent adjustable travel limit switches and wiring to BAS for indication of valve position.

- .11 general purpose, drip proof NEMA 2 die-cast housing with corrosion resistant steel cover for indoor applications, watertight NEMA 4 enclosure for outdoor use,
- .12 electric actuators suitable for operation down to -35°C where installed outdoors.
- .10 Valve actuators for service on radiation, radiant panel, and reheat coil valve applications;
  - .1 output shaft driven by gear train mechanism.
  - .2 reversible motor with automatic load limit,
  - .3 input type and range as suitable for interfacing to output of BAS controllers,
  - .4 adjustable span and offset travel,
  - .5 position feedback signal on actuators used for proportional control,
  - .6 general purpose, dustproof, die-cast aluminum housing,
  - .7 actuator rotation limit.
- .11 "Energy Valves" (Heating or Cooling);
  - .1 Belimo Energy Valve, pressure independent complete with Power Control and Belimo Delta T Manage logic built in to monitor coil performance and optimize the available energy of the coil by maintaining Delta T, standard analog signal and feedback wiring and connection to the BAS via BACnet MS/TP and built-in web server for visualization of the valves' operation in real time.
- .12 Unless otherwise specified, pneumatic valve operators are to be renewable neoprene diaphragm piston type. Pneumatic operators used to sequence multiple valves must be equipped with a pilot positioner to ensure proper sequence of each valve and allow for an adjustable "dead band" between heating and cooling valves.

## 2.3 CONTROL DAMPERS AND OPERATORS

- .1 T. A. Morrison & Co. Inc. "TAMCO" 100 mm (4') deep, flanged, AMCA low leakage certified aluminium dampers. Dampers for modulating and mixing applications are to be parallel blade type. Dampers for open-shut service are to be opposed blade type. Maximum blade length is to be 1 m (4'). Dampers greater than 2 sections wide are to be complete with a jackshaft. Each damper is to be complete with:
  - .1 extruded 6063T5 aluminum frame and airfoil blades, each with an integral slot to receive a gasket;
  - .2 extruded TPE frame gaskets and extruded EPDM blade gaskets;
  - .3 slip-proof aluminium and corrosion resistant plated steel linkage of a metal thickness to prevent warping or bending during damper operation, concealed in frame, equipped with seal-sealing and self-lubricating bearings consisting of a Celcon inner bearing fixed on hexagonal blade pin and rotating in a polycarbonate outer bearing inserted in frame.
- .2 For standard damper(s), Series 1500 as above.
- .3 For insulated damper(s), Series 9000 as above but with all 4 sides of frame insulated with polystyrene, and blades thermally broken and insulated with expanded polyurethane foam.
- .4 For stainless steel dampers, as above but constructed of type 316 stainless steel and equipped with Teflon blade bearings.
- .5 Each damper motor is to be shaft mounted, spring return, fail safe in the normally open or normally closed position, sized to control damper against maximum pressure or dynamic closing pressure, whichever is greater, to suit sizes of dampers involved, and to provide sufficient force to maintain damper rated leakage characteristics. Each operator is to be complete with a damper position indicator, and external adjustable stops to limit length of stroke in either direction, and is to be mounted on a corrosion resistant adjustable bracket. Operating arms are to have double yoke linkages and double set screws for fastening to damper shaft. Operators for dampers to be connected to building fire alarm system or to freeze protection devices are to be equipped with

additional relays to permit dampers to respond and go to required position in less than 15 seconds upon receipt of a signal. Operator enclosures are to be suitable in all respects for environment in which they are located.

- .6 Electric damper operators are to be equal to Belimo EF Series 24 volt or 120 volt AC spring return, direct coupled electric motor operators for either modulating or 2-position control as required. Each operator is to be overload protected and complete with an enclosure to suit the mounting location.
- .7 All exhaust dampers shall be complete with Nailor "1380" heavy duty backdraft damper.
- .8 Pneumatic damper operators are to be replaceable elastomer diaphragm piston type, suitable in all respects for damper sequence.

## 2.4 LOCAL CONTROL PANELS

- .1 NEMA 1 (NEMA 2 in sprinklered areas) wall mounting, enamelled steel barriered enclosures sized to suit the application with 20% spare capacity, a perforated sub-panel, numbered terminal strips for all low and line voltage wiring, hinged door, and slotted flush latch.

## 2.5 CONTROL SYSTEM COMPONENTS

- .1 Components specified below are required for control of equipment and systems in accordance with drawing control diagrams and sequences of operation. Not all required components may be specified.
- .2 Sensor/transmitter input devices must be suitable in all respects for the application and mounting location. Devices are as follows:
  - .1 unless otherwise specified, temperature sensors are to be resistance type, either 2-wire 1000 ohm nickel RTD or 2-wire 1000 ohm platinum RTD with accuracy (includes errors associated with sensor, lead wire, and A to D conversion), equipped with type 316 stainless steel thermowells for pipe mounting applications, as follows:
    - .1 chilled water, room temperature, and duct temperature points,  $\pm 1^{\circ}\text{C}$  ( $\pm 0.5^{\circ}\text{F}$ );
    - .2 all other points,  $\pm 0.75^{\circ}\text{C}$  ( $\pm 1.3^{\circ}\text{F}$ ).
  - .2 unless otherwise specified, room temperature sensors constructed to be selected in accordance with the following classifications:
    - .1 Type 1: Space temperature sensor (private/non-public areas);
      - .1 for measurement of space temperature only as shown on the floor plans and/or as described in the Sequence of Operation;
      - .2 set-point adjustment shall be accessible through the cover;
      - .3 sensor operating temperature range from  $4^{\circ}\text{C}$  to  $60^{\circ}\text{C}$  ( $40^{\circ}\text{F}$  to  $140^{\circ}\text{F}$ );
      - .4 surface mounted plastic mono-chromatic guard with surface mounting plate and wall anchors;
      - .5 mono-chromatic guard secured to mounting plate by screws;
    - .2 Type 2: Space temperature sensor (public areas or secure areas);
      - .1 for measurement of space temperature of space temperature only in areas subject to vandalism as shown on the floor plans and/or as described in the Sequence of Operation;
      - .2 sensor operating temperature range from  $4^{\circ}\text{C}$  to  $60^{\circ}\text{C}$  ( $40^{\circ}\text{F}$  to  $140^{\circ}\text{F}$ );
      - .3 stainless steel flat plate surface type with sensor epoxy-bonded to back of cover plate;



- .4 tamperproof/secure concealed fasteners;
- .5 set-point adjustment is to be concealed behind the cover.
- .3 Type 3: Adjustable space temperature sensor with display (Private Areas, Office areas);
  - .1 for measurement and adjustment of space temperature as shown on the floor plans and/or as described in the Sequence of Operation;
  - .2 digital set point operating temperature adjustment range from 4°C to 60°C (40°F to 140°F);
  - .3 surface mounted plastic mono-chromatic guard with surface mounting plate and wall anchors;
  - .4 mono-chromatic guard secured to mounting plate by screws;
  - .5 on/off button to allow occupant override feature;
  - .6 three-digit LED digital temperature display with 0.2° display resolution;
  - .7 5% to 95% relative humidity, non-condensing;
  - .8 minimum/maximum limit set point values adjustable from the BAS operator interface and controller.
  - .9 set-point adjustment is to be accessible through the cover.
- .3 outside air sensors designed and constructed for an ambient temperature of -25°C to 60°C (-13°F to 140°F) and 5% to 95% relative humidity, non-condensing, complete with a NEMA 3R enclosure, solar shield, a weatherproof seal at all wall penetrations, and a perforated plate surrounding sensor element where exposed to wind velocity pressure;
- .4 insertion duct mounting sensors type with lock nut and mounting plate, designed to mount in an electrical box (weather-proof with gasket and cover where outside) through a hole in duct;
- .5 for ducts greater than 1.2 m (4') or for ducts where air temperature stratification occurs, averaging type sensors with multiple sensing points, and for plenums for applications such as mixed air temperature measurement to account for air turbulence and/or stratification, an averaging string of sensors with capillary supports on the sides of duct/plenum;
- .6 Where both temperature and humidity are shown to be measured at same location or in same airstream, use of single measuring unit is permitted provided that features and performance of both temperature sensor and humidity sensor are in accordance with requirements of this specification.
- .3 factory solid-state relative humidity sensors with an element that resists contamination, weather-proof with a NEMA 3R enclosure for outside air applications, supplied with a type 304 stainless steel probe with mounting bracket and hardware for duct mounting, each complete with a factory calibrated humidity transmitter which is accurate (including lead loss and analog to digital conversion) to 3% between 25°C to 60°C (-13°F to 140°F) and 5% to 95% relative humidity, non-condensing and complete with non-interactive span and zero adjustments, and a 2-wire isolated loop powered, 4-20 mA, 0 to 100% linear proportional output;
- .4 Pressure transmitters are to be constructed to withstand 100% pressure over-range without damage and to hold calibrated accuracy when subject to a momentary 40% over-range input. Pressure transmitters are to transmit a 0 to 5 VDC, 0 to 10 VDC, or 4 to 20 mA output signal. Differential pressure transmitters used for flow measurement are to be sized to the flow sensing device and supplied with a tee fitting and shut-off valves in the high and low sensing pick-up lines to allow permanent ease of use connection for balancing, etc. Transmitter housing is to suit mounting location. Standalone pressure transmitters are to be mounted in a minimum NEMA 1 (NEMA 2 in sprinklered area) by-pass valve assembly panel with high and low connections piped and valved, air bleed units, by-pass valves, and compression fittings. Transmitters are to be as follows:



- .1 low differential water pressure, 0 to 5 kPa (0 to 20" wc): equal to Setra or Mamac industrial quality transmitter capable of transmitting a linear 4 to 20 mA output signal in response to variation of flow meter differential pressure or water pressure sensing points, each complete with non-interactive zero and span adjustments adjustable from outside the cover, and performance as follows:
  - .1 maintain accuracy up to 20 to 1 ratio turndown;
  - .2 reference accuracy: +0.2% of full scale.
- .2 medium to high differential water pressure, over 5 kPa (20" wc): equal to Setra or Mamac transmitters as specified above for low pressure transmitters but with a pressure range of from 2.5 kPa (10" wc) to 2070 kPa (300 psi), a reference accuracy of  $\pm 1\%$  of full span (includes non-linearity, hysteresis, and repeatability);
- .3 building differential air pressure: equal to Setra or Johnson Controls Inc. industrial quality transmitter with a range suitable for the application, capable of transmitting a linear 4 to 20 mA output in response to variation of differential pressure or air pressure sensing points, each complete with non-interactive zero and span adjustments adjustable from outside the cover, and performance as follows:
  - .1 maintain accuracy up to 20 to 1 ratio turndown;
  - .2 reference accuracy: +0.2% of full span.
- .4 low differential air pressure, 0 to 1.25 kPa (0" to 5" wc): equal to Setra or Johnson Controls Inc. industrial quality transmitter with a range suitable for the application, capable of transmitting a linear 4 to 20 mA output signal in response to variation of differential pressure or air pressure sensing points, each complete with non-interactive zero and span adjustments adjustable from outside the cover, and performance as follows:
  - .1 maintain accuracy up to 20 to 1 ratio turndown;
  - .2 reference accuracy: +0.2% of full span.
- .5 medium differential air pressure, over 1.5 kPa (5" wc): equal to Setra or Johnson Controls Inc. transmitters as specified above for low pressure air transmitters but performance requirements as follows:
  - .1 zero and span: (c/o F.S./Deg. F); .04% including linearity, hysteresis, and repeatability;
  - .2 accuracy: 1% F.S. (best straight line); static pressure effect: 0.5% F. S.;
  - .3 thermal effects: less than +0.33 F.S./°F over 40°F to 100°F (calibrated at 70°F).
- .5 Air and water flow monitoring stations and probes are to be Air Monitor Corp., Tek-Air Systems Inc., Ebtron, or Dietrich Standard products as follows:
  - .1 Fan Inlet Air Flow Measuring Station: At fan inlet and near exit of inlet sound trap, air flow traverse probes are to continuously monitor fan air volume and system velocity pressure, and traverse probes are to be as follows:
    - .1 each probe is to be of a dual manifold, cylindrical, anodized type 3003 extruded aluminium construction probe with sensors located along the stagnation plane of approaching air flow, and the static pressure manifold is to incorporate dual offset static taps on opposing sides of averaging manifold so as to be insensitive to flow angle variations for as much as  $\pm 20^\circ$  in approaching air stream;
    - .2 each probe is not to introduce a measurable pressure drop, nor is sound level within duct to be amplified by its singular or multiple presence in air stream, and each probe is to contain multiple static and total pressure sensors placed at equal distances along its length in accordance with ASHRAE Standards for duct traversing.

- .2 Single Probe Air Flow Measuring Sensor: Duct mounting hot wire anemometer type which utilizes 2 temperature sensors, one is a heater element temperature sensor and the other is to measure downstream temperature, with temperature differential related directly to air flow velocity. Sensor insertion length is to be adjustable up to 200 mm (8"), and transmitter is to produce a 4 to 20 mA or 0 to 10 VDC signal linear to air velocity.
- .3 Duct Flow Measuring Stations: #14 gauge galvanized steel casing with duct connection flanges of a size to mate with connecting ductwork, and complete with an air directionalizer and a 98% free area parallel cell 20 mm ( $\frac{3}{4}$ ") honeycomb profile suppressor across entering air stream to equalize velocity profile and eliminate turbulent and rotational flow from the air stream prior to measuring point, mechanically fastened to casing so as to withstand velocities of up to 1828 m (6000') per minute. Additional requirements as follows:
  - .1 total pressure measurement side (high side) is to be designed and spaced to requirements of Industrial Ventilation Manual, 16th Edition, page 9-5, and self-averaging manifolding is to be constructed of brass and copper components;
  - .2 static pressure sensing probes (low side) is to be bullet-nose shaped, per detailed radius, as illustrated in Industrial Ventilation Manual referred to above, page 9-5;
  - .3 main take-off point from both total pressure and static pressure manifolds is to be symmetrical, and manifolds are to terminate with external ports for connection to control tubing;
  - .4 each station is to be equipped with a label on casing indicating unit model number, size, area, and specified air flow capacity;
  - .5 each station is to have a self-generated sound rating of less than NC 40, and sound level within duct is not to be amplified nor is additional sound to be generated.
- .4 Static Pressure Traverse Probe: Duct mounting, complete with multiple static pressure sensors located along exterior surface of cylindrical probe.
- .5 Shielded Static Air Probe: Indoor type or outdoor type as required, each with multiple sensing ports, an impulse suppression chamber, and air flow shielding.
- .6 Water Flow Monitoring: Equal to Onicon microprocessor-based electromagnetic water flow meters with an accuracy of 0.25%.
- .6 Power (amps) monitoring is to be performed by a combination of a current transformer and a current transducer with transformer sized to reduce full amperage of monitored circuit to a maximum 5 ampere signal which will be converted to a 4 to 20 mA DDC compatible circuit for use by building automation system. Current transformer and current transducer are as follows:
  - .1 equal to Veris Industries split core current transformer with an operating frequency of from 50 Hz to 400 Hz, 0.6 kV class, 10 kV BIL insulation, and 5 ampere secondary;
  - .2 equal to Veris Industries current to voltage or current to mA transducer with an accuracy of  $\pm 5\%$ , a minimum load resistance of 30 kOhm, an input of 0 to 20 amperes and an output of 4 to 20 mA, and a 24 VDC regulated power supply.
- .7 Duct mounting smoke detectors supplied as part of electrical work for mounting as part of control system work.
- .8 Double contact switches to monitor equipment status and safety conditions, and generate alarms when a failure or abnormal condition occurs. Status and safety switches are to be as follows:
  - .1 current sensing switches: equal to Veris Industries self-powered dry contact output switches for sensing run status of motor loads, each calibrated to indicate a positive run status only when motor is operating under load, and each consisting of a current transformer, a solid-state current sensing circuit, adjustable trip point, solid-state switch, SPDT relay, and a LED to indicate on or off status;

- .2 air filter status switches: equal to Johnson Controls Inc. or Cleveland Controls automatic reset type differential pressure switches, each complete with SPDT contacts rated for 2 amperes at 120 VAC, a scale range and differential pressure adjustment appropriate for the service, and an installation kit which includes static pressure taps, tubing, fittings, and air filters;
- .3 air flow switches: equal to Johnson Controls Inc. or Cleveland Controls pressure flow switches, bellows actuated mercury switch or snap-acting micro-switch type with an appropriate scale range and pressure adjustment;
- .4 air pressure safety switches: equal to Johnson Controls Inc. or Cleveland Controls manual reset switches, each complete with SPDT contacts rated for 2 amperes at 120 VAC and an appropriate scale range and pressure adjustment;
- .5 water flow switches: equal to Johnson Controls Inc. Model P74;
- .6 low temperature limit switches: manual reset type equal to Johnson Controls Inc. Model A70, each complete with DPST snap acting contacts rated for 16 amperes at 120 VAC, a minimum 4.5 m (15') sensing element for mounting horizontally across duct/plenum with sensing reaction from coldest 450 mm (18") section of element, and where sensing element does not provide full coverage of air stream, additional switches are to be supplied as required.
- .9 Control relays as follows:
  - .1 control pilot relays: equal to Johnson Controls Inc. or Lectro modular plug-in design with snap-mount mounting bases, retaining springs or clips, DPDT, 3 PDT or 4 PDT as required for the application, with contacts rated for 10 amperes at 120 VAC;
  - .2 lighting control relays: latching type with integral status contacts rated for 20 amperes at 120 VAC, each complete with a split low voltage coil that moves the voltage contact armature to On or Off latched position, each controlled by a pulsed tri-state output (preferred) or pulsed paired binary outputs, and each designed so power outages will not result in a change-of-state and so multiple same state commands will simply maintain commanded state.
- .10 Electronic signal isolation transducers equal to Advanced Control Technologies for installation whenever an analog output signal from building automation system is to be connected to an external control system as an input (i.e. equipment control panel), or is to receive as an input signal from a remote system, and to provide ground plane isolation between systems.
- .11 Each manual override station is to be complete with contacts rated minimum 1 ampere at 24 VAC and is to provide following:
  - .1 integral H-O-A switch to override controlled device pilot relay;
  - .2 status input to building automation system to indicate whenever switch is not in the Auto position;
  - .3 status LED to illuminate whenever output is On;
  - .4 override LED to illuminate whenever H-O-A switch is in either the Hand or Off position.
- .12 Electronic/pneumatic transducers equal to Johnson Controls Inc. transducers with an output of from 3 to 15 psig, an input of from 4 to 20 mA or 10 VDC, manual output adjustment, a pressure gauge, and an external replaceable supply air filter.
- .13 Thermostats:
  - .1 Wall mounting adjustable set-point thermostats complete with local temperature display, each suitable in all respects for equipment (and operating sequence) they are provided for, equipped with a thermometer, and any required mounting and connection accessories.
  - .2 Pneumatic thermostats are to be of bimetal element construction, double valve type, operating without constant waste of air.
  - .3 Line voltage thermostats are to be 115 volt.
  - .4 Low voltage thermostats are to be 24 volt electronic type.

- .5 Set-point adjustment for thermostats in public spaces is to be concealed behind cover. Set-point adjustment for other thermostats is to be accessible through cover.
- .6 Covers are to be removable, tamper-proof covers with temperature set-point and thermometer displays.
- .7 Guards for thermostats are to be clear, ventilated acrylic covers with allen key locking hardware.
- .14 Humidistats:
  - .1 Direct or reverse acting (to suit system), proportional type, adjustable humidity controllers, each corrosion resistant, suitable in all respects for the application and complete with a nylon element, replaceable cartridge type air filter, internally adjustable limit stops for maximum and minimum settings, a cover, and required mounting and connection accessories.
  - .2 Pneumatic humidistats are to be 2 pipe type and complete with plug-in air connections.
  - .3 Electric humidistats are to be line voltage (115 volt), or 24 volt electronic type.
  - .4 Wall mounting humidistats are to be complete with a tamper-proof display type cover.
  - .5 Duct mounting humidistats are to be complete with a display type cover, duct sampling chamber with 300 mm (12") long extruded pick-up tube for duct mounting, a moulded mounting base, and a ventilated cover.
- .15 Hardware to permit building automation system control and monitoring of input/output points in accordance with Section 25 05 02 - Building Automation System, points schedule, and drawing control diagrams and operation sequences. All such hardware is to be suitable in all respects for interface with the building automation system.

## **2.6 SYSTEM WIRING MATERIALS**

- .1 System wiring, conduit, boxes, and similar materials are to be in accordance with requirements specified in appropriate Section(s) of Electrical Work specification.

## **2.7 CONTROL AIR FILTER AND PRV ASSEMBLIES**

- .1 Combination filter/PRV assembly with quantities to suit control system capacity requirements, each assembly complete with:
  - .1 oil/particle filter with drain port and replaceable coalescing filter element in a transparent polycarbonate bowl with perforated metal shield;
  - .2 adjustable pressure reducing valve with inlet and outlet pressure gauges and outlet safety pressure relief valve;
  - .3 wall mounting bracket.
- .2 Each filter is to remove both 0.08 micron diameter particles and 0.01 micron diameter oil aerosol, and filter elements are to be removable without disconnecting any piping.

## **PART 3 - EXECUTION**

### **3.1 GENERAL RE: INSTALLATION OF CONTROLS**

- .1 Provide complete systems of control and instrumentation to control and supervise building equipment and systems in accordance with this Section and drawings.
- .2 Control systems are to generally be as indicated on drawing control diagrams and are to have all the elements therein indicated or implied.

- .3 Control diagrams show only the principal components controlling the equipment and systems. Supplement each control system with all relays, transformers, sensors, etc., required to enable each system to perform as specified and to permit proper operation and supervision.

### **3.2 INSTALLATION OF CONTROL AIR PIPING AND TUBING**

- .1 Provide required control air piping and tubing.
- .2 Connect new control air piping/tubing to existing pneumatic control air supply.
- .3 Piping/tubing is to be as follows:
  - .1 for piping mains and branches, type "M" seamless copper;
  - .2 for exposed connections to control components, hard or soft copper tubing;
  - .3 for tubing in accessible ceiling spaces, plenum rated polyethylene, neatly bundled with plastic ties and properly supported;
  - .4 for connections to control components within control cabinets, soft copper or plenum rated polyethylene tubing.
- .4 Properly install and support piping and tubing. Provide suitably sized trap legs with drain valves at all low points to prevent condensation pockets.
- .5 Solder all copper joints except at instruments or panels where compression fittings are to be used.

### **3.3 SUPPLY OF CONTROL AIR DAMPERS AND OPERATORS**

- .1 Unless otherwise specified, supply required control dampers. Hand dampers to sheet metal trade at site in location where they are required for installation as part of sheet metal work. Ensure each damper is correctly located and mounted.
- .2 Unless otherwise specified or scheduled, insulated dampers to be provided for all outdoor air intake and exhaust air applications.
- .3 Provide linkage and operators for dampers. Wherever possible locate damper operators so they are accessible from outside duct, plenum, and equipment casings. Bracket mount operators on ducts or plenums clear of insulation where applicable.
- .4 Where sequence operation is indicated, or where multiple operators drive a series of dampers, provide pilot positioners to couple their action.
- .5 Ensure dampers located in ductwork other than galvanized steel are constructed of type 316 stainless steel.

### **3.4 SUPPLY OF AUTOMATIC CONTROL VALVES AND OPERATORS**

- .1 Unless otherwise specified, supply required automatic control valves. Hand valves to appropriate piping trades at site in locations they are required for installation as part of piping work. Ensure each valve is properly located and installed.
- .2 Provide an operator for each valve.

### **3.5 INSTALLATION OF THERMOSTATS**

- .1 Unless otherwise noted, provide required thermostats.
- .2 Provide a ventilated clear acrylic cover for each thermostat located in finished areas, and a wire type guard for each thermostat located in unfinished areas and in areas such as mechanical rooms where thermostat is subject to damage.

- .3 Unless otherwise indicated, mount room thermostats 1.5 m (5 ft) above finished floor level. Thermostats intended to be used by building occupants in a barrier-free path of travel to be mounted at 1.2 m. Confirm exact location of all thermostats prior to roughing-in.
- .4 Provide stand-off mounting and an insulated sub-base for thermostats on outside walls.
- .5 Perform control wiring associated with installation of electric or electric-electronic thermostats.

### **3.6 INSTALLATION OF CONTROL SYSTEM COMPONENTS**

- .1 Provide required control system components and related hardware. Refer to drawing control diagrams and sequences.
- .2 Where components are pipe, duct, or equipment mounted supply components at proper time, coordinate installation with appropriate trade, and ensure components are properly located and mounted.

### **3.7 CONTROL WIRING**

- .1 Perform required control wiring work for control systems except:
  - .1 power wiring connections to equipment and panels, except as noted below;
  - .2 control wiring associated with mechanical plant equipment and systems whose control is not part of work specified in this Section;
  - .3 starter interlock wiring.
- .2 Except as specified below, install wiring in conduit. Unless otherwise specified, final 600 mm (2') connections to sensors and transmitters, and wherever conduit extends across flexible duct connections is to be liquid-tight flexible conduit.
- .3 Control wiring in ceiling spaces and wall cavities may be plenum rated cable installed without conduit but neatly harnessed, secured, and identified.
- .4 Wiring work is to be in accordance with certified wiring schematics and instructions, and wiring standards specified in appropriate Sections of Electrical Work Specification.

### **3.8 IDENTIFICATION AND LABELLING OF EQUIPMENT AND CIRCUITS**

- .1 Refer to identification requirements specified in Section 20 05 00 – Common Work Results for Mechanical.
- .2 Identify equipment as follows:
  - .1 enclosures and components: engraved laminated nameplates with wording listed and approved prior to manufacture of nameplates;
  - .2 wiring: numbered sleeves or plastic rings at both ends of conductor, with numbering corresponding to conductor identification on shop drawings and "as-built" record drawings.

### **3.9 TESTING, ADJUSTING, CERTIFICATION, START-UP, AND TRAINING**

- .1 When control work is complete, check installation of components and wiring connections, make any required adjustments, and coordinate adjustments with personnel doing HVAC testing, adjusting and balancing work.
- .2 For equipment/system manufacturer certification requirements, refer to Section 20 05 00 – Common Work Results for Mechanical.
- .3 For equipment/system start-up requirements, refer to Section 20 05 00 – Common Work Results for Mechanical.

- .4 Include for 2 full, 8 hour days on-site operation demonstration and training sessions. Training is to be a full review of all components including but not limited to a full operation and maintenance demonstration, with abnormal events.
- .5 Include for 2 follow-up site training and troubleshooting visits, one 6 months after Substantial Completion and other at end of warranty period, both when arranged by Owner and for a full, 8 hour day to provide additional system training as required, and to demonstrate troubleshooting procedures.

**END OF SECTION**



## **PART 1 - GENERAL**

### **1.1 ABBREVIATIONS AND DEFINITIONS**

- .1 Abbreviations used in this Specification are as follows:
  - .1 BAS building automation system;
  - .2 DDC direct digital controls;
  - .3 LAN local area network;
  - .4 PC personal computer.

### **1.2 SUBMITTALS**

- .1 Submit shop drawings/product data sheets for BAS components. As a minimum, submit the following:
  - .1 BAS network architecture, including modes and interconnections;
  - .2 systems schematics, sequences, and flow diagrams;
  - .3 points schedule for each point in BAS, including point type, object name, expanded ID, display units, controller type, and address;
  - .4 samples of graphic display screen types and associated menus;
  - .5 detailed Bill of Materials for each system or application, identifying quantities, part numbers, descriptions, and optional features;
  - .6 control damper schedule including a separate line for each damper and a column for each of damper attributes including code number, fail position, damper type, damper operator, duct size, damper size, mounting and actuator type;
  - .7 control valve schedules including a separate line for each valve and a column for valves as for control dampers;
  - .8

### **1.3 CLOSEOUT SUBMITTALS**

- .1 Submit a site inspection and start-up report from manufacturer's representative as specified in Part 3 of this Section.
- .2 Record "as-built" drawings are to include:
  - .1 schematic outline of BAS for quick reference of overall system scope;
  - .2 adequate record of work as installed, including locations and routing of system wiring.
- .3 O&M Manual is to include:
  - .1 hardware specification manual which gives a functional description of hardware components;
  - .2 operator's manual which outlines concise instructions for operation of system and an explanation and recovery route for system alarms;
  - .3 engineering manual which outlines and defines system set-up, definition and application;
  - .4 data manual which indicates applications data programmed into system;
  - .5 system software documentation.



## 1.4 QUALITY ASSURANCE

- .1 BAS hardware and software is to be installed by experienced personnel employed and trained by manufacturer/supplier of field equipment controllers. System wiring is to be installed by journeyman electricians or under direct on-site supervision of journeyman electricians.

## PART 2 - PRODUCTS

### 2.1 GENERAL RE: BUILDING AUTOMATION SYSTEM

- .1 Control system components (field devices) other than those specified in this Section are generally specified in Section 25 05 01 - Automatic Control Systems. Components factory installed with equipment or supplied with equipment are specified in mechanical work Sections with equipment.
- .2 BAS specified in this Section represents an expansion of the existing Johnson Controls DDC building automation system in accordance with drawing control diagrams and sequences, and points lists.
- .3 Manufacturers / Approved contractors:
  - .1 Johnson Controls (BAS).;
    - .1 "Michael A. Ladd" [Michael.A.Ladd@jci.com](mailto:Michael.A.Ladd@jci.com)
  - .2 Johnson Controls (Tyco) Fire and sprinkler
    - .1 Andrew Cyopick [andrew.cyopick@jci.com](mailto:andrew.cyopick@jci.com)

### 2.2 FIELD EQUIPMENT CONTROLLERS

- .1 Each field equipment controller is to be a fully user programmable BACnet Testing Labs (BTL) certified and labelled digital controller that communicates via BACnet MS/TP protocol. Each controller is to be housed in a plenum rated plastic housing with removable base to permit pre-wiring of analog and binary input/output field points without controller in place.
- .2 Each controller is to employ a finite state control engine to eliminate unnecessary conflicts between control functions at crossover points in their operational sequences, and is to be factory programmed with a continuous adaptive tuning algorithm that sense changes in physical environment and continually adjusts loop tuning parameters appropriately.
- .3 Each field equipment controller is to:
  - .1 include troubleshooting LED's to identify following conditions:
    - .1 Power On;
    - .2 Power Off;
    - .3 Download or Start-Up In Progress-Not Ready For Normal Operation;
    - .4 No Faults;
    - .5 Device Fault;
    - .6 Field Controller Bus-Normal Data Transmission;
    - .7 Field Controller Bus-No Data Transmission;
    - .8 Field Controller Bus-No Communication;
    - .9 Sensor Actuator Bus-Normal Data Transmission;
    - .10 Sensor Actuator Bus-No Data Transmission;

- .11 Sensor Actuator Bus-No Communication.
- .2 support universal inputs, configured to monitor any of following:
  - .1 analog input, voltage mode;
  - .2 analog output, current mode;
  - .3 analog input, resistive mode;
  - .4 binary input, dry contact maintained mode;
  - .5 binary input, pulse counter mode.
- .3 support binary inputs configured to monitor either of following:
  - .1 dry contact maintained mode;
  - .2 pulse counter mode.
- .4 support analog outputs configured to output either of following:
  - .1 analog output, voltage mode;
  - .2 analog output, current mode.
- .5 support binary outputs, 24 VAC Triac;
- .6 support configurable outputs capable of following:
  - .1 analog output, voltage mode;
  - .2 binary output mode.
- .7 have ability to reside on a master-slave/token-passing field controller bus supporting BACnet standard protocol as follows:
  - .1 support communications, including input/output communications between field controllers and network automation engines;
  - .2 support a minimum of one hundred input/output modules and field equipment controllers in any combination;
  - .3 operate at a maximum distance of 4560 m (15,000') between field controller and furthest connected device.
- .8 have ability to monitor and control a network of sensors and actuators over a master-slave/token-passing sensor-actuator bus supporting BACnet standard protocol as follows:
  - .1 bus is to support a minimum of ten devices per trunk;
  - .2 bus is to operate at a maximum distance of 365 m (1200') between field controller and furthest connected device.
- .9 capability of executing complex control sequences involving direct wired input/output points as well as input and output devices communicating over field controller bus or sensor-actuator bus;
- .10 support, but not limited to, following:
  - .1 hot water, chilled water/central plant applications;
  - .2 custom air handling units for special applications;
  - .3 terminal units;
  - .4 special programs as required for systems control.
- .11 support a password protected local controller LCD back-lit display with 6 key keypad as an integral part of field controller or as a remote device communicating over sensor-actuator bus to

permit user to view monitored points without logging into system, and to view and change set-points, modes of operation, and parameters.

### **2.3 INPUT/OUTPUT MODULES**

- .1 Input/output modules to facilitate additional inputs and outputs for use in field equipment controllers are to be similar to field equipment controllers but less display and with a minimum of 4 and a maximum of 17 points.

### **2.4 WIRING MATERIALS**

- .1 System wiring, conduit, boxes, and similar materials are to be in accordance with requirements specified in Division 26 – Electrical.

## **PART 3 - EXECUTION**

### **3.1 GENERAL RE: INSTALLATION OF THE BAS**

- .1 Provide an expansion of the existing building automation system in accordance with requirements of this Section of the Specification, Section 25 05 01 - Automatic Control Systems, drawings, and the input/output points list(s).
- .2 BAS to include updates to existing BAS graphics and sequences to suit the refurbished and new units.
- .3 Temporary air handling units to also be tied into the BAS with sequences/graphics updated for each phase and/or unit it is backing up.
- .4 Unless otherwise specified, perform BAS work in accordance with system manufacturer's instructions.

### **3.2 INSTALLATION OF DIRECT DIGITAL CONTROL SYSTEM COMPONENTS**

- .1 Provide required direct digital control hardware, software, accessories, and wiring for a complete BAS. Refer to drawing control diagrams and sequences, points list(s), and Section 25 05 01 - Automatic Control Systems.
- .2 DDC work is to be performed by skilled technicians, properly trained and are qualified for this work.
- .3 Materials and equipment used are to be standard components, regularly manufactured for this and/or other systems, and not custom designed especially for this project. Systems and components are to have been thoroughly tested and proven in actual use.
- .4 System is to be modular, permitting expansion by adding hardware and software without changes in communication or processing equipment.
- .5 Provide new communications bus as required complete with required ancillaries. Connect and extend existing communications bus.
- .6 Provide 1 supervisory controller (SC) per cabinet fan (air handler). Provide necessary field equipment controllers (FEC).
- .7 Provide necessary quantity of SC to accomplish requirements of this specification, and to minimize number of mechanical systems that would be inoperative in event of a FEC failure. A maximum of 2 major mechanical systems are to be controlled by 1 FEC.
- .8 Surface wall mount SC and FEC control units in Mechanical Rooms ensuring they are not mounted on vibrating surfaces, and connect to 15A-1P circuit breakers dedicated for control system applications, in branch panel circuit boards in adjacent spaces. Power wiring from control units to circuit breakers is to be the responsibility of the controls contractor. Wiring is to be in conduit and conduit and wiring are to be in accordance with standards and requirements of Division 26 –

Electrical. Refer to electrical drawings for locations of branch circuit panelboards with dedicated circuits for controls system applications.

- .9 Indicate via number, and systems controlled by SC and FEC. Indicate via a lamacoid label mounted inside panel the identification number of electrical panel supplying power to SC and FEC.
- .10 Submit schedule(s) of input/output points to Consultant for review. Directly connect each SC and FEC to point devices in accordance with control diagrams and schedule of miscellaneous control points as shown on drawings. Sensor wires for each analogue input are to be No. 18 AWG twisted-shielded cable. Other types of wire required are to be as recommended by system supplier.
- .11 Provide required sensors, remote devices, etc., and required interface accessories. Mount duct and/or plenum sensors half-way across duct or plenum.
- .12 Differential pressure sensor used to provide space pressurization control through regulation of return air quantities must be mounted with snubbers on indoor pressure leg to prevent sudden fluctuations caused by door openings, etc. Mount outdoor air ports in locations that minimize effects of abnormal surface flow conditions and wind gusts.
- .13 Supply and turn over to Consultant prior to application for a Certificate of Substantial Performance of the Work, reports to be used in assisting Owner in defining and debugging DDC programs. These reports are to consist, as a minimum, of following:
  - .1 process control language (PCL) logs;
  - .2 control loop logs;
  - .3 PCL master point.
- .14 Submit Point Data Input forms to Consultant that Owner will fill out with DDC system supplier's assistance. Input this point data into the system.
- .15 Contacts will be supplied as part of mechanical work or electrical work for alarm and status points for systems and equipment other than building environmental systems and equipment. Connect to DDC system in accordance with point schedule.

### 3.3 CONTROL WIRING

- .1 Perform required control wiring work for control systems except:
  - .1 power wiring connections to equipment and panels, except as noted below;
  - .2 control wiring associated with mechanical plant equipment and systems whose control is not part of work specified in this Section;
  - .3 starter interlock wiring.
- .2 Except as specified below, install wiring in conduit. Unless otherwise specified, final 600 mm (2') connections to sensors and transmitters, and wherever conduit extends across flexible duct connections is to be liquid-tight flexible conduit.
- .3 Control wiring in ceiling spaces and wall cavities may be plenum rated cable installed without conduit but neatly harnessed, secured, and identified.
- .4 Wiring work is to be in accordance with BAS manufacturer's certified wiring schematics and instructions, and wiring standards specified in electrical work Division of this Specification.

### 3.4 IDENTIFICATION AND LABELLING OF EQUIPMENT AND CIRCUITS

- .1 Refer to Section 20 05 00 – Common Work Results for Mechanical.
- .2 Identify BAS equipment as follows:
  - .1 enclosures: engraved laminated nameplates with lettering such as BAS Panel CP2, or BAS Relays, or BAS E/P Transformers, with all wording listed and approved prior to manufacture of nameplates;

- .2 panel points: a weather-proof input/output layout sheet for each controller with the name of each point connected to controller, and associated wire labelling information;
- .3 wiring: numbered sleeves or plastic rings at both ends of conductor, with numbering corresponding to conductor identification on shop drawings and "as-built" record drawings;
- .4 interface components: a weather-proof layout sheet clearly illustrating/identifying purpose of each component within enclosure such that an operator or service technician can quickly identify exact use of each relay, transducer, contactor, etc., with each sheet fastened securely to back of enclosure door.

### **3.5 SYSTEM STARTUP**

- .1 For equipment/system manufacturer certification requirements, refer to Section 20 05 00 – Common Work Results for Mechanical.
- .2 For equipment/system start-up requirements, refer to Section 20 05 00 – Common Work Results for Mechanical.

**END OF SECTION**

## **PART 1 - GENERAL**

### **1.1 SECTION INCLUDES**

- .1 Common requirements for electrical work.
- .2 Mounting heights for electrical equipment and devices.

### **1.2 RELATED REQUIREMENTS**

- .1 Provisions of this section apply to all sections of Division 26, Division 27 and Division 28.
- .2 This section is to be read in conjunction with Division 00 documents, and Division 01 specification sections, which take precedence as described in CCDC 2-2008.
  - .1 General Conditions.
  - .2 Supplementary General Conditions.
  - .3 General Requirements.

### **1.3 INTENT**

- .1 Include all material, labour, equipment, and plant construction as necessary to make a complete installation as shown and specified hereinafter.
- .2 Leave complete systems ready for continuous and efficient satisfactory operation.
- .3 Discipline and Trade Jurisdiction
  - .1 In accordance with CCDC 2-2008 GC 1.1.7: Neither the organization of the Specifications nor the arrangement of Drawings shall control the Contractor in dividing the work among Subcontractors and Suppliers.
  - .2 MasterFormat's organizational structure used in a project manual does not imply how the work is assigned to various design disciplines, trades, or subcontractors. MasterFormat is not intended to determine which particular elements of the project manual are prepared by a particular discipline. Similarly, it is not intended to determine what particular work required by the project manual is the responsibility of a particular trade. A particular discipline or trade is likely to be responsible for subjects from multiple Divisions, as well as from multiple Subgroups.

### **1.4 DRAWINGS AND SPECIFICATIONS**

- .1 The drawings and specifications are complementary each to the other and what is called for by one to be binding as if called for by both. Should any discrepancy appear between the drawings and specifications, which leaves the Contractor in doubt as to the true intent and meaning of plans and specifications, a ruling is to be obtained from the Consultant in writing before submitting Bid. If this is not done, the maximum, the most expensive alternate or option will be provided in base tender bid.
- .2 All drawings and all Divisions of these specifications shall be considered as a whole, and work of this Division shown anywhere therein shall be furnished under this Division.
- .3 Drawings are diagrammatic and indicate the general arrangement of equipment and pathways. Most direct routing of conductors and wiring is not assured. Exact requirements are governed by architectural, structural, and mechanical conditions of the job. Consult all other drawings in preparation of the bid. Extra lengths of wiring or addition of pull and junction boxes, etc. necessitated by such conditions are to be included in the bid. Check all information and report and apparent discrepancies before submitting the bid.
- .4 Contractor shall determine the exact locations of equipment and rough-ins, and the exact routing of pathways so as to best fit the layout of the job. Plan, coordinate, and establish exact locations and

routing of services with affected trades prior to installation such that services clear each other as well as other obstructions.

- .5 Unless otherwise directed by Consultant, Mechanical Contractor is to determine final locations of major work within ceiling spaces.
- .6 Unless otherwise shown or specified, conceal work in finished areas, and conceal work in partially finished and/or unfinished areas to extent made possible by the area construction. Install services as high as possible to conserve headroom and/or ceiling space. Notify Consultant where headroom or ceiling space appears to be inadequate prior to installation of the work.
- .7 Scaling off the drawings will not be sufficient or accurate for determining these locations. Where job conditions require reasonable changes in indicated arrangement and locations, such changes shall be made at no additional cost to the Owner.
- .8 Because of the scale of the drawings, certain basic items, such as junction boxes, pull boxes, conduit fittings, etc. may not be shown, but where such items are required by other sections of the specifications of where there are required for proper installation of the work, such items are to be furnished and installed.
- .9 Before ordering any conduit, cable tray, conductors, wireways, raceway bus duct, fittings, etc., verify all pertinent dimensions at the job site and be responsible for their accuracy.
- .10 If obvious ambiguities or omissions are noticed when tendering refer same to the Consultant for a ruling and obtain the ruling in writing in the form of an Addendum. Claims for extras for ambiguities or omission of items brought to the attention of the Consultant after the award of a contract which, due to the nature of the ambiguity or omission, should have been brought to the attention of the Consultant during the tendering period, will not be allowed.
- .11 The drawings are performance drawings, diagrammatic, and show locations for apparatus and materials. The drawings are intended to convey the scope of work and do not intend to show Architectural and Structural details. The locations shown are approximate, and may be altered, when approved by the Consultant, to meet requirements of the material and/or apparatus, other equipment and systems being installed, and of the building. Do not scale drawings.
- .12 Control products, products requiring maintenance, junction boxes, and similar products, particularly such products located above suspended ceilings must be located for easy access for servicing and/or removal. Products which do not meet this location requirement are to be relocated to an accessible location at no additional cost.
- .13 Be responsible for making necessary changes, at no additional cost, to accommodate structural and building conditions that were missed due to lack of coordination by this Division.
- .14 Where drawings indicate that acoustic tile ceiling is being suspended below existing plaster ceiling, coordinate with General Trades Contractor design of framework used to support suspended ceiling, lighting, diffusers, and other Electrical Divisions components that are mounted within or through ceiling. Do not mount devices to suspended ceiling. Secure and mount to ceiling slab above. Seal ceiling openings to maintain required fire rating.
- .15 Provide any fitting, offset, transformation, etc., required to suit architectural and structural details but not shown.

## **1.5 WORK RESTRICTIONS**

- .1 Refer to Division 00 documents, and Division 01 specification sections.
- .2 Existing buildings:
  - .1 Examine the existing building, the site and surrounding areas and be fully informed as to the conditions and limitations under which the work has to be executed. Claims for additional costs will not be entertained with respect to conditions which could reasonably be ascertained by an inspection prior to Tender closing.



- .2 All work in the existing building, other than minor works required to permit construction of the new addition, is to be performed in such a manner as to not disrupt the building operations.
- .3 All systems are to be kept in full operation during normal building hours.
- .4 Note that any noise generating works that disrupt the building operation shall be coordinated accordingly and carried out after/before normal operating hours.
- .5 Cut, modify, or extend as necessary or as directed by the Consultant, the existing material or equipment to be reused or relocated to suit work under this contract.
- .6 Existing materials and equipment which are to be used in new work shall be repaired and refinished as necessary. Provide additional new materials and components as required to facilitate reinstallation of such existing materials and equipment.
- .7 Co-ordinate with the Owner, and refer to General Conditions.
- .8 Do work in existing areas to best suit available space and not interfere with or obstruct use of existing facilities.
- .9 Where disruptions of existing services are required, coordinate shut down with the Owner's operating staff and do the work at a time and in a manner mutually acceptable. Carefully schedule disruptions to keep "down time" to a minimum.
- .3 Do all cutting, patching and making good to leave in a finished condition and to make the several parts of the Work come together properly. Co-ordinate work to keep cutting and patching to a minimum.
- .4 Quality of workmanship and materials used in patching, making good and refinishing of existing construction and/or compartments shall be of a standard equal to that specified for new construction and if not specified, equal to or exceeding that of original existing work.
- .5 Prior to cutting openings, examine wall, floor and ceiling construction for buried electrical cables and pipes; and take adequate protection. Conduct cable locating tests to locate buried cables in existing work.
- .6 Openings
  - .1 Supply opening sizes and locations to Consultant to allow verification of their effect on design, and for inclusion on structural drawings where appropriate.
  - .2 No openings are permitted through completed structure without written approval from Owner and review with Consultant. Show required openings on a copy of structural drawings. Identify exact locations, elevations, and size of proposed openings and submit to Consultant for review, well in advance of doing work.

## **1.6 SUBSTITUTION PROCEDURES**

- .1 Refer to Division 00 documents, and Division 01 specification sections for the General Provisions of the Contract.
- .2 Additionally, "Approved Equal" shall be defined as an alternate approved by the Consultant.
- .3 If during the tender bid process, the bidding contractor wishes to substitute the specified equipment for an "Approved Equal", the bidding contractor must submit shop drawings to the Consultant before the tender close for approval. If no substitution request is made, the as-specified equipment is that to be provided.
- .4 Where several manufacturers' names are given, the first named manufacturer constitutes the basis for job design and establishes the equipment quality required to be used in this contract.
- .5 This contractor, at his option, may use equipment as manufactured by the other manufacturers if listed. This contractor is responsible to ensure that all items submitted by these other manufacturers meets are requirements of the drawings and specification and fits in the allocated space. The final



determination of a product being equivalent is to be determined by the Consultant when a catalog number is not listed, or listed in part.

- .6 Any material, article or equipment of other unnamed manufacturers which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Consultant as described in the General Provisions of the Contract for Submittals. The Contractor bears full responsibility for the unnamed manufacturers' equipment adequately meeting the intent of the design. The Owner or the Consultant may reject manufacture at time of shop drawing submittal.

## 1.7 CONTRACT MODIFICATION PROCEDURES

- .1 Unless otherwise specifically specified in Divisions 00 or 01, include for requirements herein this article.
- .2 Whenever Consultant proposes in writing to make a change or revision to design, arrangement, quantity, or type of any work from that required by Contract Documents, prepare and submit to Consultant for review and Owner approval, a quotation being proposed cost for executing change or revision.
- .3 Quotation to be a detailed and itemized estimate of product, labour, and equipment costs associated with change or revision, plus overhead and profit percentages and applicable taxes and duties.
- .4 Overhead and profit percentages are specified in Division 00 for additional work under Contract as approved by Owner and reviewed with Consultant.
- .5 Unless otherwise specified in Divisions 00 or 01, following additional requirements apply to quotations submitted:
  - .1 when change or revision involves deleted work as well as additional work, cost of deleted work (less overhead and profit percentages but including taxes and duties) is to be subtracted from cost of additional work before overhead and profit percentages are applied to additional work;
  - .2 material costs are not to exceed those published in local estimating price guides (i.e. NECA, RS Means);
  - .3 electrical material labour unit costs are to be in accordance with National Electrical Contractors Association Manual of Labor Units at difficult level, less 25%;
  - .4 mechanical material labour unit costs are to be in accordance with Mechanical Contractors Association of America Labor Estimating Manual, less 25%;
  - .5 costs for journeyman and apprentice labour must not exceed prevailing rates at time of execution of Contract and must reflect actual personnel performing work;
  - .6 cost for site superintendent must not exceed 10% of total hours of labour estimated for change or revision, and change or revision must be such that site superintendent's involvement is necessary;
  - .7 costs for rental tools and/or equipment are not to exceed local rental costs;
  - .8 overhead percentage will be deemed to cover quotation costs other than actual site labour and materials, and rentals;
  - .9 quotations, including those for deleted work, to include a figure for any required change to Contract time.
- .6 Quotations submitted that are not in accordance with requirements specified above will be rejected and returned for re-submittal. Failure to submit a proper quotation to enable Consultant to expeditiously process quotation and issue a Change Order will not be grounds for any additional change to Contract time.

- .7 Make requests for changes or revisions to work to Consultant in writing and, if Consultant agrees, will issue Notice of Change.
- .8 Do not execute any change or revision until written approval for change or revision has been obtained from Owner and reviewed with Consultant.

#### **1.8 PROGRESS PAYMENT BREAKDOWN**

- .1 Prior to submittal of first progress payment draw, submit a detailed breakdown of work cost to assist Consultant in reviewing and approving progress payment claims.
- .2 Payment breakdown is subject to Consultant's approval and progress payments will not be processed until an approved breakdown is in place. Breakdown is to include one-time claim items such as mobilization and demobilization, insurance, bonds (if applicable), shop drawings and product data sheets, commissioning including system testing and verification, and project closeout submittals.
- .3 Indicate equipment, material and labour costs for site services (if applicable) and indicate work of each trade in same manner as they will be indicated on progress draw.

#### **1.9 PHASING**

- .1 Include for scheduling, co-ordination, and construction phasing to suit project as specified in Division 01 and on drawings. Review exact phasing requirements with Consultant prior to start of Work.
- .2 Protect existing areas above, below and adjacent areas of Work from any debris, noise, or interruptions to existing services to satisfaction of Owner and Consultant. Maintain in operation existing services to these areas to allow Owner to continue use of these areas. If services that are required to be maintained run through areas of renovations, provide necessary protection to services or reroute, to approval of Owner and Consultant. Include for required premium time work to meet these requirements.
- .3 Work being performed within occupied spaces and work affecting surfaces adjacent to occupied spaces may need to be performed after regular business hours. For areas where spaces are used by Owner on a 24 hours basis or over various hours, coordinate hours of work with Owner on a regular basis to suit Owner's schedule. Execute work at times confirmed with and agreed to by Consultant and Owner, so as not to inconvenience Owner's occupation or in any way hinder Owner's use of building. Include for required premium timework to meet these requirements.
- .4 Project partial occupancy permits to be required throughout project. Provide for each partial permit, local governing authority certificate and any other testing/verification certificates for systems.

#### **1.10 COORDINATION**

- .1 Coordinate work with other trades to avoid conflict and to provide correct rough-in and connection for equipment furnished under other trades that require electrical connection. Inform Contractors of other trades of the required access to and clearances around electrical equipment to maintain serviceability and code compliance.
- .2 Verify equipment dimensions and requirements with provision specified under this Section. Check actual job conditions before fabricating work. Report necessary changes in time to prevent needless work. Changes or additions subject to additional compensation, which are made without written authorization and an agreed price, shall be at Contractor's risk and expense.
- .3 Read specifications and drawings of other trades and conform with their requirements before proceeding with any work specified in this Division related to other trades. Co-operate with all other trades on the job, so that all equipment can be satisfactorily installed, and so that no delay is caused to any other trades.

- .4 Coordinate utility service outages with the owner. Prior to any outage or interruption, inform Owner and Consultant in writing 10 working days in advance of proposed outage or interruption and obtain written consent to proceed. Do not shut-down or interrupt any system or service without such written consent. Shutdowns of some essential services may require additional advance notification time.
- .5 Perform work associated with shut-downs and interruptions as continuous operations to minimize shut-down time and to reinstate systems as soon as possible, and, prior to any shut-down. Disable system only to make switch overs and connections. Ensure materials and labour required to complete the work for which shut-down is required are available at site.
- .6 Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.
- .7 Co-ordinate work with all trades to ensure a proper and complete installation. Notify all trades concerned of the requirement for openings, sleeves, insets and other hardware necessary for the installation and, where work is to be integrated with the work of other trades or is to be installed in close proximity with the work of other trades, carefully co-ordinate the work prior to installation.
- .8 Systems Coordination
  - .1 Be responsible for and perform specific coordination of various low voltage systems supplied by Electrical Divisions and also with systems supplied by other Divisions of Work. Include for but not be limited to provision of following, as applicable:
    - .1 coordinate with General Contractor and other Subcontractors, various systems of trades which in any way are interfaced with or monitored by or integrated to, or need to be coordinated with;
    - .2 prepare systems coordination drawings detailing related system coordination and integration points being monitored and/or controlled; submit coordination drawings as part of shop drawing submission;
    - .3 coordinate security system requirements with successful door hardware supplier and prepare detailed coordination drawings of component installations, wiring and conduit layouts, division of responsibility between various trades, etc.; review security system requirements with associated door hardware (electromagnetic locks, electric strikes, etc.), to ensure proper sequence of operation and door functionality is provided to suit each door configuration; prepare detailed door functionality of each door configuration and submit for review by Consultant;
    - .4 review systems requirements for component back boxes and conduits; ensure that system of conduits and boxes meet respective system wiring bending radii requirements;
    - .5 review specifications of each trade/Division ( i.e. for BAS points, elevator requirements, electrical devices in millwork or prefabricated service consoles, outlet box and back box requirements), to ensure proper power supplies, interconnecting wiring requirements and back box/ outlet box requirements;
    - .6 review with manufacturers coordination and integration requirements of their systems;
    - .7 review each systems communication protocols to ensure they are compatible and can communicate with each other as required;
    - .8 review system shop drawings prior to submission to Consultant, to verify that each system has been coordinated with other systems and that required options and features are selected to meet coordination requirements;
    - .9 be present at testing and commissioning functions of each system and provide technical assistance with regards to system operations;
    - .10 be "on-site" coordinator of respective system trades with regards to respective system coordination of installation and testing;

- .11 liaise with Consultant with regards to ensuring that systems coordinate and integrate properly to satisfaction of Owner;
  - .12 document coordination and integration requirements and maintain records for submission as part of shop drawings;
  - .13 respond to coordination and integration requirements and be responsible for such work;
  - .14 where a system integrator has been included for, coordinate integration requirements with system integrator.
- .9 Working Detail Drawings
- .1 The contractor is to prepare working detail drawings supplementary to the contract drawings, when deemed necessary by the Consultant, for all areas where a multiplicity of materials and or apparatus occur, or where the work due to architectural and structural considerations involves special study and treatment. Such drawings may be prepared jointly by all trades affected, or by the one trade most affected with due regard for and approval of the other trades, all as the Consultant will direct in each instance. Such drawings must be reviewed by the Consultant before the affected work is installed.
  - .2 Carry out all alterations in the arrangement of work which has been installed without proper study and approval, even if in accordance with the contract documents, in order to make such work come within the finished lines of walls, floors and ceilings, or to allow the installation of other work, without additional cost. In addition, make any alterations necessary in other work required by such alterations, without additional cost.

#### 1.11 SUBMITTAL PROCEDURES

- .1 Before delivery to site of any item of equipment, submit shop drawings complete with all data, pre-checked and stamped accordingly, for review by the Consultant. Indicate project name on each brochure or sheet, make reference to the number and title of the appropriate specification section, type identifier such panelboard ID or luminaire type as indicated on appropriate schedule, and provide adequate space to accommodate the Consultant's review stamp(s).
- .2 Verify field measurements and affected adjacent Work are coordinated, including passageway clearances for movement of equipment into location.
- .3 Submit shop drawings to the Consultant in electronic (PDF) format, as coordinated after award of contract. Where submittals are derived from digital originals, do not print and rescan documents; submittals made as such will be immediately rejected.
- .4 Submit a schedule of shop drawings within one week after award of contract. Group submittals by specification division as appropriate.
- .5 Shop Drawings
  - .1 Submit for review, properly identified shop drawings showing in detail the design and construction of all equipment and materials as requested in sections of the specification governed by this Section.
  - .2 Obtain and comply with the manufacturer's installation instructions.
  - .3 Submit for review, drawings showing in detail design, construction, and performance of equipment and materials as requested in Specification. Include minimally for preparation and submission of following, as applicable:
    - .1 product literature cuts;
    - .2 equipment data sheets;
    - .3 equipment dimension drawings;
    - .4 system block diagrams;
    - .5 sequence of operation;
    - .6 connection wiring schematic diagrams;
    - .7 functionality with integrated systems.

- .4 Each shop drawing or product data sheet is to be properly identified with project name and product drawing or specification reference. Shop drawing or product data sheet dimensions are to match dimension type on drawings.
- .5 Each system and each major component are to be separate shop drawing submissions. Shop drawings for common devices such as devices of each system are to be submitted together.
- .6 Obtain shop drawings for submission from product manufacturer's authorized representatives and supplemented with additional items specified herein.
- .7 Supply equipment loads (self-weight, operating weight, housekeeping pad, inertia pads, etc.) to Consultant, via shop drawing submissions, prior to construction.
- .8 Do not order product until respective shop drawing review process has been properly completed by Consultant.
- .9 Where extended warranties are specified for equipment items, submit specified extended warranty with shop drawing submittal.
- .10 Endorse each shop drawing copy "CERTIFIED TO BE IN ACCORDANCE WITH ALL REQUIREMENTS", stamp each copy with your company name, date each copy with the submittal date, and sign each copy. Shop drawings which are received and are not endorsed, dated and signed will be returned for re-submittal.
- .11 The Consultant will stamp shop drawings as follows:
  - .1 Reviewed ( )
  - .2 Reviewed as Modified ( )
  - .3 Revise and Re-Submit ( )
  - .4 Not Reviewed ( )
- .12 If "REVIEWED" is checked-off, the shop drawing is satisfactory. If "REVIEWED AS MODIFIED" is checked-off, the shop drawing is satisfactory subject to requirements of remarks put on shop drawing copies. If "REVISE AND RE-SUBMIT" is checked-off, the shop drawing is entirely unsatisfactory and must be revised in accordance with comments written on shop drawing copies and resubmitted. If "NOT REVIEWED" is checked-off, the shop drawing is in error of submission, not applicable for this project.
- .13 This review by the Consultant is for the sole purpose of ascertaining conformance with the general design concept. This review shall not mean that the Consultant approved the detail design inherent in the shop drawings, responsibility for which shall remain with the Contractor, and such review shall not relieve the Contractor of responsibility for errors or omissions in the shop drawings or of responsibility for meeting all requirements of the contract documents. Be responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation, and for co-ordination of the work as well as compliance with codes and inspection authorities such as CSA, etc.

## 1.12 SAFETY REQUIREMENTS

- .1 Be responsible for the safety of workers and the equipment on the project in accordance with all applicable safety legislation passed by Federal, Provincial, and local authorities governing construction safety. The more stringent regulations prevail.
- .2 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials. Submit WHMIS MSDS (Material Safety Data Sheets) for products where required, and maintain one copy at site in a visible and accessible location available to personnel.
- .3 Comply with requirements of Occupational Health and Safety Act and other regulations pertaining to health and safety, including worker's compensation/ insurance board and fall protection regulations.



When working in confined spaces, comply with requirements of Occupational Health and Safety Act - Ontario Regulation 632, "Confined Spaces".

- .4 If at any time during course of existing building work, hazardous materials other than those identified in Documents and pertaining to Project Scope of Work, are encountered or suspected that were not identified as being present and which specific instructions in handling of such materials were not given, cease work in area in question and immediately notify Consultant. Comply with local governing regulations with regards to working in areas suspected of containing hazardous materials. Do not resume work in affected area without approval from Consultant.

### 1.13 REGULATORY REQUIREMENTS

#### .1 Codes and Standards

- .1 Where any code, regulation, bylaw, standard, contract form, manual, printed instruction, and installation and application instruction is quoted it means, unless otherwise specifically noted, latest published edition at time of submission of Bids adopted by and enforced by local governing authorities having jurisdiction. Include for compliance with revisions, bulletins, supplementary standards or amendments issued by local governing authorities.
- .2 Where regulatory codes, standards and regulations are at variance with Drawings and Specification, more stringent requirement will apply unless otherwise directed by Consultant.
- .3 Supplementary mandatory Specifications and requirements to be used in conjunction with project include but are not limited to following:
  - .1 American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc., (ASHRAE);
  - .2 American Standards Association (ASA or ANSI);
  - .3 ANSI/ASHRAE Standard 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings;
  - .4 Building Industry Consulting Services, International (BICSI);
  - .5 Canadian Standards Association (CSA);
  - .6 CSA Z317.5, Illumination Systems in Health Care Facilities.
  - .7 CSA Z32, "Electrical Safety and Essential Systems in Health Care Facilities";
  - .8 CSA Z432 Safeguarding of Machinery;
  - .9 CSA Z462, "Workplace Electrical Safety";
  - .10 CAN/CSA Z8000, Canadian Health Care Facilities.
  - .11 CSA Z8001, "Commissioning of Health Care Facilities";
  - .12 Electrical and Electronic Manufacturers Association of Canada (EEMAC);
  - .13 Electrical Safety Authority (ESA);
  - .14 Electronic Industries Association (EIA);
  - .15 Illuminating Engineering Society (IES);
  - .16 Institute of Electrical and Electronic Engineers (IEEE);
  - .17 National Building Code of Canada (NBC);
  - .18 National Electrical Manufacturers Association (NEMA);
  - .19 National Fire Protection Association (NFPA);
  - .20 Occupational Health and Safety Act - Ontario Regulation 632, " Confined Spaces";
  - .21 Occupational Health and Safety Act (OHSA);
  - .22 Ontario Building Code (OBC);
  - .23 Ontario Electrical Safety Code (OESC);
  - .24 Technical Standards and Safety Authority (TSSA);
  - .25 Telecommunications Industry Association (TIA);
  - .26 Underwriters' Laboratories of Canada (ULC);
  - .27 additional codes and standards listed in Trade Sections;
  - .28 Codes, standards, and regulations of local governing authorities having jurisdiction;
  - .29 Hydro inspection permits;
  - .30 Material Safety Data Sheets by product manufacturers.

- .31 National Association of Pharmacy Regulatory Authorities (NAPRA), Practice and Regulatory Standards.
- .4 In addition, obtain, review and comply with requirements of latest version of issued Owner's Constructors Health & Safety Rules.
- .5 Provide applicable requirements for barrier free access in accordance with latest edition of local governing building code.
- .6 Where any governing Code, Regulation, or Standard requires preparation and submission of special details or drawings for review they are to be prepared and submitted. Pay associated costs associated with these submittals.
- .7 Unless otherwise specified, 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.
- .8 Work is to be performed by journeyperson tradesmen who perform only the work that their certificates permit, or by apprentice tradesmen under direct on site supervision of an experienced journeyperson tradesman. Journeyperson to apprentice ratio is not to exceed ratio determined by the Board as stated in Ontario College of Trades and Apprenticeship Act.
- .9 Journeyperson tradesmen are to have a copy of valid trade certificates available at site for review by Consultant at any time.
- .10 Experienced and qualified superintendent is to be on-site at times when work is being performed.
- .11 Coordinate work inspection reviews and approvals with governing inspection department to ensure that construction schedule is not delayed. Be responsible for prompt notification of deficiencies to Consultant and submission of reports and certificates to Consultant.
- .12 Properly protect equipment and materials on site from damage due to elements and work of trades, to satisfaction of Consultant. Equipment and materials are to be in new condition upon Substantial Performance of the Work.
- .2 Permits and Fees
  - .1 Obtain and pay for all permits and fees required for the execution and inspection of the electrical work and pay all charges incidental to such permits. Submit to Electrical Inspection Department and Supply authority necessary number of drawings and specifications for examination and approval prior to commencement of work. Arrange and pay for any special inspection of equipment specified if and when required.
  - .2 Apply, pay and obtain all permits as required for the electrical work.
  - .3 Submit required applications, shop drawings, electrical distribution system protection device coordination studies, and short circuit calculations, and any other information requested by local authority.
  - .4 Be responsible for ensuring that authorities having jurisdiction which require on-site inspection of work, have ample notification to perform inspection, with sufficient lead time to correct deficiencies in a manner that will not impede schedule of completion of Work.
  - .5 Upon substantial completion of your work, supply and turn over to the Consultant all required inspection certificates from governing authorities to certify that the work as installed conforms to the rules and regulations of the governing authorities.
  - .6 Where electromagnetic locks are provided whether by this Division or by others, be responsible for obtaining and paying for required certificates of work with regards to such electromagnetic lock work.
- .3 Infection Prevention and Decontamination Requirements

- .1 Comply with following CAN/CSA Standards:
  - .1 CAN/CSA-Z317.13, Infection Control During Construction, Renovation, and Maintenance of Health Care Facilities;
  - .2 CAN/CSA-Z317.10, Handling of Waste Materials in Healthcare Facilities.
  - .3 CAN/CSA-Z318.0, Commissioning of Healthcare Facilities.
- .2 Prepare a list of all areas of the work where the infection control procedures are to be in force and review the list and procedures with the healthcare facility's infection control officer or a designated healthcare facility representative prior to any work in the areas commencing, and as work proceeds ensure that all infection control procedures are being maintained.
- .3 Healthcare facility has policies and procedures that are to be reviewed and followed when working within areas of healthcare facility. Include for requirements specified in Division 01 and in this article.
- .4 Comply with healthcare facility's latest policies and procedures regarding infection prevention measures during work of construction/renovation/installation/maintenance.
- .5 Comply with healthcare facility's latest requirements regarding decontamination. Exact requirements and scope of this work are to be defined on drawings or in specifications where applicable and also may be defined in Division 01.
- .4 Patient Care Areas
  - .1 Comply with requirements for patient care areas (PCA) included in Work as required by Section 24 of OESC. Patient care areas are identified on drawings or in schedule appended to end of this Section. Review final PCA nomenclature with Consultant prior to start of Work.
  - .2 Note that room and area names/numbers are based on information available at time of preparation of documents and such names/numbers may be revised in later documents or during construction of Work. In no way are patient care area classifications to be reduced due to name/number revisions. Confirm exact classifications as per local governing electrical code requirements to suit final construction and any design changes made by Consultant.
  - .3 Provide testing and verification of circuits and devices to confirm compliance with OESC.
- .5 Patents
  - .1 Pay all royalties and licence fees, and defend all suits or claims for infringement of any patent rights, and save the Owner, Architect, Project Manager and Consultants harmless of loss or annoyance on account of suit, or claims of any kind for violation or infringement of any letters patent or patent rights, by this Subcontractor or anyone directly or indirectly employed by him or by reason of the use by him or them of any part, machine, manufacture or composition of matter on the work, in violation or infringement or such letters patent or rights.

#### 1.14 REFERENCES

- .1 Canadian Standards Association
  - .1 CSA-C22.1-12, Canadian Electrical Code, Part 1 (22nd Edition),
  - .2 Standard for Electrical Installations.
  - .3 CAN3-C235-83(R2006), Preferred Voltage Levels for AC Systems, 0 to 50 000 V.
  - .4 Do underground systems in accordance with CSA C22.3 No.7-06, Underground Systems, except where specified otherwise.
  - .5 Ontario Electrical Safety Code, 25th Edition / 2012.
- .2 Electrical and Electronic Manufacturer's Association of Canada (EEMAC)



- .1 EEMAC 2Y-1-1958, Light Gray Colour for Indoor Switch Gear.
- .3 Health Canada / Workplace Hazardous
- .4 Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .5 Ontario Electrical Safety Code, 25th Edition / 2012, and all bulletins.
- .6 Hydro requirements and local applicable codes and regulations.
- .7 Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC)
  - .1 IEEE SP1122-2000, The Authoritative Dictionary of IEEE Standards Terms, 7th Edition.

#### **1.15 DEFINITIONS**

- .1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE SP1122.

#### **1.16 REQUIREMENTS FOR CONTRACTOR RETAINED ENGINEERS**

- .1 Professional engineers retained to perform consulting services with regard to Project work, i.e. seismic engineer, fire protection engineer, structural engineer, are to be members in good standing with local Association of Professional Engineers, and are to carry and pay for errors and omissions professional liability insurance in compliance with requirements of governing authorities in Place of the Work.
- .2 Retained engineer's professional liability insurance is to protect Contractor's Consultants and their respective servants, agents, and employees against any loss or damage resulting from professional services rendered by aforementioned Consultants and their respective servants, agents, and employees in regards to the Work of this Contract.
- .3 Liability insurance requirements are as follows:
  - .1 coverage is to be a minimum of \$1,000,000.00 CDN inclusive of any one occurrence;
  - .2 insurance policy is not to be cancelled or changed in any way without insurer giving Owner minimum thirty days written notice;
  - .3 liability insurance is to be obtained from an insurer registered and licensed to underwrite such insurance in the Place of the Work;
  - .4 Retained Consultants are to ascertain that Sub-Consultants employed by them carry insurance in the form and limits specified above;
  - .5 evidence of the required liability insurance in such form as may be required is to be issued to Owner, Owner's Consultant, and Municipal Authorities as required prior to commencement of aforementioned Consultant's services.

#### **1.17 QUALITY ASSURANCE**

- .1 The specifications contained herein are set forth as the minimum acceptable requirements. This does not relieve the Contractor from executing other quality assurance measures to obtain a complete operating system within the scope of this project.
- .2 Ensure that all workmanship, all materials employed, all required equipment and the manner and method of installation conforms to accepted construction and engineering practices, and that each piece of equipment is in satisfactory working condition to satisfactorily perform its functional operation.
- .3 Provide quality assurance tests and operational check on all components of the electrical distribution system, all lighting fixtures, and communication systems.

- .4 Only first class workmanship will be accepted, not only in regards to durability, efficiency and safety, but also in regards to neatness of detail. Present a neat and clean appearance on completion to the satisfaction of the Consultant. Any unsatisfactory workmanship will be replaced at no extra cost.
- .5 Conform to the best practices applicable to this type of work. Install all equipment and systems in accordance with the manufacturer's recommendations, but consistent with the General Requirements of this specification. Electrical Contractor will be held responsible for all damage to the work of his own or any other trade, resulting from the execution of his work. Store all electrical equipment and materials in dry locations.
- .6 Provide foreman in charge of this work at all times.
- .7 The contractor shall be fully liable to provide and maintain in force during the life of this Contract, such insurance, including Public Liability Insurance, Product Liability Insurance, Auto Liability Insurance, Worker's Compensation, and Employer's Liability Insurance.
- .8 Governing Federal, Provincial and Municipal codes and regulations will be considered minimum standards for the work and where these are at variance with the drawings and specification, the more stringent ruling will apply.
- .9 Where any code, regulation, bylaw, or standard is quoted it shall mean the current edition including all revisions or amendments at the time of the tender.
- .10 In case of conflict, the codes and regulations take precedence over the Contract Documents. In no instance reduce the standard or scope of work or intent established by the drawings and specifications by applying any of the codes referred to herein.

#### **1.18 QUALITY CONTROL**

- .1 Refer to Division 00 documents, and Division 01 specification sections
- .2 Provide a full time Superintendent to oversee and coordinate all sub-trades in these divisions.

#### **1.19 TEMPORARY UTILITIES**

- .1 Do not use any of the permanent facility systems during construction except as may be specified, or unless written approval is obtained from the Consultant.
- .2 The use of permanent facilities for temporary construction service will not affect in any way the commencement day of the warranty period.
- .3 Temporary heating during the construction period will be provided as described in Division 01.

#### **1.20 TEMPORARY FACILITIES AND CONTROLS**

- .1 Prior to start of each work period in occupied area, install temporary protection to prevent damage to any personal property or furnishing. Coordinate with Owner's representative if any furniture must be relocated to facilitate work.
- .2 Coordinate with General Contractor, requirements for temporary services including but not limited to temporary electrical power, lighting and exit pathways. Locations of exit pathways to be as decided at discretion of General Contractor, and to be illuminated complete with emergency lighting, and provided with exit signage and fire alarm devices in accordance with requirements of local governing building code and local governing inspection authorities.
- .3 Take necessary steps to ensure that required firefighting apparatus is accessible at all times. Flammable materials shall be kept in suitable places outside the building.
- .4 Maintain fire protection of areas which may include fire watch during temporary shutdowns of existing systems, in accordance with requirements of local governing code and local governing authorities.
- .5 Submit temporary protection plan to Owner's Representative for approval prior to use.

## 1.21 PRODUCT REQUIREMENTS

- .1 The design, manufacture and testing of electrical equipment and materials shall conform to or exceed the latest applicable CSA, IEEE, and ANSI standards.
- .2 All materials must be new and be ULC or CSA listed. Any materials not covered by the aforementioned listing standards shall be tested and approved by an independent testing laboratory, Technical Inspection Services, or other government agency.
- .3 Materials and equipment are specifically described and named in this Specification in order to establish a standard of material and workmanship.
- .4 Materials required for performance of work shall be new and the best of their respective kinds and of uniform pattern throughout work.
- .5 Materials shall be of Canadian manufacture where obtainable. Materials of foreign manufacture, unless specified, shall be approved before being used.
- .6 Equipment items shall be standard products of approved manufacture. Identical units of equipment shall be of same manufacture. In any unit of equipment, identical component parts shall be of same manufacture, but the various component parts comprising the unit need not be of one manufacture.
- .7 Chemical and physical properties of materials and design performance characteristics and methods of construction and installation of items of equipment, specified herein, shall be in accordance with latest issue of applicable Standards or Authorities when such are either mentioned herein, or have jurisdiction over such materials or items of equipment.
- .8 Materials shall bear approval labels as required by Code and/or Inspection Authorities.
- .9 Install materials in strict accordance with manufacturer's recommendations.
- .10 Include items of material and equipment not specifically noted on Drawings or mentioned in Specification but which are necessary to make a complete and operating installation.
- .11 Remove materials, condemned as not approved for use, from job site and deliver and install suitable approved materials in their place.
- .12 Unless otherwise noted, equipment and material specifications in Sections of the Specification governed by this Section are based on products of a manufacturer selected by the Consultant for the purpose of setting a standard of quality, size, performance, capacity, appearance and serviceability.
- .13 In most instances the names of acceptable manufacturers are also stated for materials and equipment, and you may base your tender price on equipment and materials produced by either the specified manufacturer or a manufacturer listed as acceptable.
- .14 For any items of equipment, material, or for any system where acceptable manufacturers are not stated, you must provide only the equipment, material or system specified.
- .15 If materials or equipment manufactured and/or supplied by a manufacturer named as acceptable are used in lieu of products of the manufacturer specified, be responsible for ensuring that the substituted material or equipment is equivalent in size, performance and operating characteristics to the specified materials or equipment, and it shall be understood that all costs for larger starters, additional space, larger power feeders, and changes to associated or adjacent work required as a result of providing materials and equipment named as acceptable in lieu of the specified product will be borne by Contractor.
- .16 In addition to the manufacturers specified or named as acceptable, the Contractor may propose alternative manufacturers of equipment and/or apparatus to the Consultant for acceptance, listing in each case a corresponding credit for each alternative proposed, however, the tender price must be based on apparatus or materials specified or named as acceptable. Certify in writing to the Consultant that the alternative meets all space, power, design, and all other required of the specified or equivalent material or apparatus. In addition, it shall be understood that all costs for larger starters, space, power feeders, and changes to associated equipment, mechanical and/or electrical, required by acceptance of proposed alternatives, will be borne by the party making the

proposal. Alternative equipment requiring greater than specified energy requirements or unduly limiting service space requirements will not be accepted.

- .17 Where a manufacturer is not listed for a particular product, it will be deemed to mean that the contractor will provide the specified manufacturer's product.
- .18 Whenever use of product other than based specified products or named as acceptable is being supplied, time for process of submission of other products and Consultant's review of products will not alter contract time or delay work schedule.
- .19 Requirements for low voltage systems of this project that are of technology that changes rapidly and are forever evolving and changing, resulting in systems that may be out dated by time of installation, are to include provisions to allow Owner option to select most updated technology. Shop drawings for such systems and equipment are to include provisions for a minimum 6-week review time for Owner to review degree of technology of each system and determine acceptance. Owner will have right to substitute a more advanced technology subject to negotiated pricing.

## **1.22 EXAMINATION AND PREPARATION**

- .1 Examine the existing equipment, the site and surrounding areas and be fully informed as to the conditions and limitations under which the work has to be executed. Claims for additional costs will not be entertained with respect to conditions which could reasonably have been ascertained by an inspection prior to Tender closing.
- .2 Examine work upon which your work depends. Report in writing defects in such work. Application of your work shall be deemed acceptance of work upon which your work depends.
- .3 Drawings are, in part, diagrammatic and are intended to convey scope of work and indicate general and approximate location, arrangement and sizes of equipment, piping, and similar items. Obtain more accurate information about locations, arrangement and sizes from study and coordination of drawings, including shop drawings and manufacturers' literature and become familiar with conditions and spaces affecting these matters before proceeding with work.
- .4 Owner and Consultant reserve right to relocate electrical components such as receptacles, switches, communication system, outlets, hard wired outlet boxes and luminaries at a later date, but prior to installation, without additional cost to Owner, if relocation per components do not exceed 3 m (10') from original location. No credits will be anticipated where relocation per components of up to and including 3 m (10') reduces materials, products and labour. Should relocations exceed 3 m (10') from original location, adjust contract price for that portion beyond 3 m (10') in accordance with provisions for changes in Contract Documents.

## **1.23 CUTTING AND PATCHING**

- .1 The Electrical Contractor will be responsible for all cutting and patching required for the electrical installation. Structural members are not to be cut without the consent of the Consultant.
- .2 All cutting and patching required under Division 26, Division 27, and Division 28 shall be in accordance with Division 01. Layout such work for approval before undertaking same.
- .3 Cutting shall be kept to an absolute minimum and performed in a neat and workmanlike manner using the proper tools and equipment. Caution shall be exercised in all cutting and procedures to ensure that concealed services are not affected. Do not cut if in doubt. Request Consultant's presence to determine if concealed services exist.
- .4 Assume responsibility for prompt installation of Work in advance of concrete pouring or similar Work. Should any cutting or repairing of finished/unfinished Work be required because such installation was not done, employ the particular trade, whose Work is involved, to do such cutting and patching. Pay for any resulting costs. Layout such Work for approval before undertaking same.

#### 1.24 CLEANING AND WASTE MANAGEMENT

- .1 The Contractor and associated sub trades, at all times during construction, to keep the site free of all debris, boxes, packing, etc., resulting from work of this trade. At the completion of this work, the electrical installation is to be left in a clean and finished condition to the satisfaction of the Consultant.
- .2 Clean and repair existing materials and equipment which remain or are to be reused.
- .3 Luminaires to be reinstalled: Remove existing luminaires for cleaning. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. Replace lamps, ballasts and broken electrical parts.
- .4 Assume responsibility for removing tools and waste materials on completion of Work, and leave Work in clean and perfect condition.
- .5 At time of final cleaning, clean luminaire reflectors, lenses, and other luminary surfaces that have been exposed to construction dust and dirt, including top surface, whether it is exposed or in ceiling space.
- .6 Clean switches, receptacles, communications outlets, coverplates, and exposed surfaces.
- .7 Clean other electrical equipment and devices installed as part of this project.

#### 1.25 STARTING AND ADJUSTING

- .1 Conduct acceptance tests to demonstrate that the equipment and systems actually meet the specified requirements. Tests may be conducted as soon as conditions permit, and consequently make all changes, adjustments, or replacements required as the preliminary tests may indicate prior to the final tests. Tests shall be as specified in various sections of this Division. Carry out tests in the presence of the Consultant. Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project. The Electrical Contractor shall be in charge of the plant during tests. He shall assume responsibility for damages in the event of injury to the personnel, building, equipment, and shall bear all costs for liability, repairs, and restoration in this connection. Submit test results.
- .2 Make tests of equipment and wiring at times requested.
- .3 Tests shall include meggered insulation values, voltage and current readings to determine balance of panels and feeders under full load, and operation of each piece of equipment for correct operation.
- .4 Supply meters, materials and personnel as required to carry out these tests.
- .5 Test electrical work to standards and function of Specification and applicable codes in an approved manner. Replace defective equipment and wiring with new material and leave entire system in complete first class operating condition.
- .6 Connect single phase loads so that there is the least possible unbalance of the supply phases.
- .7 Submit all test results in report format.
- .8 Trial Usage
  - .1 The Consultant reserves the right to use any system, piece of equipment, device, or material for such reasonable lengths of time and at such times as may be required to make a complete and thorough test of the same, or for the purpose of learning operational procedures, before the final completion and acceptance of the work. Such tests shall not be construed as evidence of acceptance of the work, and it is agreed and understood that no claim for damage will be made for injury or breakage to any part or parts of the above due to the aforementioned tests, where such injuries or breakage are caused by a weakness or inaccuracy of parts, or by defective materials or workmanship of any kind. Supply all labour and equipment required for such tests.

- .2 Perform and pay for all costs associated with any testing required on the system components where, in the opinion of the Consultant the equipment manufacturer's ratings or specified performance is not being achieved.

#### **1.26 CLOSEOUT PROCEDURES**

- .1 The Consultant will carry out inspections and prepare deficiency list for action by the Contractor, during and on completion of project.
- .2 Furnish a Certificate of Acceptance from Inspection Department on completion of work.

#### **1.27 CLOSEOUT SUBMITTALS**

- .1 Prior to application for Substantial Performance of the Work, submit required items and documentation specified, including following:
  - .1 Operating and Maintenance Manuals;
  - .2 as-built record drawings and associated data;
  - .3 extended warranties for equipment as specified;
  - .4 operating test certificates;
  - .5 final commissioning report;
  - .6 identified keys for equipment and/or panels for which keys are required, and other items required to be submitted;
  - .7 other data or products specified.
- .2 Project Record Documents
  - .1 Extra sets of white prints will be provided on which to make, as the job progresses, all approved changes and deviations from the original drawings. Complete Record Drawings accurately marked up in red ink must be submitted for approval before the contract is considered to be completed.
  - .2 Changes and deviations include those made by addenda, change orders, and supplemental instructions, and changes and deviations to be marked on the white print record drawings indicated on supplemental drawings issued with addenda, change orders, and supplemental instructions. Maintain the "as-built" white prints at the site for periodic inspection by the Consultant throughout the duration of the work.
  - .3 Upon substantial completion of the work, obtain a set of reproducible white prints of the drawings and neatly amend the print in accordance with the marked-up white prints to produce a true "as-built" set of drawings.
  - .4 As-built drawings are to indicate the following:
    - .1 all circuiting as installed and all distribution junction box locations as well as conduit routes.
    - .2 dimensioned location of inaccessible concealed work;
    - .3 location and identification of devices in concealed locations such as accessible ceiling spaces and raised floors;
    - .4 location of fire alarm devices and include addresses of devices; identify fire alarm zones;
    - .5 locations of control devices with identification for each;
    - .6 identify routing and location of concealed conduits/ducts of diameter 50 mm (2") and greater;
    - .7 for underground ducts, record dimensions, invert elevations, offsets, fittings, and locate dimensions from benchmarks to be preserved after construction is complete;
    - .8 location of concealed services terminated for future extension and work concealed within building in inaccessible locations.
    - .9 trace routing of existing panelboard feeders for all panelboards and indicate on as-built drawings.
  - .5 Supply electronic files of format confirmed with Owner for following:



- .1 fire alarm system test report devices and addresses;
- .2 network cabling system test report devices and labelling of each device and cable.
- .6 Unless otherwise noted in Divisions 00 or 01, failure to maintain accurate record drawings will incur additional 5% holdback on progress claims until drawings are brought up to date to satisfaction of Consultant.
- .7 As-Built AutoCAD Drawings
  - .1 Refer to Division 00 documents, and Division 01 specification sections.
  - .2 Transfer the information from the "as-built" white prints to the files, and submit to the Consultant for review.
  - .3 Employ a competent computer draftsman to indicate changes on the electronic set of record drawings. Provide drawings in Adobe Acrobat 6.0, and AutoCAD release 2010.
  - .4 Submit three (3) CD's of as-built drawings in AutoCAD format, one with each O&M manual.
  - .5 Provide three (3) sets of full size as-built drawings in hard copy format, one with each O&M manual.
- .8 As-built Single Line Diagram:
  - .1 Provide in Main Electrical Room one wall mounted copy of as-built Single Line Diagram on 1/4 inch foam board.
  - .2 As-built Single Line Diagram to indicate manufacturer name and catalogue numbers of as-installed products.
- .3 Operations and Maintenance (O&M) Data
  - .1 Submit two complete sets of Operation and Maintenance instruction manuals in hard copy, and one in electronic format. Include in each copy of the manual:
    - .1 Verification certificates for installation of life safety systems by the manufacturer's representative.
    - .2 A copy of "reviewed" shop drawings.
    - .3 Complete explanation of operating principles and sequences.
    - .4 Recommended maintenance practices and precautions.
    - .5 Complete wiring and connection diagrams.
    - .6 Certificates of guarantees.
    - .7 Before applying for a Certificate of Substantial Performance of the Work, assemble one copy of O & M Manual and submit to Consultant for review prior to assembling remaining copies. Incorporate Consultant's comments into final submission.
    - .8 Provide 2 digital copies of contents of operating and maintenance manuals and load onto separate USB type flash drives and submit to Consultant. Prepare digital copies using version of Adobe Acrobat Portable Document Format or equal as confirmed with Consultant and enhanced with bookmarks and internal document links.
  - .2 Ensure that operating and maintenance instructions are specific and apply to the model and types of equipment provided.
  - .3 Include in each copy of operating and maintenance instruction manuals, copies of approvals and inspection certificates issued by regulatory authorities to certify that completed Work is in accordance with regulations of regulatory authorities and is acceptable to them.
- .4 Warranties

- .1 Submit a written guarantee to the Owner for one year from the date of acceptance. This guarantee shall bind the contractor to correct, replace or repair promptly any defective equipment workmanship without cost to the Owner.
- .2 All equipment, materials and workmanship shall be unconditionally guaranteed for a minimum period of one year from the date of acceptance.
- .3 Provide warranty certificates, wherever given or required, in excess of the normal warranty period showing the name of the firm giving the warranty, dated and acknowledged, on specific equipment and systems.
- .4 Where equipment includes extended warranty period, e.g., five (5) years, first year of warranty period is to be governed by terms and conditions of warranty in Contract Documents, and remaining years of warranty are to be direct from equipment manufacturer and/or supplier to Owner.
- .5 Warranty to include parts, labour, travel costs and living expenses incurred by manufacturer's authorized technician to provide factory authorized on-site service.
- .6 Repair and/or replace any defects that appear in Work within warranty period without additional expense to Owner. Be responsible for costs incurred in making defective work good, including repair or replacement of building finishes, other materials, and damage to other equipment. Ordinary wear and tear and damage caused wilfully or due to carelessness of Owner's staff or agents is exempted.
- .7 Include these certificates with the maintenance and operating manuals in the appropriate sections.

#### **1.28 DEMONSTRATION AND TRAINING**

- .1 In the presence of the Owner, demonstrate the proper operation of all systems.
- .2 Instruct the Owner's designated representatives in all aspects of the operation and maintenance of systems and equipment listed in the trade sections governed by this Section. Obtain in writing from the Consultant a list of the Owner's representatives qualified to receive instructions.
- .3 Arrange for and pay for the services of qualified service technicians and other manufacturer's representatives required for instruction of specialized portions of the installation.
- .4 Train Owner's designated personnel in aspects of operation and maintenance of equipment and systems as specified. Demonstrations and training are to be performed by qualified technicians employed by equipment/system manufacturer/supplier. Supply hard copies of training materials to each attendee.
- .5 Unless where specified otherwise in trade Sections, minimum requirements are for manufacturer/suppliers of each system and major equipment, to provide minimum two separate sessions each consisting of minimum 4 hours on site or in factory training (at Owner's choice), of Owner's designated personnel (for up to 6 people each session), on operation and maintenance procedures of system.
- .6 For each item of equipment and for each system for which training is specified, prepare training modules as specified below. Use Operating and Maintenance Manuals during training sessions. Training modules include but are not limited to:
  - .1 Operational Requirements and Criteria: equipment function, stopping and starting, safeties, operating standards, operating characteristics, performance curves, and limitations;
  - .2 Troubleshooting: diagnostic instructions, test and inspection procedures;
  - .3 Documentation: equipment/system warranties, and manufacturer's/supplier's parts and service facilities, telephone numbers, email addresses, and the like;
  - .4 Maintenance: inspection instructions, types of cleaning agents to be used as well as cleaning methods, preventive maintenance procedures, and use of any special tools;



- .5 Repairs: diagnostic instructions, disassembly, component removal and repair instructions, instructions for identifying parts and components, and review of any spare parts inventory.
- .7 Training Sessions:
  - .1 Before instructing Owner's designated personnel, submit to Consultant for review a preliminary copy of training manual and a proposed schedule of demonstration and training dates and times. Incorporate Consultant's comments in final copy.
  - .2 Obtain in writing from Consultant a list of Owner's representatives to receive instructions. Submit to Consultant prior to application for a Certificate of Substantial Performance of the Work, a complete list of systems for which instructions were given, stating for each system:
    - .1 date instructions were given to Owner's staff;
    - .2 duration of instruction;
    - .3 names of persons instructed;
    - .4 other parties present (manufacturer's representative, consultants, etc.).
  - .3 Obtain signatures of Owner's staff to verify they properly understood system installation, operation and maintenance requirements, and have received operating and maintenance instruction manuals and "as-built" record drawings.
- .8 Submit to Consultant copy of electronic version of training materials. Include in operating and maintenance manuals submission.

## **1.29 FINAL INSPECTION**

- .1 Submit to Consultant, written request for final inspection of systems. Include written certification that:
  - .1 deficiencies noted during job inspections have been completed;
  - .2 field quality control procedures have been completed;
  - .3 maintenance and operating data have been completed and submitted to, reviewed and accepted by Consultant;
  - .4 nameplates are in place and equipment identifications have been completed;
  - .5 clean-up is complete;
  - .6 spare parts and replacement parts specified have been provided and acknowledged by Consultant;
  - .7 as-built and record drawings have been completed and submitted to, reviewed and accepted by Consultant;
  - .8 Owner's staff has been instructed in operation and maintenance of systems;
  - .9 fire alarm verification has been 100% completed and Verification Certificate has been submitted to and accepted by Consultant;
  - .10 commissioning procedures have been completed and perform corrective work identified by Commissioning Agent.

## **PART 2 - PRODUCTS – NOT USED**

## **PART 3 - EXECUTION**

### **3.1 DEMOLITION**

- .1 Refer to Division 02 and Section 26 05 05.
- .2 Remove all electrical equipment and devices on redundant structures. Make safe all circuits, and provide continuity of remaining circuits.

- .3 To make safe: Withdraw redundant wiring and remove unwanted conduit/wiring and accessories. Position breakers to OFF position and update panel schedules.
- .4 Make safe any redundant mechanical devices as shown on mechanical drawings.
- .5 Maintain continuity of existing services for other circuits/devices serving areas outside the Work area. Provide additional wiring/conduits/boxes etc. to suit existing services to be maintained and also implement new Work as detailed.
- .6 Allow for this work in Tender Price.
- .7 Turn over designated equipment to the Owner. Dispose of unwanted materials and equipment.

### 3.2 FIRESTOPPING

- .1 Provide firestopping in accordance with Section 07 85 00.
- .2 Ensure that fire ratings of floors and walls are maintained.
- .3 Provide ULC classified firestopping products by 3M or Hilti which have been tested in accordance with CAN4-S115.
- .4 Pack clearance spaces, fill all spaces between openings, pipes and ducts passing through fire separations and install firestopping systems in accordance with the appropriate ULC system number for the products and type of penetration.
- .5 Install firestopping systems using personnel trained or instructed by the product manufacturer.

### 3.3 ACCESS DOORS

- .1 Provide access doors in accordance with Section 10 08 00.
- .2 Group conduit work to ensure the minimum number of access doors is required.
- .3 Access doors are to be installed by the trade responsible for the particular type of construction in which the doors are required.

### 3.4 PAINTING AND FINISHES

- .1 Refer to Section 09 91 00.
- .2 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.
- .3 Repair and finish factory finished equipment, damaged or scratched during installation, in an approved manner.
- .4 All structural steel including hangers, brackets, supports and other ferrous metals shall be shop or factory prime painted wherever practicable. Wherever structural steel including hangers, brackets, supports, and other ferrous metals cannot be shop or factory prime painted, wire brush to remove all traces of rust, clean of all traces of dirt, oil, and grease, and apply one coat of an approved rust inhibiting primer in accordance with CGSB-GB-40d, and leave ready to receive finish paint.
- .5 Primary and final painting for Work, other than items specified as factory primed or finished, will be performed as described in Division 09 – Finishes.
- .6 All electrical fittings, supports, hanger rods, pull boxes, channel frames, conduit racks, outlet boxes, brackets, clamps etc., to have galvanized finish or paint finish over corrosion-resistant primer.
- .7 All panelboards, motor starters etc., to be factory finished with baked on enamel. All enamel to be baked on gloss over corrosion resistant primer.
- .8 Touch up minor damage to finish on factory finished equipment. Items suffering major damage to finish shall be replaced at the direction of the Consultant.

- .9 Protect work so that finishes will not be damaged or marred during construction. Maintain the necessary protection until completion of the work.
- .10 Provide all exposed ferrous metal work on equipment with at least one factory prime coat, or paint one prime coat on job. Clean up or wire brush all equipment, etc., before painting.
- .11 For factory applied finishes, repaint or refinish surfaces damaged during shipment, erection or construction work.

### **3.5 LOCATION OF OUTLETS**

- .1 Refer to Architectural drawings for dimensions denoting exact locations.
- .2 The Consultant reserves the right to change the location of outlets to within 3 m from the point indicated on the plans without extra charge providing the Contractor is advised before installation is made.
- .3 Location of lighting, convenience, telephone, power and communication outlets shall be subject to change, without extra cost to Owners, provided information is given prior to installation. No extra amount will be paid for extra labour and materials for relocating outlets up to 3000 mm from their original location nor will credits be anticipated where relocation up to 3000 mm reduces materials and labour. Other cases will be considered on their individual merits.
- .4 Coordinate location of boxes with latest architectural drawings and instructions to suit door swings, millwork etc. prior to rough-in.

### **3.6 MOUNTING HEIGHTS AND DEVICE LOCATIONS**

- .1 Refer to architectural drawings for exact location of electrical equipment and devices.
- .2 Architectural elevations take precedence over electrical elevations. If there are conflicts between architectural and electrical, adjust locations of electrical equipment at no additional cost to the owner.
- .3 Prior to roughing-in, the contractor is to mark locations of electrical equipment and devices for conflicts with architectural, studs, etc. If conflicts are noted, inform the consultant for a decision prior to commencing the rough-in.
- .4 Mounting heights of equipment and devices listed below is from finished floor to centreline of equipment, unless specified or indicated otherwise.
- .5 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

### **3.7 PROVISIONS FOR LEAD SHIELDING**

- .1 As part of scope of General Trades work, walls to be provided with lead shielding. Coordinate exact scope of work with General Trades Contractor and Consultant and be responsible for following:
  - .1 disconnection of electrical and communications system devices to accommodate lead shielding installation work;
  - .2 maintain integrity of lead shielding; do not penetrate lead shielding unless method of procedure is approved in writing by Owner and reviewed with Consultant;
  - .3 relocation/extension of back boxes and outlet boxes to accommodate work;
  - .4 provision of pull/junction boxes located in accessible ceiling space for existing conductors which are of insufficient length to suit device relocations; do not splice telecommunications cabling (structured data/voice cabling) if run is not sufficient length; replace with home run data/voice cabling; splicing of power conductors must be made by means recommended by cable manufacturers and reviewed with Consultant and approved by Owner; clearly identify each box to its purpose;

- .5 existing wall mounted raceway to be relocated out from wall to accommodate installation of lead shielding; if necessary, provide additional raceways to match existing raceway;
- .6 where existing devices are disconnected and that such devices are part of a telecommunication system or other such building system, engage respective system vendor's authorized technician to provide required system programming, control work, testing and verification to ensure devices are left in proper operating order.

### **3.8 TESTS AND ACCEPTANCE**

- .1 The operation of the equipment and electrical system does not constitute an acceptance of the work by the Owner. The final acceptance is to be made after the Contractor has adjusted his equipment and demonstrated that it fulfills the requirements of the drawings and the specifications.
- .2 Testing of all systems shall be performed in the presence of the Owner's designated representative. The contractor shall give 10 days advance notice to the Owner before beginning the tests.
- .3 Upon completion of the installation, the Contractor shall furnish certificates of approval from all authorities having jurisdiction, as applicable. Contractor shall demonstrate that work is complete and in perfect operating condition, with raceway and conduit systems properly grounded, wiring free from grounds, shorts, and that the entire installation is free for any physical defects.

**END OF SECTION**

## **PART 1 - GENERAL**

### **1.1 SECTION INCLUDES**

- .1 Work in existing facilities.
- .2 Electrical demolition.

### **1.2 RELATED REQUIREMENTS**

- .1 Section 02 – Demolition.

### **1.3 SCHEDULING**

- .1 Refer to Section 01.
- .2 All work in the existing building, other than minor works required to permit construction of the new Work, is to be performed in such a manner as to not disrupt the building operations.
- .3 All systems are to be kept in full operation during normal building hours.
- .4 Coordinate any noise generating works that disrupt the building operation to be carried out after/before normal operating hours.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- .1 Materials and equipment for patching and extending work: As specified in individual sections.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- .1 Verification of Conditions
  - .1 Verify field measurements and circuiting arrangements are as shown on Drawings.
  - .2 Verify that abandoned wiring and equipment serve only abandoned facilities.
  - .3 Demolition drawings are based on casual field observation. Report discrepancies to the Consultant before disturbing existing installation.
  - .4 Beginning of demolition means installer accepts existing conditions.
- .2 Tracing Existing Electrical Circuits
  - .1 Trace all circuits in the area of work listed as existing, and verify existing conditions prior to any modifications as indicated.
  - .2 Where drawings indicate "connect to existing circuit", use a spare breaker, where available. Otherwise, verify existing load with a meter and advise the Consultant if the additional load will cause a circuit to trip.
  - .3 Where provided panelboard schedules indicate "Existing Circuit" or similar, provide the correct description for the circuit. Existing Circuit will not be acceptable in the final panelboard schedules submitted as part of closeout submittals.

### **3.2 PREPARATION**

- .1 Coordinate utility service outages with utility company.

- .2 Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.
- .3 Existing electrical service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switch overs and connections. Obtain permission from Owner at least 24 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.
- .4 Existing Telephone System: Maintain existing system in service. Notify Owner at least 24 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.
- .5 Existing Fire Alarm System: Maintain existing system in service. Minimize outage duration. Provide fire watch as required. Make temporary connections to maintain service in areas adjacent to work area.

### **3.3 DEMOLITION / REMOVAL**

- .1 Disconnect electrical systems in walls, floors, and ceilings scheduled for removal.
- .2 Demolish and extend existing electrical work to Section 02 40 00, and this Section.
- .3 Remove, relocate, and extend existing installations to accommodate new construction.
- .4 Remove abandoned wiring to source of supply.
- .5 When relocating or removing equipment, should any circuits be abandoned, the conductors to these circuits must be removed or properly terminated as detailed in Ontario Electrical Safety Code (OESC) bulletin 12-25-1, or latest revision.
- .6 Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.
- .7 Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets which are not removed.
- .8 Disconnect and remove abandoned panelboards and distribution equipment.
- .9 Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.
- .10 Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.
- .11 Repair adjacent construction and finishes damaged during demolition and extension work.
- .12 Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.
- .13 Maintain continuity of existing services for other circuits/devices serving areas outside the Work area. Provide additional wiring/conduits/boxes etc. to suit existing services to be maintained and also implement new Work as detailed.

### **3.4 RESTORATION**

- .1 Install relocated materials and equipment under the provisions of Division 01.

### **3.5 CLEANING**

- .1 Clean and repair existing materials and equipment which remain or are to be reused.

- .2 Luminaires: Remove existing luminaires for cleaning. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. Replace lamps, ballasts, and broken electrical parts.
- .3 Waste Management
  - .1 Turn over designated equipment to the Owner.
  - .2 Dispose of unwanted materials and equipment.

### **3.6 PROTECTION**

- .1 Maintain access to existing electrical installations which remain active. Modify installation or provide access panels as appropriate.

**END OF SECTION**

## **PART 1 - GENERAL**

### **1.1 SECTION INCLUDES**

- .1 Building wire and cable.
  - .1 Armoured cable.
  - .2 Metal clad cable.
  - .3 Wiring connectors and connections.
- .2 Permitted voltage drop for feeder and branch circuits.

### **1.2 REFERENCES**

- .1 CSA C22.1 - Canadian Electrical Code, Part I, Safety Standard for Electrical Installations
- .2 Ontario Electrical Safety Code
- .3 CSA C22.2 No. 0.3 - Test Methods for Electrical Wires and Cables.
- .4 CSA C22.2 No. 48-M90 (R2000) - Non-metallic Sheathed Cable.
- .5 CSA C22.2 No. 51 Armoured Cables.
- .6 CSA C22.2 No. 52-96 (R2000) - Underground Service-Entrance Cables.
- .7 CAN/CSA C22.2 No. 65-03 (CSA/UL/ANCE) – Wire Connectors.
- .8 CSA C22.2 No. 75-03 (CSA/UL/ANCE) - Thermoplastic-Insulated Wires and Cables.
- .9 CSA C22.2 No. 123 Aluminum Sheathed Cables.
- .10 CSA C22.2 No. 131 Type TECK 90 Cable.
- .11 NECA (National Electrical Contractors Association) - Standard of Installation.
- .12 NETA (International Electrical Testing Association) - ATS-2003 - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
- .13 CAN/ULC-S139-12 – Standard Method of Fire Test for Evaluation of Integrity of Electrical Power, Data and Optical Fibre Cables.

### **1.3 SUBMITTALS**

- .1 Submit shop drawings for products of this Section as requested by Consultant.
- .2 Additionally as part of shop drawing submission process, submit following to Consultant for review:
  - .1 samples of each typical wiring device, faceplates, finishes and colours; mount to sample board, clearly labelling devices and finishes; submit for review by Owner and Consultant; do not order any device unless finishes have been reviewed with Consultant;
  - .2 sample of each proposed type of access door, as well as three prints of reflected ceiling plan drawings showing proposed ceiling access door locations;
  - .3 dimensioned location drawings indicating required sleeves and formed openings in structural poured concrete or precast concrete construction or in roofing, and locations of cutting or drilling required for Electrical Divisions work;
  - .4 samples of materials and any other items as specified in succeeding Sections of Electrical Divisions;
  - .5 weight loads of selected equipment (upon request);
  - .6 equipment nameplate and warning sign proposed nomenclature, print type, symbols, sizing and colours;
  - .7 fire stopping installation drawings with ULC certifications;



- .8 copies of prior to start of construction approvals from local governing authorities having jurisdiction.

#### **1.4 PATIENT CARE AREAS**

- .1 Comply with requirements for patient care areas (PCA) included in Work as required by Section 24 of OESC. Patient care areas are identified on drawings. Review final PCA nomenclature with Consultant prior to start of Work.
- .2 Note that room and area names/numbers are based on information available at time of preparation of documents and such names/numbers may be revised in later documents or during construction of Work. In no way are patient care area classifications to be reduced due to name/number revisions. Be responsible for confirming exact classifications as per local governing electrical code requirements to suit final construction and any design changes made by Consultant.
- .3 Provide testing and verification of circuits and devices to confirm compliance with OESC.

#### **1.5 COORDINATION**

- .1 Where wire and cable destination is indicated and routing is not shown, determine exact routing and lengths required.

#### **1.6 QUALIFICATIONS**

- .1 Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' experience.

#### **1.7 REGULATORY REQUIREMENTS**

- .1 Conform to CSA C22.1.
- .2 Provide products listed and classified by CSA (Canadian Standards Association) as suitable for the purpose specified and indicated.

#### **1.8 SITE CONDITIONS**

- .1 Verify that field measurements are as indicated.
- .2 Conductor sizes are based on copper unless indicated as aluminum or "AL".
- .3 Wire and cable routing indicated is approximate unless dimensioned.

### **PART 2 - PRODUCTS**

#### **2.1 MANUFACTURERS**

- .1 BICC Phillips.
- .2 General Cable.
- .3 Nexans.
- .4 Prysmian.
- .5 Southwire.

#### **2.2 BUILDING WIRE**

- .1 RW90:
  - .1 Single copper conductor.

- .2 Minimum #12 AWG for branch circuit wiring.
- .3 Minimum #14 AWG for 120V control wiring.
- .4 Chemically cross-linked polyethylene insulation.
- .5 Rated for 90 degrees C, 600V
- .6 Suitable for handling to minus 40 degrees C.
- .7 For interior installations in conduit.
- .2 RWU90:
  - .1 Single copper conductor.
  - .2 Minimum 12 AWG for branch circuit wiring.
  - .3 Minimum 14 AWG for 120 V control wiring.
  - .4 Chemically cross-linked polyethylene insulation.
  - .5 Rated for 90 degrees C, 600 V
  - .6 Suitable for handling to minus 40 degrees C.
  - .7 For exterior installations in conduit.
- .3 T90 Nylon:
  - .1 Single copper conductor.
  - .2 Thin wall PVC insulation with nylon covering.
  - .3 Rated for 90 degrees C, 600V.
  - .4 May be used up to size 10 AWG for interior installations.
  - .5 Base conduit fill on RW90 cable diameters.
- .4 AC90 flexible armored:
  - .1 Two, three or four copper conductors rated RW90, 1000 V.
  - .2 Bare copper ground wire.
  - .3 Insulation Voltage Rating: 600 volts.
  - .4 Insulation Temperature Rating: 90 degrees C (194 degrees F).
  - .5 Insulation Material: Thermoplastic.
  - .6 Overall interlocked aluminum tape armour.
  - .7 Runs to be limited to fixture drops and in walls, maximum exposed run 1.5 m.
  - .8 Do not daisy chain (leap frog) luminaires with armoured cable.
- .5 For all building wire types solid conductors to and including No. 10 AWG; stranded conductors in sizes larger than No. 10 AWG; branch circuit conductors constructed of 98% conductive copper; and approved for minimum 600 volts.

## 2.3 CONTROL AND COMMUNICATIONS CABLES

- .1 ULC listed and labelled, CSA certified to C22.2 No. 127, No. 18 AWG "TEW" thermoplastic insulated, solid copper wire rated for 600 volts service, and 105°C (220°F) conductor temperature, complete with required number of copper conductors and colour coding.
- .2 Nexans, "Securex II", FAS 105, 300 volts, 105°C (220°F) conductor temperature rated fire alarm system flexible armoured cable with solid copper conductor, shielding, flame retardant PVC insulation and red colour outer overall jacket, ULC listed and labelled and CSA certified to C22.2 No. 208.

## 2.4 CONDUCTOR PULLING LUBRICANT

- .1 IDI Electric (Canada) Ltd., "Ideal Yellow 77" or "Wire Lube" as required.

## 2.5 CONNECTORS

- .1 Armoured cable connectors must be proper squeeze type connectors and plastic anti-short bushings at terminations.
- .2 Connectors for conductors connecting to devices as per local governing electrical requirements to be equal to IDI Electric (Canada) Ltd., "Ideal" No. 451, No. 452 and No. 453, "Wing-Nut", CSA certified, 600 volts, rated pressure type connectors.
- .3 For conductors sized 3/0 and greater, provide long barrel double crimp, two (2) hole compression type lug connectors, unless otherwise noted.

## 2.6 WIRING TERMINATION

- .1 Lugs, terminals, or screws used for termination of wiring to be suitable for copper conductors. Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring. Maintain phase sequence and colour coding throughout.
- .2 Splice wire, up to and including No. 6 gauge, with nylon insulated expandable spring type connectors.
  - .1 Thomas & Betts – Marr Max Series
- .3 Splice large conductors using compression type connections insulated with heat shrink sleeves.
  - .1 Thomas & Betts – 5400 Series lugs & heat shrink type #s series

## 2.7 CONDUCTORS, WIRES, AND CABLES

- .1 Indoor wiring installed in conduit, unless otherwise noted: 600 volt "RW90 XLPE".
- .2 Wiring in channel back of fluorescent lighting fixtures: 600 volt type GTF or TEW.
- .3 Lighting and power branch circuit wiring:
  - .1 Copper, minimum No. 12 gauge.
  - .2 Home runs to lighting and receptacle panels, which exceed 22 m (75 feet) in length: minimum No. 10 gauge.
- .4 Size wires for 2 per cent maximum voltage drop to farthest outlet on a maximum 80 per cent loaded circuit.
- .5 Outdoor wiring: "RWU90 XLPE".
- .6 Conductors shall be colour coded. Conductors No. 10 gauge and smaller shall have colour impregnated into insulation at time of manufacture. Conductors size No. 8 gauge and larger may be colour coded with adhesive colour coding tape but only black insulated conductors shall be employed in this case, except for neutrals which shall be white wherever possible.
- .7 Colour coding as follows:
  - .1 Phase "A" - Red
  - .2 Phase "B" - Black
  - .3 Phase "C" - Blue
  - .4 Control - Orange
  - .5 Ground - Green
  - .6 Neutral - White

- .8 Neatly train circuit wiring in cabinets, panels, pull boxes and junction boxes and hold with nylon cable ties.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- .1 Voltage Drop
  - .1 Ensure voltage drop in power and control conductors is in accordance with the requirements of the Electrical Code.
  - .2 Size conductors accordingly when sizes are not identified.
    - .1 Feeder conductors: maximum voltage drop of 2 per cent.
    - .2 Branch circuit conductors: maximum voltage drop of 3 per cent.
- .2 Verify that mechanical work likely to damage wire and cable has been completed.
- .3 Verify that raceway installation is complete and supported.

### **3.2 PREPARATION**

- .1 Completely and thoroughly swab raceway before installing wire.

### **3.3 INSTALLATION**

- .1 Route wire and cable as required to meet project conditions.
- .2 Install cable to CSA C22.1.
- .3 Conduit and cable supports
  - .1 All wiring to be installed in EMT at all exposed areas and in partitions unless otherwise specified.
  - .2 All mechanical equipment to be connected with liquid tight flexible conduit.
  - .3 Support cables above accessible ceiling, using spring metal clips to support cables from structure. Do not rest cable on ceiling panels.
- .4 Conductors
  - .1 Provide separate neutral for each circuit. Common neutrals not permitted.
  - .2 Use solid conductor for feeders and branch circuits 10 AWG and smaller.
  - .3 Use stranded conductors for control circuits.
  - .4 Use conductor not smaller than 12 AWG for power and lighting circuits.
  - .5 Use conductor not smaller than 16 AWG for control circuits.
  - .6 Armoured cable (commonly referred to as BX) is only to be used for light fixture connections and limited to maximum 1830 mm in length.
  - .7 Use 10 AWG conductors for 20 ampere, 120 volt branch circuits longer than 25 m.
- .5 Pulling conductors
  - .1 Pull all conductors into raceway at same time.
  - .2 Use suitable wire pulling lubricant for building wire 4 AWG and larger.
  - .3 Neatly train and lace wiring inside boxes, equipment, and panelboards.
  - .4 Protect exposed cable from damage.

.6 Connectors

- .1 Use suitable cable fittings and connectors.
- .2 Clean conductor surfaces before installing lugs and connectors.
- .3 Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
- .4 Use split bolt connectors for copper conductor splices and taps 6 AWG and larger. Tape uninsulated conductors and connector with electrical tape to 150 per cent of insulation rating of conductor.
- .5 Use solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.
- .6 Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.

**3.4 IDENTIFICATION**

- .1 Identify and colour code wire and cable to Section 26 05 53. Identify each conductor with its circuit number or other designation indicated.
- .2 Where colour-coded tape is utilized, apply a minimum of 50 mm (2 inches) at terminations, junction and pull boxes and conduit fittings. Do not paint conductors under any condition.
- .3 Utilize colour coding on bussing in panels and, switchgear, disconnects, and metering cabinets to match conductor colour coding.

**END OF SECTION**

## PART 1 - GENERAL

### 1.1 SECTION INCLUDES

- .1 Grounding electrodes and conductors.
- .2 Equipment grounding conductors.
- .3 Bonding.
- .4 The terms "connect" and "bond" are used interchangeably in this Specification and have the same meaning.

### 1.2 RELATED REQUIREMENTS

- .1 [Section 09 65 36.13 – Static-Dissipative Resilient Flooring: Grounding of static dissipative tile (SDT).]
- .2 [Section 09 69 00 – Access Flooring: Grounding of raised floor pedestals.]
- .3 Section 27 05 26 – Grounding and Bonding for Communications Systems.

### 1.3 REFERENCES

- .1 CSA Group:
  - .1 CSA C22.1:21, Canadian Electrical Code, Part 1 (25th Edition), Safety Standard for Electrical Installations.
  - .2 Ontario Electrical Safety Code (28th edition/2021).
  - .3 CSA C22.2 No.0.4-17, Bonding of electrical equipment.
  - .4 CSA C22.2 No. 41-13, Grounding and bonding equipment.
  - .5 CSA C22.2 No. 75-17, Thermoplastic insulated wires and cables.
- .2 ANSI/TIA/EIA J-STD-607-A - Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.
- .3 Institute of Electrical and Electronics Engineers, Inc.
  - .1 IEEE 81-1983 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System.

### 1.4 ACTION SUBMITTALS

- .1 Product Data: Provide for grounding electrodes and connections.

### 1.5 INFORMATIONAL SUBMITTALS

- .1 Test Reports: Indicate overall resistance to ground and resistance of each electrode.
- .2 Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

### 1.6 CLOSEOUT SUBMITTALS

- .1 Project Record Documents: Record actual locations of components and grounding electrodes.
- .2 Certificate of Compliance: Indicate approval of installation by authority having jurisdiction.

## **1.7 QUALIFICATIONS**

- .1 Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years' experience.

## **1.8 REGULATORY REQUIREMENTS**

- .1 Products: Listed and classified testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

# **PART 2 - PRODUCTS**

## **2.1 MANUFACTURERS**

- .1 B-Line by Eaton.
- .2 Hubbell (Burdny).
- .3 Panduit.
- .4 Thomas & Betts.

## **2.2 PERFORMANCE CRITERIA**

- .1 Grounding System Resistance: 5 ohms.
- .2 Provide all equipment grounding as required regardless of whether it has been shown on drawings or called for in this specification. Arrange grounds so that under normal operating conditions no injurious amount of current will flow in any grounding conductor.

## **2.3 GROUNDING AND BONDING CONDUCTORS**

- .1 Electrical grounding conductors shall be CSA C22.2 No. 75 insulated stranded copper, except that sizes #10 AWG and smaller shall be solid copper. Insulation colour shall be continuous green for all equipment grounding conductors.
- .2 Bonding conductors shall be ASTM B8 bare stranded copper, except that sizes #10 AWG and smaller shall be ASTM B1 solid bare copper wire.

## **2.4 ROD ELECTRODES**

- .1 Material: Copper-clad steel.
- .2 Diameter: 19 mm.
- .3 Length: 3000 mm.

## **2.5 GROUND RODS**

- .1 Copper clad steel, 19 mm (3/4 inch) diameter by 3000 mm (10 feet) long, conforming to CSA C22.2 No. 41.
- .2 Quantity of rods shall be as required to obtain the specified ground resistance.

## **2.6 SPLICES AND TERMINATION COMPONENTS**

- .1 Components shall meet or exceed CSA C22.2 No. 41, and be clearly marked with the manufacturer, catalog number, and permitted conductor size(s).

## **2.7 GROUND CONNECTIONS**

- .1 Below Grade: Exothermic-welded type connectors.
- .2 Above Grade:
  - .1 Bonding Jumpers: compression type connectors, using zinc-plated fasteners and external tooth lockwashers.
  - .2 Ground Busbars: Two-hole compression type lugs using tin-plated copper or copper alloy bolts and nuts.

## **2.8 GROUND TERMINAL BLOCKS**

- .1 At any equipment mounting location (e.g. backboards and hinged cover enclosures) where rack-type ground bars cannot be mounted, provide screw lug-type terminal blocks.

## **2.9 SPLICE CASE GROUND ACCESSORIES**

- .1 Splice case grounding and bonding accessories shall be supplied by the splice case manufacturer when available. Otherwise, use 6 AWG insulated ground wire with shield bonding connectors.

## **2.10 MECHANICAL CONNECTORS**

- .1 Material: Bronze.

## **2.11 WIRE**

- .1 Material: Stranded copper.
- .2 Foundation Electrodes: 2/0 AWG.
- .3 Grounding Electrode Conductor: Size to meet Ontario Electrical Safety Code requirements.

## **2.12 GROUNDING WELL COMPONENTS**

- .1 Well Pipe: 200 mm by 600 mm long concrete pipe with belled end.
- .2 Well Cover: Cast iron with legend "GROUND" embossed on cover.

# **PART 3 - EXECUTION**

## **3.1 EXAMINATION**

- .1 Verify that final backfill and compaction has been completed before driving rod electrodes.

## **3.2 INSTALLATION**

- .1 General
  - .1 Ground in accordance with the Ontario Electrical Safety Code, as shown on drawings, and as hereinafter specified.
  - .2 System Grounding:
    - .1 Secondary service neutrals: Ground at the supply side of the secondary disconnecting means and at the related transformers.
    - .2 Separately derived systems (transformers downstream from the service entrance): Ground the secondary neutral.



- .3 Equipment Grounding: Metallic structures (including ductwork and building steel), enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames, and other conductive items in close proximity with electrical circuits shall be bonded and grounded.
- .4 Ground electrical equipment and wiring in accordance with Ontario Electrical Safety Code and Local Inspection Authority's Rules and Regulations.
- .5 Install grounding conductors, outside Electric Rooms and Electrical Closets in conduit and conceal where possible. Make connections to water mains, all metallic piping systems, neutral and equipment with brass, copper or bronze bolts and connectors or weld using Cadweld or Thermoweld processes.
- .6 Provide grounding conductors, sized as per Code, and connect to grounding bus or water main wherever non-raceways are installed.
- .2 Provide grounding electrode conductor and connect to reinforcing steel in foundation footing. Bond steel together.
- .3 Provide bonding to meet Regulatory Requirements.
- .4 Bond together metal siding not attached to grounded structure; bond to ground.
- .5 Install ground grid under access floors indicated.
- .6 Bond together each metallic raceway, pipe, duct and other metal object entering space under access floors. Bond to underfloor ground grid. Use #6 AWG bare copper conductor.
- .7 Equipment Grounding Conductor: Provide separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.
- .8 Ground Resistance
  - .1 Grounding system resistance to ground not to exceed 5 ohms. Make necessary modifications or additions to the grounding electrode system for compliance without additional cost to the Owner. Final tests shall assure that this requirement is met.
  - .2 Resistance of the grounding electrode system shall be measured using a four-terminal fall-of-potential method as defined in IEEE 81. Ground resistance measurements shall be made before the electrical distribution system is energized and shall be made in normally dry conditions not less than 48 hours after the last rainfall. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together below grade. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.
  - .3 Services at power company interface points shall comply with the power company ground resistance requirements.
- .9 Ground Rod Installation
  - .1 Drive each rod vertically in the earth, not less than 3000 mm (10 feet) in depth.
  - .2 Where permanently concealed ground connections are required, make the connections by the exothermic process to form solid metal joints. Make accessible ground connections with mechanical pressure type ground connectors.
  - .3 Where rock prevents the driving of vertical ground rods, install angled ground rods or grounding electrodes in horizontal trenches to achieve the specified resistance.
- .10 Inaccessible Grounding Connections
  - .1 Make grounding connections, which are buried or otherwise normally inaccessible (except connections for which periodic testing access is required) by exothermic weld.
- .11 Secondary Equipment and Circuits
  - .1 Main Bonding Jumper: Bond the secondary service neutral to the ground bus in the service equipment.

- .2 Metallic Piping, Building Steel, and Supplemental Electrode(s):
  - .1 Provide a grounding electrode conductor sized per code between the service equipment ground bus and all metallic water and gas pipe systems, building steel, and supplemental or made electrodes. Jumper insulating joints in the metallic piping. All connections to electrodes shall be made with fittings that conform to CSA C22.2 No 41.
  - .2 Provide a supplemental ground electrode and bond to the grounding electrode system.
- .3 Conduit Systems:
  - .1 Ground all metallic conduit systems. All metallic conduit systems shall contain an equipment grounding conductor.
  - .2 Non-metallic conduit systems shall contain an equipment grounding conductor, except that non-metallic feeder conduits which carry a grounded conductor from exterior transformers to interior or building-mounted service entrance equipment need not contain an equipment grounding conductor.
  - .3 Conduit containing only a grounding conductor, and which is provided for mechanical protection of the conductor, shall be bonded to that conductor at the entrance and exit from the conduit.
- .4 Feeders and Branch Circuits: Install equipment grounding conductors with all feeders and power and lighting branch circuits.
- .5 Boxes, Cabinets, Enclosures, and Panelboards:
  - .1 Bond the equipment grounding conductor to each pull box, junction box, outlet box, device box, cabinets, and other enclosures through which the conductor passes (except for special grounding systems for intensive care units and other critical units shown).
  - .2 Provide lugs in each box and enclosure for equipment grounding conductor termination.
  - .3 Provide ground bars in panelboards, bolted to the housing, with sufficient lugs to terminate the equipment grounding conductors.
- .6 Receptacles shall not be grounded through their mounting screws. Ground with a jumper from the receptacle green ground terminal to the device box ground screw and the branch circuit equipment grounding conductor.
- .7 Raised Floors: Provide bonding of all raised floor components.
- .12 Corrosion Inhibitors
  - .1 When making ground and ground bonding connections, apply a corrosion inhibitor to all contact surfaces. Use corrosion inhibitor appropriate for protecting a connection between the metals used.
- .13 Conductive Piping
  - .1 Bond all conductive piping systems, interior and exterior, to the building to the grounding electrode system. Bonding connections shall be made as close as practical to the equipment ground bus.

### **3.3 [GROUNDING AND BONDING IN HEALTHCARE FACILITIES]**

- .1 Provide required grounding and bonding work in accordance with the drawings and in accordance with requirements of governing authorities, including the OESC. Review grounding requirements of project areas with specific requirements of use of areas as outlined in Contract Documents. Review exact requirements with the Consultant prior to start of work.
- .2 Review medical equipment grounding with equipment vendor and provide requirements to suit.

- .3 Throughout the renovated areas, solidly ground and bond the system equipment and make all required grounding connections to all new electrical devices and apparatus. Ground conductors shall be insulated copper wire connected with approved fittings in accordance with the OESC.
- .4 All ground connections in slab shall be made using OESC approved welded copper connections - Cadweld as supplied by Erico Products or approved equal.
- .5 Service conductors exceeding 400 amperes shall be provided with minimum No. 3/0 AWG grounding conductors, unless otherwise noted.
- .6 Do not use conduit systems as ground conductors in patient care areas or in areas as per local governing electrical code requirements.
- .7 Ground and bond telecommunication components as required.
- .8 Provide conductors as sized on drawings and in accordance with OESC requirements, but which shall be of size no smaller than the requirements specified herein this article or on drawings.

### **3.4 FIELD QUALITY CONTROL**

- .1 Perform inspections and tests listed in NETA ATS, Section 7.13.

**END OF SECTION**

## **PART 1 - GENERAL**

### **1.1 SECTION INCLUDES**

- .1 Conduit and equipment supports.
- .2 Anchors and fasteners.

### **1.2 REFERENCES**

- .1 CSA C22.1-18, Canadian Electrical Code, Part 1 (24th Edition), Safety Standard for Electrical Installations.
- .2 Ontario Electrical Safety Code (27th edition/2018).
- .3 CECA - Canadian Electrical Contractors Association.

### **1.3 CLOSEOUT SUBMITTALS**

- .1 Submit the following in the Operation and Maintenance Manual for products used over the course of the project:
  - .1 Product Data: Provide manufacturer's catalogue data for fastening systems.
  - .2 Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

### **1.4 REGULATORY REQUIREMENTS**

- .1 Provide products listed and classified by Canadian Standards as suitable for purpose specified and shown.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- .1 B-line by Eaton.
- .2 Burndy Canada Ltd. (Hubbell).
- .3 Erico Caddy.
- .4 E. Myatt & Co. Inc.
- .5 Hilti Canada.
- .6 Thomas & Betts.
- .7 Unistrut.
- .8 Approved equal.

### **2.2 GENERAL**

- .1 All supporting devices, strut channel, threaded rod, anchors, etc. to be used shall be of the "hot dipped" galvanized type. Electrogalvanized components will not be accepted.
- .2 Materials and Finishes: Provide adequate corrosion resistance.
- .3 Provide materials, sizes, and types of anchors, fasteners and supports to carry the loads of equipment and conduit. Consider weight of wire in conduit when selecting products.
- .4 Anchors and Fasteners:

- .1 Concrete Structural Elements: Use expansion anchor and preset inserts.
- .2 Steel Structural Elements: Use beam clamps and welded fasteners.
- .3 Concrete Surfaces: Use self-drilling anchors and expansion anchors.
- .4 Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts and hollow wall fasteners.
- .5 Solid Masonry Walls: Use expansion anchors and preset inserts.
- .6 Sheet Metal: Use sheet metal screws.
- .7 Wood Elements: Use wood screws.

## **2.3 ANCHORS AND HANGERS**

- .1 Hangers for electrical conduit shall be galvanized after fabrication.
- .2 Perforated strapping: not permitted.

## **2.4 INSERTS**

- .1 Use only factory-made threaded or toggle type.
- .2 Where inserts cannot be placed, use factory-made expansion shields for light weights, where approved by the Consultant.
- .3 Do not use powder-activated tools except with the written permission of the Consultant.

## **2.5 SLEEVES**

- .1 Through interior walls, use standard weight steel pipes, conduit, or 18 gauge galvanized steel. Cut flush with finished surfaces. Check room finish schedules.
- .2 Through exterior walls above grade, floors, and roof use standard weight steel pipes, machine cut, flush with finished surface inside and to suit flashing outside.
- .3 Through exterior walls below grade, water-proofed floors, and other water-proof walls, use heavy weight cast iron pipes, machine cut. Extend sleeves 100 mm (4 inches) above finished floors, and cut flush with underside of floor.

## **2.6 STEEL CHANNEL**

- .1 Description: Painted steel.

## **2.7 SUPPORTS**

- .1 Steel supports in wet or dry locations to be galvanized after fabrication.
- .2 Where galvanized members are bolted together use cadmium plated bolts.
- .3 For hanger rods use minimum 10 mm (3/8 inch) diameter steel threaded rod. Use clevis type attachment.
- .4 Provide minimum 100 mm (4 inch) high concrete bases for all floor mounted equipment.

## **2.8 SUPPORTS AND BASES**

- .1 Submit proposed method of attachment of hangers and beam clamps, to cellular steel deck for approval before proceeding with Work.
- .2 Supply and erect special structural Work required for the installation of electrical equipment. Provide anchor bolts and other fastenings unless noted otherwise. Mount equipment required to be

suspended above floor level, where details are not shown, on a frame or platform bracketed from the wall or suspended from the ceiling. Carry supports to either the ceiling or the floor, or both as required, at locations where, because wall thickness is inadequate, it is not permitted to use such brackets.

- .3 Electrical panels, switches or other electrical equipment shall be complete with suitable bases or mounting brackets.
- .4 Provide channel or other metal supports where necessary, to adequately support lighting fixtures. Do not use wood unless wood forms part of the building structure.
- .5 Support hangers, in general, from inserts in concrete construction or from building structural steel beams, using beam clamps. Provide additional angle or channel steel members, required between beams for supporting conduits and cables.
- .6 Provide any additional supports required from existing concrete construction for any piping or equipment, by drilling same and installing expansion bolt cinch anchors.
- .7 Do not use explosive drive pins in any section of Work without obtaining prior approval.

## **2.9 THREADED ROD COVERS**

- .1 Protect cable from abrasion caused by contact with threaded rod.
- .2 To meet UL 94V-0 specifications.
- .3 Colour: Black.
- .4 Example product: Panduit TRC18FR-X20Y.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- .1 Obtain permission from the Consultant before drilling or cutting structural members.
- .2 Fabricate supports from structural steel or steel channel. Rigidly weld members or use hexagon head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.
- .3 Install surface-mounted cabinets and panelboards with minimum of four anchors.
- .4 In wet and damp locations use steel channel supports to stand cabinets and panelboards 25 mm (1 inch) off wall.
- .5 Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.
- .6 [Where threaded rod is exposed in data centre, provide threaded rod cover.]
- .7 Provide inserts, sleeves, equipment supports and hangers, sealing of sleeves and openings, as required for all electrical work. Ensure that the load onto structures does not exceed the maximum loading per square metre as shown on Structural Drawings or as directed by the Consultant.
- .8 Provide insets, holes, anchor bolts and sleeves in time when walls, floors, and roof are erected.
- .9 Place insets only in structural members and not in the finishing material.
- .10 Secure all supports and hangers to the structure unless noted otherwise.
- .11 Suspend hanger rods from approved concrete inserts and from beam clamps. Obtain Consultant's approval before welding to steel structural members.
- .12 Secure supports to precast concrete members to inserts originally cast into the members or by rods passing between the members and connected to a steel plate bearing.
- .13 Sealing of Sleeves and Openings to Maintain Fire Rating

- .1 Use Dow-Corning #3-6548 'Silicone RTV' foam, Thomas & Betts "Flamesafe" firestop system, Electrovert 'Flameseal" firestop putty, or approved equal materials installed in accordance with the manufacturer's specifications and recommendations.
- .2 Submit data sheets for review prior to installation.
- .14 Supports
  - .1 All conduits, panels, etc. to be securely and adequately supported.
  - .2 Where more than three conduits run together, conduit racks to be used.
  - .3 Single runs of conduit to be supported by galvanized conduit straps or ring bolt type hangers. Tie wire or perforated metal strap hangers will NOT be accepted.

**END OF SECTION**

## **PART 1 - GENERAL**

### **1.1 SECTION INCLUDES**

- .1 Metal conduit.
- .2 Flexible metal conduit.
- .3 Liquid tight flexible metal conduit.
- .4 Electrical metallic tubing.
- .5 Fittings and conduit bodies.

### **1.2 REFERENCES**

- .1 Canadian Standards Association
  - .1 CSA C22.1 – Canadian Electrical Code, Part I, Safety Standard for Electrical Installations.
  - .2 Ontario Electrical Safety Code.
  - .3 CAN/CSA-C22.2 No. 18 – Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.
  - .4 CSA C22.2 No. 45 – Rigid Metal Conduit.
  - .5 CSA C22.2 No. 45.1 – Rigid Metal Conduit - Steel.
  - .6 CSA C22.2 No. 56 – Flexible Metal Conduit and Liquid - Tight Flexible Metal Conduit.
  - .7 CSA C22.2 No. 83.1 – Electrical Metallic Tubing - Steel.
  - .8 CSA C22.2 No. 211.1 – Rigid Types EB1 and DB2/ES2 PVC Conduit.
  - .9 CSA C22.2 No.211.2 – Rigid PVC (Unplasticized) Conduit.
  - .10 CSA C22.2 No. 211.3 – Reinforced Thermosetting Resin Conduit (RTRC) on Fittings.
  - .11 CSA C22.2 No. 227.1 – Electrical Nonmetallic Tubing.
  - .12 CSA C22.2 No. 227.2.1 – Liquid-Tight Flexible Nonmetallic Conduit.

### **1.3 PROJECT RECORD DOCUMENTS**

- .1 Accurately record actual routing of conduits larger than 51 mm.
- .2 Accurately record actual routing of all conduits installed below grade, regardless of size, including whether direct buried or installed in concrete duct bank.

### **1.4 REGULATORY REQUIREMENTS**

- .1 Provide products listed and classified by CSA (Canadian Standards Association) as suitable for purpose specified and shown.

### **1.5 DELIVERY, STORAGE, AND HANDLING**

- .1 Accept conduit on site. Inspect for damage.
- .2 Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

### **1.6 PROJECT CONDITIONS**

- .1 Verify that field measurements are as shown on drawings.
- .2 Verify routing and termination locations of conduit prior to rough-in.



- .3 Conduit routing is shown on drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- .1 Where products are listed in this section based on a single manufacturer, the equivalent product from the following manufacturers is acceptable:
  - .1 Appleton.
  - .2 Columbia-MBF.
  - .3 Crouse-Hinds by Eaton.
  - .4 Hubbell.
  - .5 Thomas & Betts Ltd.

### **2.2 CONDUIT REQUIREMENTS**

- .1 Minimum size: 21 mm (3/4 inch) unless otherwise specified.
- .2 Outdoor locations, above grade: use rigid steel.
- .3 Wet and damp locations: use rigid and non-metallic tubing.
- .4 Dry locations:
  - .1 Concealed: Use electrical metallic tubing
  - .2 Exposed: Use electrical metallic tubing.

### **2.3 METAL CONDUIT**

- .1 Rigid Steel Conduit: C22.2 No. 45.1.
- .2 Rigid Aluminum Conduit: C22.2 No. 45.
- .3 Intermediate Metal Conduit (IMC): Rigid steel.
- .4 Fittings and Conduit Bodies: Material to match conduit.

### **2.4 FLEXIBLE METAL CONDUIT**

- .1 Description: Interlocked steel construction.
- .2 Fittings: CSA C22.2 No. 56.

### **2.5 LIQUID TIGHT FLEXIBLE METAL CONDUIT**

- .1 Description: Interlocked steel aluminum construction with PVC jacket.
- .2 Fittings: CSA C22.2 No. 56.

### **2.6 ELECTRICAL METALLIC TUBING (EMT)**

- .1 Description: CSA C22.2 No. 83.1; galvanized tubing.
- .2 Fittings and Conduit Bodies: CSA C22.2 No. 83.1; steel type.

## 2.7 ELECTRICAL NONMETALLIC TUBING (ENT)

- .1 Not permitted.

## 2.8 CONDUIT, FITTINGS, AND ACCESSORIES

- .1 Conduit accessories, conduits and fittings conforming to CSA Standard C22.2 No. 18-1972.
- .2 Rigid conduit bushings:
  - .1 Thomas & Betts Ltd. - Series 5031.
- .3 EMT Connectors:
  - .1 Thomas & Betts Ltd. - Steel City TC 121E Series.
- .4 Ground Bushings:
  - .1 Thomas & Betts – Blackjack or 1220 Series.
- .5 Flexible conduit connectors:
  - .1 Thomas & Betts Ltd. - Series 3110.
  - .2 EMT couplings: steel concrete tight to match connectors.
- .6 Terminate rigid conduit entering boxes or enclosures with nylon insulated steel threaded bushings.
  - .1 Thomas & Betts – 8125 Series.
- .7 Terminate EMT entering boxes or enclosures with nylon insulated steel concrete tight connectors.
- .8 Terminate flexible conduit entering boxes or enclosures with nylon insulated steel connectors.
  - .1 Thomas & Betts – 5332 Series.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- .1 Install conduit to CSA C22.1.
- .2 Provide conduit for conductors except armoured cable and copper sheathed mineral insulated conductors, and except where duct or similar raceway materials are provided.
- .3 Provide conduit as follows:
  - .1 for interior building surface mounted services greater than 600 V – rigid galvanized steel;
  - .2 for feeders exceeding 600 V for main distribution wiring in Electrical rooms, and for concealed conduit in exterior walls-rigid galvanized steel;
  - .3 for exposed conduit outside building, for semi-exterior areas such as loading areas – rigid galvanized steel (rigid PVC where permitted by local codes and approved by Consultant);
  - .4 for exposed conduit mounted at a height of less than 1200 mm (4') in electrical, mechanical or other service areas – rigid galvanized steel;
  - .5 for short branch circuit connectors to motorized equipment and distribution transformers (minimum length 450 mm (18"), maximum length 600 mm (24") with 180° loop where possible) – galvanized steel flexible liquid-tight conduit;
  - .6 at points, where conductors cross building expansion joints – galvanized steel flexible conduit with no less than 600 mm (24") of extra curve;
  - .7 for branch circuit conductors in poured concrete slab – rigid PVC;
  - .8 for interior conduit above 50 mm (2") diameter containing distribution conductors or communication systems conductors (fire alarm, telephone etc.) (except as noted above) – EMT with separate insulated ground conductor;
  - .9 for conductors except as noted above or elsewhere in this Specification –EMT.

- .4 Provide manufactured expansion joints in rigid PVC plastic conduit at spacing as recommended by conduit manufacturer.
- .5 Provide a separate ground conductor in plastic conduits.
- .6 Unless otherwise noted, provide conduit fittings constructed of same materials as conduit and which are suitable in respects for application.
- .7 Provide proper adaptors for joining conduits of different materials.
- .8 Cut square and properly ream site cut conduit ends.
- .9 Provide conduit as sized on drawings. Size conduit not sized on drawings in accordance with latest edition of local governing electrical code with consideration that sizes of branch circuit conductors indicated are minimum sizes and must be increased as required to suit length of run and voltage drop in accordance with voltage drop schedule found on drawings and as required by local governing electrical code. Where conductor sizes are increased to suit voltage drop requirements, increase scheduled or specified conduit size to suit. Unless otherwise noted on drawings or required by local governing electrical code or specified elsewhere, conduit to be of minimum size 13 mm (1/2") diameter. Structured network cabling system conduit to be of minimum 20 mm (3/4") diameter, unless otherwise noted.
- .10 Site made bends for conduit to maintain full conduit diameter with no kinking, and conduit finishes are not flake or crack when conduit is bent.
- .11 Plug ends of roughed-in conduits which are exposed during construction with approved plugs.
- .12 Arrangement and supports
  - .1 Arrange supports to prevent misalignment during wiring installation.
  - .2 Arrange conduit to maintain headroom and present neat appearance.
  - .3 Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
  - .4 Group related conduits; support using conduit rack.
  - .5 Construct rack using steel channel; provide space on each for 25 per cent additional conduits.
  - .6 Fasten conduit supports to building structure and surfaces.
  - .7 Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports
  - .8 Do not attach conduit to ceiling support wires.
  - .9 Route exposed conduit parallel and perpendicular to walls.
  - .10 Route conduit installed above accessible ceilings parallel and perpendicular to walls.
  - .11 Route conduit in and under slab from point-to-point.
  - .12 Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.
  - .13 Provide suitable fittings to accommodate expansion and deflection where conduit crosses expansion joints to permit free movement without imposing additional stress or loading upon support system, and to prevent excessive movement at joints and connections, in accordance with drawing details.
- .13 Clearances
  - .1 Maintain adequate clearance between conduit and piping.
  - .2 Maintain 300 mm (12 inch) clearance between conduit and surfaces with temperatures exceeding 40 degrees C.
- .14 Conduit bends
  - .1 Install no more than equivalent of three 90 degree bends between boxes.

- .1 Use conduit bodies to make sharp changes in direction, as around beams.
- .2 Use hydraulic one-shot bender to fabricate bends in metal conduit larger than 50 mm size.
- .15 Install wall entrance seals where conduits pass through exterior walls below grade.
- .16 Provide expansion coupling in conduit runs at building expansion joints and in long runs subject to thermal expansion, all in accordance with manufacturer recommendations.
- .17 Cut conduit square using saw or pipe cutter; de-burr cut ends.
- .18 Bring conduit to shoulder of fittings; fasten securely.
- .19 Use suitable caps to protect installed conduit against entrance of dirt and moisture.
- .20 Use conduit hubs or sealing locknuts to fasten conduit and to cast boxes.
- .21 Provide suitable pull string in each empty conduit except sleeves and nipples.
- .22 Wiring Methods
  - .1 Install wiring in conduit unless otherwise specified.
  - .2 Install wiring and conduit work in a concealed manner. Surface conduit work is not permitted unless specifically noted.
  - .3 Use thin wall conduit, up to and including 53 mm (2 inch) conduit size, for branch circuit and feeder wiring in ceilings, furred spaces, and in hollow walls and partitions. Use rigid galvanized steel conduit for wiring in poured concrete, where exposed, and for conduit 65 mm or larger. Use rigid PVC conduit for wiring in slabs on grade and wiring below grade.
  - .4 Flexible conduit and armoured cable will be accepted for a maximum length of 1500 mm for final connection to lighting fixtures. Do not connect from fixture to fixture.
  - .5 Conduit manufacturer's touch-up enamel shall be used to repair all scratches and gouges on epoxy-coated conduit.

## END OF SECTION

## PART 1 - GENERAL

### 1.1 SECTION INCLUDES

- .1 Wall and ceiling outlet boxes.
- .2 Pull and junction boxes.

### 1.2 RELATED REQUIREMENTS

- .1 Section 26 09 23 – Lighting Control Devices.
- .2 Section 26 27 26 – Wiring Devices: Wall plates in finished areas, floor box service fittings, fire-rated poke-through fittings, and access floor boxes.
- .3 Section 26 28 00 - Low Voltage Circuit Protective Devices

### 1.3 REFERENCES

- .1 CSA C22.1 - Canadian Electrical Code, Part I, Safety Standard for Electrical Installations
- .2 Ontario Electrical Safety Code.
- .3 CAN/CSA-C22.2 No. 18 - Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.
- .4 CSA C22.2 No. 18.1 (CSA/UL/ANCE) - Metallic Outlet Boxes.
- .5 CSA C22.2 No. 40 - Cutout, Junction and Pull Boxes.
- .6 CAN/CSA-C22.2 No. 85 - Rigid PVC Boxes and Fittings.

### 1.4 CLOSEOUT SUBMITTALS

- .1 Record actual locations and mounting heights of outlet, pull, and junction boxes on project record documents.

### 1.5 REGULATORY REQUIREMENTS

- .1 Provide products listed and classified by CSA (Canadian Standards Association) as suitable for the purpose specified and indicated.

## PART 2 - PRODUCTS

### 2.1 OUTLET BOXES

- .1 Sheet Metal Outlet Boxes: CSA C22.2 No. 18, galvanized steel.
  - .1 Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 13 mm male fixture studs where required.
  - .2 Concrete Ceiling Boxes: Concrete type.
- .2 Non-metallic Outlet Boxes: CSA C22.2 No. 18.
- .3 Cast Boxes: CSA C22.2 No. 18, Type FD, aluminum. Provide gasketed cover by box manufacturer. Provide threaded hubs.
- .4 Wall Plates for Finished Areas: As specified in Section 26 27 26.
- .5 Each outlet box and back box to be suitable in respects for application and complete with suitable securing lugs, connectors suitable for connected conduit, knockouts and, where necessary, suitable plaster rings, concrete rings, covers, carpet flanges and any other required accessory.

## 2.2 PULL BOXES AND JUNCTION BOXES

- .1 Sheet Metal Boxes: CSA C22.2 No. 18, galvanized steel.
- .2 Hinged Enclosures: As specified in Section 26 27 16.
- .3 Surface Mounted Cast Metal Box: CSA C22.2 No. 18, Type 4; flat-flanged, surface mounted junction box:
  - .1 Material: Cast aluminum.
  - .2 Cover: Provide with ground flange, neoprene gasket, and stainless steel cover screws.

## 2.3 OUTLET BOXES

- .1 Conform to CSA C22.2 No. 18.
- .2 Where 103 mm (4 inch) square outlet boxes are installed in exposed concrete or cinder block finished areas, blocks will be cut as described in Division 04 as instructed under this Section. Cut openings to provide a close fit to boxes and covers so that edges of openings are not visible after installation of plates. Use of mortar to patch up openings that are cut too large or to patch ragged edges is not permitted.
- .3 Ceiling boxes: 103 mm (4 inch) octagon or square, complete with fittings, where required to support fixtures.
- .4 Switch and receptacle boxes:
  - .1 103 mm (4 inch) square with plaster ring, where flush mounted in plaster walls.
  - .2 Iberville 1104 series box, or equal, where flush mounted in wood or drywall, with stud fasteners as required.
  - .3 Masonry boxes in masonry walls.
- .5 Where boxes are surface mounted in unfinished areas they shall be FS conduits.
- .6 Standard outlet boxes manufactured from code gauge galvanized steel.
- .7 Provide a suitable outlet box for each light, switch, receptacle or other outlet, approved for the particular area it is to be installed.
- .8 Support outlet boxes independently of conduit and cable.
- .9 Locate outlet boxes, mounted in hung ceiling space, so they do not obstruct or interfere with the removal of lay-in ceiling tiles.
- .10 Offset outlet boxes, shown back to back in partitions, horizontally a minimum 150 mm (6 inch) to minimize noise transmission between adjacent rooms.
- .11 Use gang boxes at locations where more than one device, of the same system only, is to be mounted. Utilize separate boxes for each system.
- .12 Use tile wall covers where 103 mm (4 inch) square outlet boxes are installed in exposed concrete or cinder block in finished areas.
- .13 Provide flush mount boxes, panels, cabinets and electrical devices, which are installed in finished areas, with suitable flush trims and doors or covers, unless specifically noted otherwise.
- .14 Provide pre-formed polyethylene vapour barriers for all boxes located in walls with internal vapour barriers.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- .1 Verify locations of floor boxes prior to rough-in.

### 3.2 INSTALLATION

- .1 Install boxes to CSA C22.1.
- .2 Install in locations as shown on drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.
- .3 Set wall mounted boxes at elevations to accommodate mounting heights indicated.
- .4 Electrical boxes are shown on drawings in approximate locations unless dimensioned. Adjust box location up to 3 m (10 feet) if required to accommodate intended purpose.
- .5 Orient boxes to accommodate wiring devices oriented as specified in Section 26 27 26.
- .6 Maintain headroom and present neat mechanical appearance.
- .7 Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.
- .8 Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 150 mm (6 inch) from ceiling access panel or from removable recessed luminaire.
- .9 Install boxes to preserve fire resistance rating of partitions and other elements, using materials and methods.
- .10 Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.
- .11 Locate outlet boxes to allow luminaires positioned as shown on reflected ceiling plan.
- .12 Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.
- .13 Use flush mounting outlet box in finished areas.
- .14 Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.
- .15 Do not install flush mounting box back-to-back in walls; provide minimum 150 mm separation. Provide minimum 600 mm separation in acoustic rated walls.
- .16 Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.
- .17 Use stamped steel bridges to fasten flush mounting outlet box between studs.
- .18 Install flush mounting box without damaging wall insulation or reducing its effectiveness.
- .19 Use adjustable steel channel fasteners for hung ceiling outlet box.
- .20 Do not fasten boxes to ceiling support wires.
- .21 Support boxes independently of conduit.
- .22 Use gang box where more than one device is mounted together. Do not use sectional box.
- .23 Use gang box with plaster ring for single device outlets.
- .24 Use cast outlet box in exterior locations exposed to the weather.
- .25 Use cast outlet box in wet locations.
- .26 Set floor boxes level.
- .27 Large pull boxes: Use hinged enclosure in interior dry locations, surface-mounted cast metal box in other locations.

### 3.3 ADJUSTING

- .1 Adjust floor box flush with finish flooring material.
- .2 Adjust flush-mounting outlets to make front flush with finished wall material.
- .3 Install knockout closures in unused box openings.

### **3.4 CLEANING**

- .1 Clean interior of boxes to remove dust, debris, and other material.
- .2 Clean exposed surfaces and restore finish.

**END OF SECTION**



## **PART 1 - GENERAL**

### **1.1 SECTION INCLUDES**

- .1 Sleeves, sealing of sleeves and openings, as required for all electrical work.

### **1.2 SUBMITTALS**

- .1 Submit data sheets for firestopping in accordance with Section 01.
- .2 Submit copies of firestopping drawings with ULC certificate and system number for each specific installation.
- .3 Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance ratings.
- .4 Submit dimensioned location drawings indicating required sleeves and formed openings in structural poured concrete or precast concrete construction or in roofing, and locations of cutting or drilling required for Electrical work.

## **PART 2 - PRODUCTS**

### **2.1 SLEEVES**

- .1 Galvanized steel sleeves:
  - .1 No. 24 gauge with an integral flange at one (1) end to secure sleeve to formwork construction.
  - .2 Schedule 40 pipe.
- .2 Schedule 40 PVC sleeves.

### **2.2 SLEEVE SEALS**

- .1 Manufacturers
  - .1 Hilti Canada.
  - .2 Specified Technologies Inc.
  - .3 3M Canada Inc.
  - .4 Tremco.
  - .5 A/D Fire Protection Systems.
  - .6 Nelson.
  - .7 Approved equal.
- .2 Asbestos-free, elastomeric materials and intumescent materials, tested, listed and labelled by ULC in accordance with CAN/ULC-S115, and CAN/ULC-S101 for installation in ULC designated firestopping, and smoke seal systems to provide a positive fire, water and smoke seal and a fire resistance rating (flame, hose stream and temperature) no less than fire rating for surrounding construction.
- .3 Materials are to be compatible with abutting dissimilar materials and finishes and complete with primers, damming and back-up materials, supports, and anchoring devices in accordance with firestopping manufacturer's recommendations and ULC tested assembly. Coordinate material requirements with trades supplying abutting areas of materials.
- .4 Maintain fire rating of separation in accordance with architectural drawings.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- .1 Where conduits and conductors pass through structural poured concrete, provide sleeves of type suitable for application, and approved by local governing codes.
- .2 Sleeves in concrete slabs, except as noted below, are to be No. 24 gauge or equivalent, with an integral flange to secure sleeves for formwork construction.
- .3 Sleeves in waterproof concrete slabs and in other slabs where waterproof sleeves are required are to be lengths of Schedule 40 pipe sized to extend 100 mm (4") above floor.
- .4 Sleeves in poured concrete walls and foundation are to be Schedule 40 pipe.
- .5 Through interior walls, use standard weight steel pipes, conduit, or galvanized steel. Cut flush with finished surfaces. Check room finish schedules.
- .6 Through exterior walls above grade, floors, and roof use standard weight steel pipes, machine cut, flush with finished surface inside and to suit flashing outside.
- .7 Through exterior walls below grade, water-proofed floors, and other water-proof walls, use heavy weight cast iron pipes, machine cut. Extend sleeves 100 mm (4") above finished floors, and cut flush with underside of floor.
- .8 Size sleeves, unless otherwise noted, to leave 13 mm (1/2") clearance around conduit, duct, conductor, etc. Void between sleeves and conduit, duct, conductors, etc., to be packed and sealed for length of sleeves as in accordance with article entitled "Sleeve Seals" specified in this Section. Pack and seal sleeves set in exterior walls with governing authority approved materials suitable for application and pack both ends of sleeves watertight with approved permanently flexible and water tight materials. Coordinate exact responsibility of work with General Trades Contractor.
- .9 Submit to concrete reinforcement detailer at proper time, drawings indicating required sleeves, recesses and formed openings in poured concrete work. Completely and accurately dimension such drawings and relate sleeves, recesses and formed openings to suitable grid lines and elevation datum.
- .10 Supply sleeves of a water protecting type in accordance with detail found on drawings for installation in following locations:
  - .1 in Mechanical and Fan Room floor slabs, except where on grade;
  - .2 in slabs over Mechanical, Fan, Electrical and Telephone Equipment Rooms or closets;
  - .3 in floors equipped with waterproof membranes.
- .11 "Gang" type sleeving to be permitted only with approval of Owner and reviewed with the Consultant.
- .12 Terminate sleeves for work which is exposed, so that sleeve is flush at both ends with wall, partition, or slab surface such that sleeve may be covered completely by escutcheon plates.
- .13 Sleeves are not required in interior walls and dry area floors where conduit is installed ahead of floor construction.
- .14 Seal all openings and sleeves after installation of equipment:
  - .1 With an approved material to maintain fire rating where sleeves and openings pass through fire separations and floors.
  - .2 With an approved material to maintain fire rating for sleeves and openings provided for future equipment.
    - .1 Flash all conduits and systems passing through roof or built into an outside wall, or a waterproof floor.
    - .2 Provide copper flashing for sleeves passing through exterior walls or waterproof floors.

- .15 Provide all flashing and waterproofing for sleeves through roof and exterior walls to the requirements of Division 07.
- .16 Firestop sleeves in accordance with the manufacturer's specifications and recommendations.

**END OF SECTION**

## PART 1 - GENERAL

### 1.1 SECTION INCLUDES

- .1 Tested firestop systems used in penetrations for the passage of cables, conduit, and other electrical equipment through fire-rated vertical barriers (walls and partitions), horizontal barriers (floor/ceiling assemblies), and vertical service shaft walls and partitions.

### 1.2 RELATED REQUIREMENTS

- .1 Coordinate work of this section with work of other sections as required to properly execute the work and as necessary to maintain satisfactory progress of the work of other sections, including:
  - .1 Section 07 – Firestopping.
  - .2 Section 27 05 44 – Sleeves and Sleeve Seals for Communications Pathways and Cabling.

### 1.3 REFERENCES

- .1 Underwriter's Laboratories (UL) and Underwriters Laboratories of Canada (ULC):
  - .1 Test Requirements: CAN/ULC-S115:2018, Standard Method of Fire Tests of Firestop Systems.
  - .2 Underwriters Laboratories of Canada (ULC) runs CAN/ULC-S115:2018 under their designation of ULC-S115:2018 and publishes the results in their "FIRE RESISTANCE RATINGS DIRECTORY" that is updated annually.
  - .3 Underwriters Laboratories (UL) of Northbrook, IL runs ASTM E-814 under their designation of UL 1479 and publishes the results in their "FIRE RESISTANCE DIRECTORY" that is updated annually. UL tests that meet the requirements of ULC-S115-M are given a cUL listing and are published by UL in their "Products Certified for Canada (cUL) Directory".
  - .4 CAN/ULC-S102:2018, Standard Test Method for Surface Burning Characteristics of Building Materials and CAN/ULC-S101 Fire Endurance Tests of Building Construction and Materials.
- .2 ASTM:
  - .1 Omega Point Laboratories runs ASTM E-814 and publishes the results annually in their "Omega Point Laboratories Directory".
  - .2 Inspection Requirements: ASTM E 2174, "Standard Practice for On-site Inspection of Installed Fire Stops.", and ASTM E2393 Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers.
  - .3 Test Requirements: ASTM E 2307, "Standard Test Method for Determining Fire Resistance of Perimeter Fire Barrier Systems Using Intermediate-Scale, Multi-story Test Apparatus".
  - .4 ASTM D6904, "Standard Practice for Resistance to Wind Driven Rain for Exterior Coatings Applied on Masonry".
  - .5 ASTM C 679, "Standard Test Method for Tack-Free Time of Elastomeric Sealants".
- .3 International Firestop Council Guidelines for Evaluating Firestop Systems Engineering Judgments.
- .4 Ontario Building Code.
- .5 Ontario Electrical Safety Code.

### 1.4 DEFINITIONS

- .1 Firestopping: Material or combination of materials used to retain integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke, and hot gases through penetrations in fire rated wall and floor assemblies.

## 1.5 SUBMITTALS

- .1 Submit Product Data: Manufacturer's specifications and technical data for each material including the composition and limitations, documentation of ULC or cUL firestop systems to be used and manufacturer's installation instructions to comply with Section 01 33 00.
- .2 Manufacturer's engineering judgment identification number and drawing details when no ULC or cUL system is available for an application. Engineered judgment must include both project name and contractor's name who will install firestop system as described in drawing.
- .3 Submit material safety data sheets provided with product delivered to job-site.
- .4 Submit shop drawings in accordance with Section 01 33 00:
  - .1 Submit complete cUL, ULC, or equivalent approved systems for all applications. Ensure the listing is clearly noted on the submittal.
- .5 [Submit certificate by firestopping manufacturer proving that the products supplied comply with LEED requirements for indoor environmental quality credit including printed statement of VOC.]

## 1.6 CLOSEOUT SUBMITTALS

- .1 On completion of firestopping and smoke sealing installation, submit a Letter of Assurance to the Consultant certifying the firestopping and smoke sealing installation has been carried out throughout the building to electrical service penetrations and that installation has been done in strict accordance with requirements of the Ontario Building Code, any applicable municipal bylaws, ULC requirements, and manufacturer's instructions.

## 1.7 QUALITY ASSURANCE

- .1 Fire-Test-Response Characteristics: Provide through-penetration fire stop systems and fire-resistive joint systems that comply with specified requirements of tested systems.
- .2 Firestop System installation must meet requirements of CAN/ULC-S115 tested assemblies that provide a fire rating as shown in Section 2.1 Clauses 4, 5, 6, and 7 below.
- .3 Proposed firestop materials and methods shall conform to applicable governing codes having local jurisdiction.
- .4 Firestop Systems do not re-establish the structural integrity of load bearing partitions/assemblies, or support live loads and traffic. Installer shall consult the structural engineer prior to penetrating any load bearing assembly.
- .5 For those firestop applications that exist for which no ULC or cUL tested system is available through a manufacturer, a manufacturer's engineering judgment derived from similar ULC or cUL system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineering judgment drawings must follow requirements set forth by the International Firestop Council.

## 1.8 INSTALLER QUALIFICATIONS

- .1 Engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having the necessary training to install manufacture's products per specified requirements. A supplier's willingness to sell its firestopping products to the Contractor or to an Installer engaged by the Contractor does not in itself confer qualification on the buyer.
- .2 Installation Responsibility: assign installation of through-penetration fire stop systems and fire-resistive joint systems in Project to a single sole source firestop specialty contractor.
- .3 The work is to be installed by a contractor with at least one of the following qualifications:
  - .1 FM 4991 approved contractor.
  - .2 UL approved contractor.

- .3 Manufacturer's accredited fire stop specialty contractor.
- .4 Installer: Minimum 3 years experience with fire stop installation.

## **1.9 DELIVERY, STORAGE, AND HANDLING**

- .1 Deliver materials undamaged in manufacturer's clearly labeled, unopened containers, identified with brand, type, and ULC or cUL label where applicable.
- .2 Coordinate delivery of materials with scheduled installation date to allow minimum storage time at job-site.
- .3 Store materials under cover and protect from weather and damage in compliance with manufacturer's requirements.
- .4 Comply with recommended procedures, precautions or remedies described in material safety data sheets as applicable.
- .5 Do not use damaged or expired materials.

## **1.10 PROJECT CONDITIONS**

- .1 Do not use materials that contain flammable solvents.
- .2 Scheduling
  - .1 Schedule installation of CAST IN PLACE firestop devices after completion of floor formwork, metal form deck, or composite deck but before placement of concrete.
  - .2 Schedule installation of Drop-In firestop devices after placement of concrete but before installation of the pipe penetration. Diameter of sleeved or cored hole to match the listed system for the device.
  - .3 Schedule installation of other firestopping materials after completion of penetrating item installation but prior to covering or concealing of openings.
- .3 Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.
- .4 Weather conditions: Do not proceed with installation of firestop materials when temperatures exceed the manufacturer's recommended limitations for installation printed on product label and product data sheet.
- .5 During installation, provide masking and drop cloths to prevent firestopping materials from contaminating any adjacent surfaces.

## **PART 2 - PRODUCTS**

### **2.1 PERFORMANCE REQUIREMENTS**

- .1 Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by the firestopping manufacturer based on testing and field experience.
- .2 Provide components for each firestopping system that are needed to install fill material. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.
- .3 Provide a round fire-rated cable management device whenever cables penetrate fire rated walls, where frequent cable changes and additions may occur. The fire-rated cable management device shall consist of a corrugated steel tube with zinc coating, contain an inner plastic housing, intumescent material rings, and inner fabric smoke seal membrane. The length of the sleeve shall

be 315 mm (12.4 inches). The fire-rated cable management device shall contain integrated intumescent firestop wrap strip materials sufficient to maintain the hourly rating of the barrier being penetrated. The fire-rated cable management device shall contain a smoke seal fabric membrane or intumescent firestop plugs sufficient to achieve the L-Rating requirements of the barrier type. Install device per the manufacturer's published installation instructions.

- .4 Penetrations in Horizontal Assemblies: Provide firestopping with ratings determined in accordance with CAN/ULC-S115. For penetrations through a Fire Wall or horizontal Fire Separation provide a firestop system with a "FT" Rating as determined by ULC or cUL which is equal to the fire resistance rating of the construction being penetrated.
- .5 W-ratings: in accordance with Section 07 84 00.
- .6 Provide a firestop system with an Assembly Rating as determined by CAN/ULC-S115 which is equal to the time rating of construction joint assembly.
- .7 Penetrations in Smoke Barriers: Provide firestopping with ratings determined in accordance with CAN/ULC-S115.
  - .1 L-Rating: Not exceeding 5.0 CFM/sqft of penetration opening at both ambient and elevated temperatures.
- .8 Mold Resistance: Provide penetration firestopping with mold and mildew resistance rating of [0] as determined by ASTM G21.
- .9 Rain and water resistance: provide perimeter joint sealant tested in accordance with ASTM D 6904 with less than 1 hour tack free time as tested in accordance with ASTM C 679.

## 2.2 MANUFACTURERS

- .1 Manufacturer List:
  - .1 AD Fire Protection Systems.
  - .2 Hilti (Canada) Corporation
  - .3 3M.
  - .4 Specified Technologies, Inc. (STI).
  - .5 Tremco, Inc.
  - .6 Approved equal.
- .2 Substitutions: Where a specific manufacturer is noted in this Section, equivalent products from the manufacturers listed above may be used, subject to compliance with through penetration firestop systems and joint systems listed in the ULC Fire Resistance Directory – Volume III, or UL Products Certified for Canada (cUL) Directory.

## 2.3 MATERIALS

- .1 Use only firestop products that have been ULC or cUL tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.
- .2 Accessories: provide components for each firestopping and smoke seal systems that are needed to install fill materials. Use only components specified by firestopping material manufacturer, and approved by the qualified testing agency. Accessories include, but are not limited to, the following items:
  - .1 Permanent forming, damming and backing material.
  - .2 Temporary forming material.
- .3 Pre-formed firestop devices for use with non-combustible and combustible pipes (closed and open systems), conduit and/or cable bundles penetrating concrete floors and/or gypsum walls:



- .1 Hilti Tub Box Kit (CP 681) for use with tub installations.
- .2 Hilti Cast-In Place Firestop Device (CP 680-PX) for use with XFR pipe.
- .3 Hilti Cast-In Place Firestop Device (CP 680-M) for use with non-combustible penetrants.
- .4 Hilti Speed Sleeve (CP 653) for use with cable penetrations.
- .5 Hilti Firestop Drop-In Device (CFS-DID) for use with non-combustible and combustible penetrants.
- .6 Hilti Cast-in Firestop sleeve (CFS-CID MD P) and (CFS-CID MD M) for use with combustible and non-combustible pipes through metal deck.
- .7 Hilti Firestop Block (CFS-BL).
- .8 STI SpecSeal series SSC Firestop Collars.
- .9 STI SpecSeal series LCC Firestop Collars.
- .4 Sealants or caulking materials for use with non-combustible items including steel pipe, copper pipe, rigid steel conduit and electrical metallic tubing (EMT).
  - .1 Hilti Intumescent Firestop Sealant (FS-ONE MAX).
  - .2 Hilti Fire Foam (CP 620)/CP 660.
  - .3 Hilti Flexible Firestop Sealant (CP 606).
  - .4 Hilti Firestop Silicone Sealant Gun Grade (CFS-S SIL GG).
  - .5 Hilti Firestop Silicone Sealant Self Leveling (CFS-S SIL SL).
- .5 Intumescent sealants or caulking materials for use with combustible items (penetrants consumed by high heat and flame) including insulated metal pipe, PVC jacketed, flexible cable or cable bundles and plastic pipe.
  - .1 Hilti Intumescent Firestop Sealant (FS-ONE MAX).
- .6 Foams, intumescent sealants, or caulking materials for use with flexible cable or cable bundles.
  - .1 Hilti Intumescent Firestop Sealant (FS-ONE MAX).
  - .2 Hilti Fire Foam (CP 620)/660.
  - .3 Hilti Flexible Firestop Sealant (CP 606).
  - .4 Hilti Firestop Silicone Sealant Gun Grade (CFS-S SIL GG).
  - .5 Hilti Firestop Silicone Sealant Self Leveling (CFS-S SIL SL).
- .7 Firestop Putty Pads: Intumescent, non-hardening putty pads to be installed on metallic and non-metallic electrical switch and receptacle boxes to reduce horizontal separation between boxes to less than 610 mm (24 in):
  - .1 STI SpecSeal Series SSP Firestop Putty Pads.
  - .2 Hilti Firestop Putty Pad (CP 617).
- .8 Materials used for large size/complex penetrations made to accommodate cable trays, multiple steel and copper pipes, electrical busways in raceways.
  - .1 Hilti Firestop Block (CFS-BL).
  - .2 Hilti Composite Sheet (CFS-COS).
  - .3 Hilti Firestop Mortar (CP 637).
  - .4 Hilti Fire Foam (CP 620)/660.
  - .5 Hilti Firestop Board (CP 675T).
- .9 Non-curing, re-penetrable materials used for large size/complex penetrations made to accommodate cable trays, multiple steel and copper pipes, electrical busways in raceways.



- .1 Hilti Firestop Block (CFS-BL).
- .2 Hilti Firestop Board (CP 675T).
- .10 Re-penetrable, round cable management devices for use with new or existing cable bundles penetrating gypsum or masonry walls.
  - .1 Hilti Speed Sleeve (CP 653) with integrated smoke seal fabric membrane.
  - .2 Hilti Firestop Cable Collar (CFS-CC).
  - .3 Hilti Firestop Sleeve (CFS-SL SK).
  - .4 Hilti Retrofit Sleeve (CFS-SL RK) for use with existing cable bundles.
  - .5 Hilti Gangplate (CFS-SL GP) for use with multiple cable management devices.
  - .6 Hilti Gangplate Cap (CFS-SL GP CAP) for use at blank openings in gangplate for future penetrations.
- .11 For blank openings made in fire-rated wall or floor assemblies, where future penetration of pipes, conduits, or cables is expected.
  - .1 Hilti CFS-BL Firestop Block (for walls and floors).
  - .2 Hilti CFS-PL Firestop Plug (for walls and floors).
- .12 Cast-In-Place Firestop Device: Single component molded firestop device installed on forms prior to concrete placement with totally encapsulated, tamper-proof integral firestop system and smoke sealing gasket. Device shall allow for a concrete floor thickness of minimum 63 mm (2-1/2 in) up to 914 mm (36 in) without the use of field applied extension tubing:
  - .1 STI SpecSeal CID Cast-In Firestop Device.
  - .2 Hilti CP 680 Cast-In Place Firestop Device (for floors only).
- .13 For single or cable bundles up to one inch diameter penetrating gypsum, masonry, concrete walls or wood floor assemblies.
  - .1 Hilti CFS-D Firestop Cable Disc.

## **PART 3 - EXECUTION**

### **3.1 INSTALLERS**

- .1 Labour Use to Install Firestop Systems
  - .1 To ensure complete harmony on the project site, the installation of each scope of work is to be performed jurisdictionally correct per existing trade agreements.

### **3.2 PREPARATION**

- .1 Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.
  - .1 Verify penetrations are properly sized and in suitable condition for application of materials.
  - .2 Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, rust, laitance, release agents, water repellents, and any other substances that may affect proper adhesion.
  - .3 Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.
  - .4 Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of firestopping.
  - .5 Do not proceed until unsatisfactory conditions have been corrected.

### 3.3 COORDINATION

- .1 Coordinate construction of openings, penetrations to ensure that the fire stop systems are installed according to specified requirements.
- .2 Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration fire stop systems.
- .3 Coordinate fire stopping with other trades so that obstructions are not placed in the way prior to the installation of the fire stop systems.
- .4 Do not cover up through-penetration fire stop and joint system installations that will become concealed behind other construction until each installation has been examined by the building inspector.

### 3.4 INSTALLATION

- .1 Regulatory Requirements: Install firestop materials in accordance with ULC Fire Resistance Directory or UL Products Certified for Canada (cUL) Directory or Omega Point Laboratories Directory.
- .2 Manufacturer's Instructions: Comply with manufacturer's instructions for installation of through-penetration and construction joint materials.
  - .1 Seal all holes or voids made by penetrations to ensure an air and water-resistant seal.
  - .2 Consult with mechanical engineer, project manager, and damper manufacturer prior to installation of ULC or cUL firestop systems that might hamper the performance of fire dampers as it pertains to duct work.
  - .3 Protect materials from damage on surfaces subjected to traffic.

### 3.5 FIELD QUALITY CONTROL

- .1 Examine sealed penetration areas to ensure proper installation before concealing or enclosing areas.
- .2 Keep areas of work accessible until inspection by applicable code authorities.
- .3 Inspection of through-penetration firestopping shall be performed in accordance with ASTM E 2174, "Standard Practice for On-Site Inspection of Installed Fire Stops", or other recognized standard.
- .4 Perform under this section patching and repairing of firestopping caused by cutting or penetrating of existing firestop systems already installed by other trades.
- .5 Manufacturer's Field Services: During Installation, provide periodic destructive testing inspections to assure proper installation/application. After installation is complete, submit findings in writing indicating whether or not the installation of the tested system identified was installed correctly.

### 3.6 IDENTIFICATION AND DOCUMENTATION

- .1 The firestop contractor is to supply documentation for each single application addressed. This documentation is to identify each penetration location on the entire project.
- .2 The Documentation Form for through penetrations is to include:
  - .1 A Sequential Location Number.
  - .2 The Project Name.
  - .3 Date of Installation.
  - .4 Detailed description of the penetration location.
  - .5 Tested System or Engineered Judgment Number.
  - .6 Type of assembly penetrated.

- .7 A detailed description of the size and type of penetrating item.
- .8 Size of opening.
- .9 Number of sides of assemblies addressed.
- .10 Hourly rating to be achieved.
- .11 Installer's Name.
- .3 Copies of these documents are to be provided to the general contractor at the completion of the project.
- .4 Identify through-penetration firestop systems with pressure-sensitive, self-adhesive, preprinted vinyl labels. Attach labels permanently to surfaces of penetrated construction on both sides of each firestop system installation where labels will be visible to anyone seeking to remove penetrating items or firestop systems. Include the following information on labels:
  - .1 The words: "Warning-Through Penetration Firestop System-Do Not Disturb. Notify Building Management of Any Damage."
  - .2 Contractor's Name, address, and phone number.
  - .3 Through-Penetration firestop system designation of applicable testing and inspecting agency.
  - .4 Date of Installation.
  - .5 Through-Penetration firestop system manufacturer's name.
  - .6 Installer's Name.

### **3.7 ADJUSTING AND CLEANING**

- .1 Remove equipment, materials and debris, leaving area in undamaged, clean condition.
- .2 Clean all surfaces adjacent to sealed holes and joints to be free of excess firestop materials and soiling as work progresses.

**END OF SECTION**

## PART 1 - GENERAL

### 1.1 SECTION INCLUDES

- .1 Provide positive seismic restraints on electrical systems and components required by the building code and by the local authority having jurisdiction.
- .2 This section covers design, supply, installation, and inspection of complete SFRS (Seismic Force Resisting System) for electrical systems.

### 1.2 REFERENCES

- .1 Seismic restraints are to be provided for all electrical and non-structural components of building services in accordance with the current: NBCC; OBC, and good engineering practice (references listed below):
  - .1 CSA S832-14 (R2019), Seismic risk reduction of operation and functional components (OFCs) of buildings.
  - .2 SMACNA (Sheet Metal and Air-conditioning Contractors' National Association's) Seismic Restraint Manual Guidelines for Mechanical Systems (3rd ed.).
  - .3 ASHRAE (American Society for Heating, Refrigerating and Air-conditioning Engineers) A Practical Guide to Seismic Restraint; ASHRAE Applications Handbook, Seismic and Wind Restraint Design Chapter; ASHRAE Standard 171-2008: Methods of Test for Seismic restraints.
  - .4 VISCMA (The Vibration Isolation and Seismic Control Manufacturers Association) has developed Testing and Rating Standards for Seismic Restraint Components that comply with Code and ASHRAE based requirements.
- .2 The following guides may be used for supplemental information on typical seismic installation practices. Where a conflict exists between the guides and these construction documents, the construction documents will preside.
  - .1 Federal Emergency Management Agency (FEMA) manual 413, Installing Seismic Restraints for Electrical Equipment, January 2014.

### 1.3 COORDINATION

- .1 Trades shall supply necessary information to the Vibration Isolation Manufacturer regarding equipment to be isolated.
- .2 Provide shop drawings to other trades for setting anchor bolts and other appurtenances necessary for the proper installation of this equipment.

### 1.4 SUBMITTALS

- .1 Shop Drawings:
  - .1 Include placement drawings for electrical equipment and equipment assemblies including runs of cable trays and conduit/cable racks showing methods of attachment to particular structure for each piece of equipment and assembly and provide anchorage/attachment details. Submit samples of materials required to complete seismic restraint work for review if and when required.
- .2 Product Data:
  - .1 Include Seismic Rating Data for each seismically rated isolator or restraint component.
  - .2 Submit copies of documents requested herein, testing reports, certificate of approvals, and commissioning sheets.
- .3 Delegated Design Submittals:

- .1 Submit for Consultant's review, seismic design drawings and product shop drawings with calculations approved and sealed by a Professional Engineer licensed and registered in Place of Work and experienced in such Work. Be responsible for costs for services of this Professional Engineer. Shop drawings to identify equipment type, manufacturer's name, model number and weight of equipment to be restrained.
- .2 Include for manufacturer of vibration control products, to develop/design a seismic restraint system and perform seismic calculations in accordance with latest requirements of local governing building code, requirements of local governing authority having jurisdiction, and additional requirements specified in this article. Design of seismic restraints to include requirements to withstand forces of area rating as per local governing building code requirements.
- .3 Provide calculations to determine restraint loadings for all restrained systems and equipment resulting from seismic forces.

## **1.5 CLOSEOUT SUBMITTALS**

- .1 Include for Professional Engineer to inspect same on site (note that multiple inspections to be required as work progresses) and to provide typewritten Inspection Reports to the Consultant throughout construction and to provide "Letters of Assurance and Conformance" with specified Codes, Standards and Bylaws. Additionally, include copies of documents in Operating and Maintenance Manuals.
- .2 At the completion of the project, upon request by the Consultant, attend a review of the installation on site.
- .3 Provide a sealed written report, certifying that the installations have been completed in accordance with the specified design(s) and shop drawing(s) can be furnished, by others, upon this request.
- .4 The installing contractor shall submit a report to the Consultant, including the manufacturer's representative's final report, indicating that all seismic restraint material has been properly installed, or steps that are to be taken by the Contractor to properly complete the seismic restraint work as per the specifications.
- .5 Record documents: documented torques.

## **1.6 QUALITY ASSURANCE**

- .1 The contractor shall utilize a supplier familiar/experienced with the design of seismic systems to provide a comprehensive package of isolation and seismic restraint for the project. Provide detailed shop drawings showing the proposed restraint system for all required equipment, piping, and ductwork on the project. The shop drawings shall include calculations certified by a Professional Engineer (Structural), licensed in the jurisdiction where the project occurs.
- .2 Certification documents to be signed and sealed by a Professional Engineer (Structural) with at least 5 years experience in the design of seismic restraints.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- .1 Manufacturer List:
  - .1 Eaton TOLCO.
  - .2 Mason Industries.
  - .3 Kinetics Noise Control.
  - .4 nVent (Caddy).

- .5 Vibro-Acoustics.
- .2 Substitutions: Other manufacturers acceptable to the Authority Having Jurisdiction.

## **2.2 DESIGN CRITERIA**

- .1 Review architectural and structural drawings to confirm the seismic criteria for the project.

## **2.3 GENERAL**

- .1 Electrical equipment installation is to meet local governing authority having jurisdiction and code seismic requirements and additional requirements for vibration isolation.
- .2 Provide labour, materials, and equipment required and necessary to seismically restrain electrical equipment and equipment bases including concrete pads, and guarantee function of materials and equipment supplied.
- .3 Provide additional seismic requirements for suspended electrical raceways, luminaires, and other equipment as per governing local authority requirements and requirements of current codes and by-laws.
- .4 Provide seismic restraining devices to restrain mechanical, electrical, and related equipment, and equipment bases including concrete pads, as per governing local authority requirements and requirements of current codes and by-laws.
- .5 In event that inadequate isolation is provided by isolation product manufacturer's isolation package, be responsible for improving isolation to an acceptable standard at no additional cost to contract. Isolation product manufacturer's seismic restraint engineer to verify that seismic restraints and combination isolator/restraints intended for use on project are fit for intended purpose. Be responsible for ensuring that manufacturer's seismic restraints are in compliance with applicable local building code requirements for Place of Work.

## **2.4 VIBRATION CONTROLS AND SEISMIC RESTRAINTS**

- .1 Electrical equipment installation is to meet local governing authority having jurisdiction and code seismic requirements and additional requirements outlined herein.
- .2 Provide labour, materials, and equipment required and necessary to seismically restrain electrical equipment and equipment bases including concrete pads, and guarantee function of materials and equipment supplied.
- .3 Make electrical connections to vibration-isolated equipment with flexible conduit or other flexible means acceptable to the Consultant and local governing authority having jurisdiction so as not to restrict maximum anticipated movement of equipment under seismic excitation movement.
- .4 In event that inadequate isolation is provided by isolation product manufacturer's isolation package, be responsible for improving isolation to an acceptable standard at no additional cost to contract. Isolation product manufacturer's seismic restraint engineer to verify that seismic restraints and combination isolator/restraints intended for use on project are fit for intended purpose. Be responsible for ensuring that manufacturer's seismic restraints are in compliance with applicable local building code requirements for Place of Work.
- .5 Provide additional seismic requirements for suspended electrical raceways, luminaires, and other equipment as per governing local authority requirements and requirements of current codes and by-laws.
- .6 Include for manufacturer of vibration control products to develop/design a seismic restraint system and perform seismic calculations in accordance with latest requirements of local governing building code, requirements of local governing authority having jurisdiction, and additional requirements specified in this article. Design of seismic restraints to include provisions to withstand forces of area rating as per governing building code requirements.

- .7 Provide vibration isolation for equipment or parts connected rigidly to isolated equipment.
- .8 Provide vibration isolation for transformers by means of bridge bearing neoprene isolators or open steel spring isolators. Static deflection of vibration isolators for electrical transformers is indicated below. Isolators requiring a static deflection greater than 13 mm (1/2") to be open spring isolators unless otherwise specified.

Transformer Rating	On Grade (Isolated Slab)	Location on Grade (Continuous Slab)	Upper Floor (Suspended Slab)
Less than 10 kVA	6 mm	6 mm	18 mm
10 – 100 kVA	6 mm	12 mm	25 mm
Greater than 100 kVA	6 mm	25 mm	38 mm

- .9 Standard vibration isolation requirements of equipment such as gensets, power transformers and distribution equipment, to comply with following:
- .1 Choose equipment isolation mounts on basis of achieving 98% vibration isolation efficiency at lowest operating speed. Natural frequency of each vibration isolation system to be at least 1/10 of lowest excitation frequency of rotating machinery, whenever practicable, but in no case less than 1/7. Where structural floor deflection exceeds 1/10 of determined static deflection of isolator, increase isolator static deflection to maintain this minimum ratio of floor to isolator deflection. Where static deflections are shown on drawings, Specifications, or schedules, they are to be used as a guide only. Actual isolators are to achieve required static deflection under load, with at least 50% reserve deflection;
- .2 Submit shop drawings identifying equipment, lowest operating speed, weight, brand, type and location of isolators prior to ordering or fabrication.
- .10 Neoprene Isolators:
- .1 Neoprene isolators to be bridge bearing rated type manufactured from bridge bearing quality neoprene, CAN/CSA-S6-88 Section 11.5.8.
- .2 Where a ribbed pad is used, height of ribs is not to exceed 0.7 times width of rib. A steel layer to be used to distribute load in a multi-layered unit.
- .3 Select neoprene pads or elements at supplier's optimum recommended loading and do not load beyond limit specified in neoprene manufacturer's literature.
- .4 Test neoprene isolators to ASTM specifications. Submit to Consultant, following test data to verify performance of neoprene isolators:
- .1 A data sheet listing all of ASTM test results.
- .2 Load deflection curves for isolator indicating deflection to full compression for both laterally restrained and unrestrained isolators.
- .11 Open Steel Spring Isolators:
- .1 Springs to be "Iso-Stiff" (spring coefficient 1.0 to 1.5) with a working deflection between 0.3 and 0.6 of solid deflection.
- .2 Spring mounts to be complete with levelling devices, minimum 6 mm (1/4") thick neoprene sound pads, and zinc chromate plated hardware.
- .3 Sound pads to be sized for a minimum deflection of 1.2 mm (0.0472") and meet requirements for neoprene isolators.
- .12 Seismic restraints to restrain equipment in all directions and to be sized to meet appropriate Sp factor defined in Table 4.1.9.D of current National Building Code and Commentary J of Supplement to current Code. Calculations bearing seal of a qualified Professional Engineer to be submitted with shop drawings to justify stated seismic restraint requirements.



- .13 Attachment points and fasteners to be capable of withstanding a load of 3 times sized capacity of restraint. Equipment suppliers to provide proof of conformance with this clause by means of shop drawings certified by a qualified Professional Engineer.
- .14 Submit test data to the Consultant, showing load deflection curves up to 1.5 times rated capacity of restraint, and certifying that neither neoprene elements nor restraint body sustained any deformation after release of load.
- .15 Adjust restraints to have clearances between 3 mm (1/8") and 6 mm (1/4") under normal operating conditions of equipment.

## **PART 3 - EXECUTION**

### **3.1 GENERAL**

- .1 The following typical electrical equipment requires seismic protection (as applicable to Project):
  - .1 Transformers;
  - .2 Switchboards/switchgear;
  - .3 Panelboards;
  - .4 Engine/generator and generator control panel;
  - .5 Automatic transfer switches;
  - .6 Fire alarm system, cabinets and devices;
  - .7 Luminaires;
  - .8 Mobile generator connection box;
  - .9 Conduit and duct banks;
  - .10 Genset PLC system and cabinet;
  - .11 Other electrical equipment, as required.

### **3.2 PREPARATION**

- .1 The Contractor shall notify the local representative of the seismic restraint materials manufacturer prior to installing any seismic restraint devices. The Contractor shall seek the representative's guidance in any installation procedures with which he/she is unfamiliar.
- .2 Obtain required training from manufacturer's representative on any special installation procedures. Install components in accordance with manufacturer's instructions to suit specific installation requirements.
- .3 Coordinate size, shape, reinforcement, and attachment of all housekeeping pads supporting vibration/seismically rated equipment. Concrete shall have a minimum compressive strength of 20 kPa (3,000 psi) or as specified by the Consultant. Coordinate size, thickness, doweling, and reinforcing of concrete equipment housekeeping pads and piers with vibration isolation and seismic restraint device manufacturer to ensure adequate space, embedment and prevent edge breakout failures. Pads and piers must be adequately doweled into structural slab.
- .4 Housekeeping Pads must be adequately reinforced and adequately sized for proper installation of equipment anchors. Refer seismic restraint manufacturer's written instructions.
- .5 Coordinate with vibration/seismic restraint manufacturer and the structural engineer of record to locate and size structural supports underneath vibration/seismically restrained equipment (e.g., roof curbs, cooling towers and other similar equipment). Installation of all seismic restraint materials specified in this section shall be accomplished as per the manufacturer's written instructions. Adjust isolators and restraints after piping systems have been filled and equipment is at its operating weight, following the manufacturer's written instructions.



### 3.3 INSTALLATION

- .1 Isolated and restrained equipment, conduit located on roofs must be attached to the structure. Supports (e.g., sleepers) that are not attached to the structure are not acceptable.
- .2 Attach conduit to the trapeze per seismic restraint manufacturer's design. Install cables so they do not bend across sharp edges of adjacent equipment or building structures.
- .3 Do not brace or support equipment to separate portions of the structure that may act differently in response to an earthquake. For example, do not connect a transverse restraint to a wall, and then a longitudinal restraint to either a floor/ceiling/roof at the same braced location.
- .4 Install vertical braces to stiffen hanger rods and prevent buckling per seismic restraint manufacturer's design. Clamp vertical brace to hanger rods. Requirements apply equally to hanging equipment. Do not weld vertical braces to hanger rods.
- .5 General Seismic Controls for Electrical Systems:
  - .1 Seismically restrain per specific code requirements all Electrical components listed below (unless otherwise indicated on the drawings), using seismic cable restraints:
    - .1 Seismically restrain all conduit 78 mm (3") in nominal diameter and larger. Single supported conduit is restrained in the same fashion as single clevis supported pipe.
    - .2 Seismically restrain all conduit, bus ducts, or cable trays that are supported on trapeze bars, that have been assigned a Component Importance Factor equal to [1.5], and that have a total weight greater than 146 N/m (10 lb/ft). This total weight includes not only the conduit, bus duct, or cable trays, but also includes the trapeze bars as well.
  - .2 The Contractor is to provide the weight per unit length for cable trays and bus duct.
  - .3 Single supported conduit and trapeze supported conduit, bus duct, and cable trays to be seismically restrained in a manner similar to mechanical pipes and HVAC ducts.
  - .4 Provide seismic restraint components intended to be used with suspended single supported conduit and trapeze supported conduit, cable trays, and bus ducts. Components intended to both support and restrain distribution systems such as wall mounted conduit, cable trays, and bus ducts will need to be designed and evaluated for both the dead weight load and the design horizontal seismic load.
  - .5 To ensure that the seismic forces are transferred properly to the restraint points, cables should be strapped either individually or in bundles to the cable tray at regular intervals. It is necessary for the conduit, bus ducts, and cable trays to be attached to the trapeze bars sufficiently to resist the design horizontal seismic forces, both transverse (T) and longitudinal (L).
  - .6 Brace a change of direction longer than 3.7 m (12 ft).
  - .7 This specification does not allow the use of the "12-inch rule" where the piping and electrical may be exempted from seismic restraint based on the length of the support rods provided that the rods are not subjected to bending moments.
  - .8 Install restraint cables so they do not bend across edges of adjacent equipment or building structure. Tie back to structure at 45 degrees to the structure.
  - .9 Longitudinal restraints for single pipe supports shall be attached rigidly to the pipe, not to the pipe hanger.
  - .10 For supports with multiple pipes (trapezes), secure pipes to trapeze member with clamps approved for application.
  - .11 Install flexible metal hose loops in piping which crosses building seismic joints, sized for the anticipated amount of movement.
  - .12 Install flexible piping connectors where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is

- anchored to a different structural element from the one supporting the connections as they approach equipment.
- .13 Roof mounted duct is to be installed on sleepers or frames mechanically connected to the building structure. Roof anchors and seismic cables or frames shall be used to resist seismic and wind loading. Wind loading factors shall be determined by the registered design professional.
- .14 Longitudinal restraints for single conduit supports shall be attached rigidly to the pipe, not to the pipe/conduit hanger.
- .15 For supports with multiple conduits (trapezes), secure conduit to trapeze member with clamps approved for application.
- .16 Rod Stiffener Clamps are required where the hanger rod exceeds the maximum length shown in the seismic calculation sheets. They are only required at restraint locations.
- .17 Seismically Rated Beam Clamps are required where welding to or penetrations to steel beams are not approved.
- .18 Adjust restraint cables so that they are not visibly slack. Cable not to support weight during normal operation.
- .19 Seismic systems are to be compatible with requirements for anchoring and guiding of systems.
- .20 Drilled or power-driven anchors or fasteners shall not be permitted for use with seismic control measures.
- .21 Friction due to gravity does not constitute a seismic attachment.
- .22 Seismic restraint connections are not to be connected to the bottom chord of steel joists or the bottom flange of steel beams.
- .23 Standard beam clamps can be used to support restrained components; they cannot be used to connect the seismic restraint to the structure – only for the hanger rods.
- .24 Make electrical connections to vibration-isolated equipment with flexible conduit or other flexible means acceptable to the Consultant and local governing authority having jurisdiction so as not to restrict maximum anticipated movement of equipment under seismic excitation movement.
- .6 Panelboards, Lighting, Emergency Lighting Battery Units, and Emergency Remote Heads
  - .1 Wall mounted panelboards, lighting, emergency lighting battery units, and emergency remote heads can be directly mounted to the building structure with approved fasteners to suit. Minimum two or more anchors shall be provided on each side of all wall mounted equipment.
  - .2 For emergency battery units, pre-installed brackets must be used.

### 3.4 FIELD TESTS AND INSPECTIONS

- .1 Test, adjust, and certify installation. Submit copies of test report to the Consultant.
- .2 Inspect for removal of break away hardware to ensure proper torques of installed systems.
- .3 For non-visually verifiable product, manufacturers to verify proper torque for a minimum 10% of application. Document torques for applications per manufacturer's instructions.
- .4 The contractor shall notify the local representative of the seismic restraint materials manufacturer mid-way through the listed project if they require an inspection of any and all vibration and seismic restraint devices already installed. A typewritten report of any installation errors, improperly selected devices, or other fault in the system which could affect the performance of the system shall be documented and the contractor shall perform all steps that are required from this written report to properly complete the vibration and seismic restraint work as per the specifications. Report to include clear sketches as required.
- .5 The installing contractor shall submit a report to the Consultant, including the manufacturer's representative's final report, indicating that all seismic restraint material has been properly installed,

or steps that are to be taken by the contractor to properly complete the seismic restraint work as per the specifications.

**END OF SECTION**

## PART 1 - GENERAL

### 1.1 SECTION INCLUDES

- .1 Nameplates and labels.
- .2 Wire and cable markers.
- .3 Conduit markers.
- .4 Receptacle labels.
- .5 Signage.

### 1.2 SUBMITTALS

- .1 Product Data: Provide catalogue data for nameplates, labels, and markers.
- .2 Provide shop drawings of nameplates for Consultant's review prior to fabrication (scale 1:1)
- .3 Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under regulatory requirements. Include instructions for storage, handling, protection, examination, preparation and installation of Product.

### 1.3 REGULATORY REQUIREMENTS

- .1 Provide products listed and classified by CSA (Canadian Standards Association) as suitable for the purpose specified and indicated.

## PART 2 - PRODUCTS

### 2.1 NAMEPLATES AND LABELS

- .1 Nameplates:
  - .1 Engraved three-layer laminated plastic, letters on contrasting background.
  - .2 Colours to match existing building system, where applicable. If no building system exists, use the following:
    - .1 347/600 Volt System: White text on Blue Background.
    - .2 120/208 Volt System: Black text on White Background.
    - .3 Fire Detection System: White text on Red Background.
    - .4 Emergency Lighting System: Red text on White Background.
    - .5 LV Systems: White text on Green Background.
    - .6 120/208 Volt Uninterruptable Power Supply (UPS): White text on Orange Background.
  - .3 Confirm colours with Engineer prior to ordering nameplates.
- .2 Equipment Nameplates to indicate:
  - .1 Equipment/Panelboard ID
  - .2 Ampacity.
  - .3 Voltage
  - .4 Number of Phases
  - .5 Number of wires in system

- .6 Interrupting Capacity
- .7 Size, number of poles, Panelboard ID, and circuit number of upstream overcurrent protection device.
  - .1 Location of upstream device if not in the same room.
- .3 Coordination Study Labels.
- .4 Arc Flash Study Labels.
- .5 Locations:
  - .1 Distribution panelboards, and individual distribution panelboard branch breakers.
  - .2 Receptacle panelboards.
  - .3 Each electrical distribution and control equipment enclosure.
  - .4 Uninterruptible Power Supply.
  - .5 Mechanical Equipment.
  - .6 UPS Receptacles.
  - .7 Disconnects, starters and contactors: indicate equipment being controlled and voltage.
  - .8 Terminal cabinets, junction boxes, and pull boxes: indicate system and voltage.
  - .9 Transformers: indicate capacity, primary and secondary voltages.
- .6 Letter Size:
  - .1 Use 3 mm letters for identifying individual equipment and loads.
  - .2 Use 6 mm letters for identifying grouped equipment and loads.
- .7 Labels:
  - .1 Mechanically fastened with sheet metal screws, with 5 mm white letters on black background.
  - .2 White letters on red background for UPS and equipment, and devices downstream of UPS.
  - .3 Labels: embossed plastic labels with 6 mm high letters unless specified otherwise.
  - .4 Wording on nameplates and labels to be approved by the Engineer prior to manufacture.
  - .5 Allow for minimum of twenty-five (25) letters per nameplate and label.
  - .6 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.
  - .7 Terminal cabinets and pull boxes: indicate system and voltage.

## 2.2 WIRING IDENTIFICATION

- .1 Identify wiring with permanent indelible identifying markings, numbered, on both ends of phase conductors of feeders and branch circuit wiring.
- .2 Maintain phase sequence and colour coding throughout.
- .3 Colour coding: to CSA C22.1.
- .4 Use colour coded wires in communication cables, matched throughout system.

## 2.3 WIRE MARKERS

- .1 Description: tape, split sleeve, or tubing type wire markers.
- .2 Locations: Each conductor at panelboard gutters, pull boxes, outlet and junction boxes and each load connection.
- .3 Legend:

- .1 Power and Lighting Circuits: Branch circuit or feeder number indicated on drawings.
- .2 Control Circuits: Control wire number indicated on shop drawings.

## 2.4 CONDUIT MARKERS

- .1 Colour code conduits, boxes and metallic sheathed cables.
- .2 Location: Provide markers for each conduit longer than 2 m.
- .3 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.
- .4 Colours to match equipment nameplate background colour:
  - .1 347/600 Volt System: Blue.
  - .2 120/208 Volt System: Black.
  - .3 Fire Alarm System: Red.
  - .4 Emergency Lighting System: Red/White.
  - .5 LV Systems (EPO, Remote Monitoring, Generator Control, Communications): Green.
  - .6 120/208 Volt Uninterruptable Power Supply (UPS): Orange
- .5 Confirm colours with Engineer prior to commencing rough-in.

## 2.5 BRANCH BREAKER LABELS

- .1 General:
  - .1 Legibly identify every circuit and circuit modification as to its clear, evident, and specific purpose or use. Include sufficient detail to allow each circuit to be distinguished from all others.
  - .2 Label spare positions that contain unused overcurrent devices or switches.
  - .3 Do not describe any circuit in a manner that depends on transient conditions of occupancy.
- .2 Switchboards, distribution panelboards, enclosed breakers, and disconnect switches:
  - .1 Locate identification at each switch.
  - .2 Branch breaker nameplates on switchboards, distribution panelboards and switchboards, and generator load breakers to indicate:
    - .1 Locate identification at each switch on a switchboard.
    - .2 Identification of downstream equipment fed from the breaker.
      - .1 Location of downstream device if not in the same room.
    - .3 Breaker size and number of poles.
    - .4 Interrupting Capacity.
    - .5 Circuit number (where applicable).
    - .6 Do not describe any circuit in a manner that depends on transient conditions of occupancy.
- .3 Lighting and Receptacle Panelboards:
  - .1 Provide a circuit directory that is located on the face or inside of the panel door.
  - .2 Do not describe any circuit in a manner that depends on transient conditions of occupancy.

## **2.6 RECEPTACLE LABELS**

- .1 Label all receptacles with the panelboard ID and circuit number.
- .2 Use receptacle labels by electronic labeller Brother P-Touch, model PT-20/25, Dymo-Tape or approved equal.
- .3 Location: On receptacle wall plate.

## **PART 3 - EXECUTION**

### **3.1 EQUIPMENT NAMEPLATES FROM MANUFACTURERS**

- .1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.
- .2 Manufacturers' nameplates and CSA labels are to be visible and legible after equipment is installed. Provide warning signs, as specified, or to meet requirements of Inspection Department, Health and Safety, and the Consultant.
- .3 Label power outlets with circuit identification on visible portion of faceplate or surface mounted outlet box.

### **3.2 CONDUIT IDENTIFICATION**

- .1 Locate labels as follows:
  - .1 At every end of every conduit, duct or cable run, adjacent to item of equipment serviced.
  - .2 On each exposed conduit, duct or cable passing through a wall, partition or floor (one on each side of such wall partition or floor).
  - .3 At intervals of 50'-0" along every exposed conduit, duct or cable run exceeding 50'-0" in length.
  - .4 At every access point on concealed conduit duct or cable.
- .2 Place labels so as to be visible from 5'-0" above adjacent floor platform.

### **3.3 PREPARATION**

- .1 Degrease and clean surfaces to receive nameplates and labels.

### **3.4 APPLICATION**

- .1 Confirm colours prior to start of work.
- .2 Install nameplate and label parallel to equipment lines.
- .3 Secure nameplate to equipment front using adhesive.
- .4 Secure nameplate to inside surface of door on panelboard that is recessed in finished locations.
- .5 Identify conduit using field painting.
- .6 Paint coloured band on each conduit longer than 2 m.
- .7 Paint bands 6 m on centre.

### **3.5 LABELLING**

- .1 Colour code wiring consistently throughout the installation and generally match colour coding of internal wiring of pre-wired components.

- .2 Label wiring with point name using Thomas & Betts 12 character polestar metalized labels with 3 rows of characters per label, or equal by Brady. Label to occur as a minimum at both ends and at pull boxes of the wiring run.
- .3 Identify all pull boxes, junction boxes, etc. (installed as part of this project or used by this project) with the exact use of the box. Indelible felt pen marker is acceptable.
- .4 Label light control items with point name using Thomas & Betts 12 character label, or equal by Brady. Label to be black lettering on clear backing.
- .5 Label relays and controllers inside panels using Thomas & Betts 12 character label, or equal by Brady.
- .6 Provide red, 13 mm (1/2 inch) diameter, sticker on emergency light fixture frame. Include circuit number on sticker with thin permanent black mark pen.

### **3.6 LABELS AND SIGNS**

- .1 Manufacturers' nameplates and CSA labels are to be visible and legible after equipment is installed. Provide warning signs, as specified, or to meet requirements of Inspection Department, Health and Safety, and the Consultant.
- .2 Label power outlets with circuit identification on visible portion of faceplate or surface mounted outlet box.

**END OF SECTION**



## **PART 1 - GENERAL**

### **1.1 SECTION INCLUDES**

- .1 Provide a short circuit and coordination study for the [existing and] new portions of electrical distribution system. The basic analysis shall include a protective device evaluation, and a protective device coordination study.
- .2 The project shall begin at the point of utility service for the facility and continue down through the system to all downstream distribution and branch panelboards, motor control centres and significant motor locations.
- .3 The project shall include any new generators and any associated emergency power distribution equipment, including automatic transfer switches and generator ground fault protection.

### **1.2 RELATED REQUIREMENTS**

- .1 Section 26 05 73.19 – Arc-Flash Hazard Analysis.
- .2 Single Line Diagram.

### **1.3 REFERENCE STANDARDS**

- .1 American National Standards Institute (ANSI):
  - .1 ANSI C37.010 – Standard Application Guide for AC High Voltage Circuit Breakers Rated on a Symmetrical Current Basis.
  - .2 ANSI C37.13 – Standard for Low Voltage AC Power Circuit Breakers Used in Enclosures.
  - .3 ANSI C 37.41 – Standard Design Tests for High Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches and Accessories.
  - .4 ANSI C57.12.00 – Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers.
- .2 Institute of Electrical and Electronics Engineers, Inc. (IEEE):
  - .1 IEEE 141 – Recommended Practice for Electric Power Distribution and Coordination of Industrial and Commercial Power Systems.
  - .2 IEEE 241 – Recommended Practice for Electric Power Systems in Commercial Buildings.
  - .3 IEEE 242 – Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems.
  - .4 IEEE 399 – Recommended Practice for Industrial and Commercial Power System Analysis.
  - .5 IEEE 1015 – Recommended Practice for Applying Low-Voltage Circuit Breakers Used in Industrial and Commercial Power Systems.

### **1.4 SUBMITTALS**

- .1 In accordance with Section 01 33 00:
- .2 Submit the following:
  - .1 Submit electronic copy of the protection coordination study for Consultant's review.
  - .2 Shop drawings for equipment affected by the coordination study will not be reviewed until the coordination study has been submitted and reviewed.
  - .3 Include a one-line diagram of the system.
- .3 Projection System Coordination:

- .1 Prepare a graph or coordination curves, prior to manufacture of service entrance and distribution equipment on K & E No. 336E Time-Current characteristic graph paper. Time-current characteristics shall be plotted of the following:
    - .1 Supply Authorities relays or fuses protecting incoming service (Contractor under this section shall obtain this information).
    - .2 Main and feeder protective devices at every voltage level used in distribution system.
    - .3 Protective devices associated with largest motor and/or refrigeration compressor.
  - .2 Preliminary submission of graph for comment will be accepted. Submit graph to Supply Authority for approval by them as providing satisfactory co-ordination. When curves have been approved by Supply Authority, they shall be submitted for approval. After approval has been obtained, order protective devices, and calibrate to conform with these curves.
  - .3 Each time-current characteristic curve sheet shall include:
    - .1 A single line diagram for the portion of the system involved.
    - .2 Transformer damage curves (where applicable).
    - .3 Cable damage curves (where applicable).
    - .4 Available fault levels for the portion of the system involved.
  - .4 Consult manufacturer of the refrigeration compressors and obtain recommendations for settings on starters. Incorporate information in co-ordination curves and submit the associated curves to Compressor Manufacturer and obtain approval from the manufacturer.
  - .5 Compressor manufacturer and mechanical trade contractor will determine and calibrate proper protection on motor starters and will ensure that it coordinates with protective devices on switchboard.
  - .6 Co-ordination curves, mentioned above, shall be prepared by distribution equipment manufacturers as soon as possible after award of contract.
  - .7 At the option of this contractor under this section, these co-ordination curves may also be prepared by an independent testing organization. In this case, the independent testing organization shall determine the proper settings of all protective relays and devices and pass them on to the switchboard manufacturer for incorporation into the switchboards. Include all associated costs in the tender.
  - .8 Distribution Equipment manufacturers shall examine drawings and specifications prior to award of contract to ensure that relays and devices being supplied by them will co-ordinate satisfactorily to Supply Authority requirements. Payment will not be allowed, after award of contract, for extra charges due to device changes to comply with recommended practices, due to oversight or negligence by distribution equipment manufacturers.
- .4 [Upon review by the Consultant, submit the coordination study to the local electrical utility for their review and approval.]

#### **1.5 CLOSEOUT SUBMITTALS**

- .1 The Engineer who prepared the report shall visit the site and confirm that the feeder sizes as installed are consistent with the report as submitted.
- .2 Submit final version of the report with as-constructed feeder lengths and feeder sizes.
- .3 Provide one electronic copy of the coordination study. Provide one hardcopy of the final report in the O&M manual, and provide one electronic copy of the final report.

## 1.6 QUALITY ASSURANCE

- .1 Preparer Qualifications: Firm experienced in the analysis, evaluation, and coordination of electrical distribution systems and similar to the system for this project.
- .2 The study shall be prepared in accordance with the latest edition of NETA ATS, the Canadian Electrical Code, as well as manufacturer's recommendations.
- .3 Short-Circuit Analysis and Coordination Study shall be performed by a registered Professional Engineer. Study shall be signed and sealed by the Engineer. The Engineer shall have a minimum of eight years experience in the analysis, evaluation, and coordination of electrical distribution systems.
- .4 The firm conducting the study shall have one million worth of Professional Liability Insurance in addition to standard general insurance.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- .1 Independent Testing Organizations
  - .1 AC Tesla.
  - .2 Brosz and Associates.
  - .3 C-INTECH.
  - .4 Eastenghouse.
  - .5 G.T. Wood.
  - .6 Haronitis and Associates Ltd.
  - .7 Qualus (formerly Enkompass).
- .2 [Electrical distribution manufacturers:]
  - .1 Eaton.
  - .2 Schneider Electric.

### 2.2 PROTECTIVE DEVICE COORDINATION STUDY

- .1 Prepare coordination time-current characteristic curves to determine the required settings/sizes of the protective devices to maximize selectivity. The utility upstream protective device feeding the facility shall be maintained as the upper limit for coordination. These settings shall be obtained by the preparer, along with any other protective device setting requirements. The coordination curves shall be prepared on log-log paper and illustrate adequate clearing times between series devices. The curves shall be created through the use of the study software package, but must reflect actual protective devices to be installed. Adequate time-current curves shall be generated to depict coordination. In addition, protective device characteristics shall be suitably determined to reflect calculated short-circuit levels at the location.
- .2 A narrative analysis shall accompany each coordination curve sheet and describe the coordination and protection in explicit detail. All curve sheets shall be multi-colour for improved clarity. Areas lacking complete coordination shall be highlighted and reasons provided for allowing condition to remain or provide solution to resolve situation. System coordination, recommended ratings, and setting of protective devices shall be accomplished by a registered professional electrical engineer with a minimum of eight years of current experience in the coordination of electrical power systems.
- .3 The following information shall be provided on all curve sheets:
  - .1 Device identification and associated settings/size.

- .2 Voltage at which curves are plotted.
- .3 Current multiplier.
- .4 ANSI frequent fault damage curve.
- .5 Cable insulation damage curves.
- .6 Transformer inrush point.
- .7 Single-line for the portion of the system.
- .8 Motor starting profiles (where applicable).

### **2.3 SINGLE LINE DIAGRAM**

- .1 The final report shall include a multi-colour single line diagram of the electrical distribution system within the scope of the project. The single line diagram shall include:
  - .1 Transformer rating, voltage ratio, impedance, and winding connection.
  - .2 Feeder cable phase, neutral and ground sizes, length of cable, conductor material, and conduit size and type.
  - .3 Switchgear, switchboards, panelboards, MCC's, fuses, circuit breakers, ATS's and switches continuous current ratings.
  - .4 Protective relays with appropriate device numbers and CT's and PT's with associated ratios.
  - .5 Detailed legend indicating device type identification and other significant details.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- .1 Obtain fault level and X/R ratio information from the utility.

### **3.2 SUMMARY**

- .1 The results of the system studies shall be summarized in a final report.
- .2 Where required, copies of the final report shall be submitted to the Supply Authority for their review and approval. Submit approved copies of the report to the Consultant.

### **3.3 ADJUSTING**

- .1 The contractor shall engage the manufacturer's service group or alternately a qualified independent testing firm to perform field adjustments of the protective devices as required for placing the equipment in final operating condition. The settings shall be in accordance with the approved short circuit study and protective device evaluation / coordination study.
- .2 Necessary field settings of devices and adjustments and minor modifications to equipment to accomplish conformance with the approved protective device coordination study, shall be carried out by manufacturer's service group.
- .3 Submit a final service report confirming that settings have been completed.

**END OF SECTION**

## PART 1 - GENERAL

### 1.1 SECTION INCLUDES

- .1 Provide an Arc Flash Hazard Analysis Study per the requirements described in CSA Z462 Standard for Electrical Safety in the Workplace.
- .2 The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are obtained in CSA Z462-08, Annex D, or more recent version of the standard as cited by this Section.
- .3 The scope of the studies shall include all existing distribution equipment and all new distribution equipment supplied by the equipment manufacturer under this contract.

### 1.2 RELATED REQUIREMENTS

- .1 Section 26 05 73.16 – Coordination Studies.
- .2 Single Line Diagram.

### 1.3 REFERENCES

- .1 Institute of Electrical and Electronics Engineers, Inc. (IEEE):
  - .1 IEEE 141 – Recommended Practice for Electric Power Distribution and Coordination of Industrial and Commercial Power Systems.
  - .2 IEEE 242 – Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems.
  - .3 IEEE 399 – Recommended Practice for Industrial and Commercial Power System Analysis.
  - .4 IEEE 241 – Recommended Practice for Electric Power Systems in Commercial Buildings.
  - .5 IEEE 1015 – Recommended Practice for Applying Low-Voltage Circuit Breakers Used in Industrial and Commercial Power Systems.
  - .6 IEEE 1584-2018 - Guide for Performing Arc-Flash Hazard Calculations.
- .2 American National Standards Institute (ANSI):
  - .1 ANSI C57.12.00 – Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers.
  - .2 ANSI C37.13 – Standard for Low Voltage AC Power Circuit Breakers Used in Enclosures.
  - .3 ANSI C37.010-2016 – Standard Application Guide for AC High Voltage Circuit Breakers Rated on a Symmetrical Current Basis.
  - .4 ANSI C37.41 – Standard Design Tests for High Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches and Accessories.
- .3 CSA Group:
  - .1 CSA C22.1:24, Canadian Electrical Code, Part 1 (26th Edition), Safety Standard for Electrical Installations.
  - .2 Ontario Electrical Safety Code (29th edition/2024).
  - .3 CSA Z462:24, Workplace electrical safety.

### 1.4 SUBMITTALS

- .1 Submit the arc flash study to the Consultant prior to receiving final review of the distribution equipment shop drawings and/or prior to release of equipment drawings for manufacturing. If formal completion of the studies may cause delay in equipment manufacturing, approval from the engineer

may be obtained for preliminary submittal of sufficient study data to ensure that the selection of device and characteristics will be satisfactory.

- .2 [Upon review by the Consultant, submit the arc-flash study to the local electrical utility for their review and approval.]

## 1.5 CLOSEOUT SUBMITTALS

- .1 The results of the protective device coordination and arc flash hazard analysis studies shall be summarized in a final report. Three (3) bound copies of the complete final report shall be submitted. Additional copies of the complete report with input and output data shall be provided on CD in PDF format.
- .2 The report shall include the following sections:
  - .1 Executive Summary.
  - .2 Descriptions, purpose, basis, and scope of the study.
  - .3 Tabulations of circuit breaker, fuse, and other protective device ratings versus calculated short circuit duties.
  - .4 Protective device time versus current coordination curves, tabulations of relay and circuit breaker trip unit settings, fuse selection.
  - .5 Fault current calculations including a definition of terms and guide for interpretation of the computer printout.
  - .6 Details of the incident energy and flash protection boundary calculations.
  - .7 Recommendations for system improvements, where needed.
  - .8 Single Line Diagram.
- .3 Arc flash labels (refer to CSA Z462 Annex Q) shall be provided in hard copy only.

## 1.6 QUALIFICATIONS

- .1 Arc flash hazard analysis studies shall be conducted under the supervision and approval of a licensed Professional Electrical Engineer skilled in performing and interpreting the power system studies.
- .2 The licensed Professional Electrical Engineer shall be a full-time employee of the equipment manufacturer or an approved engineering firm.
- .3 The licensed Professional Electrical Engineer shall have a minimum of eight (8) years of experience in performing power system studies.
- .4 The equipment manufacturer or approved engineering firm shall demonstrate experience with Arc Flash Hazard Analysis by submitting names of at least ten actual arc flash hazard analysis it has performed in the past year.

## 1.7 COMPUTER ANALYSIS SOFTWARE

- .1 The studies shall be performed using the latest revision of the SKM or equivalent.

# PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- .1 Independent Testing Organizations:
  - .1 AC Tesla.

- .2 Brosz and Associates.
- .3 C-INTECH.
- .4 Eastenghouse.
- .5 G.T. Wood.
- .6 Haronitis and Associates Ltd.
- .7 Qualus (formerly Enkompass).
- .2 [Electrical distribution manufacturers:]
  - .1 Eaton.
  - .2 Schneider Electric.

## 2.2 STUDIES

- .1 The contractor shall furnish an Arc Flash Hazard Analysis Study per CSA Z462, reference Section 4.1.8.2.2, 4.3.3.

## 2.3 DATA COLLECTION

- .1 Contractor shall furnish all data as required by the power system studies. The Engineer performing arc flash hazard analysis studies shall furnish the Contractor with a listing of required data immediately after award of the contract. The Contractor shall expedite collection of the data to assure completion of the studies as required for final approval of the distribution equipment shop drawings and/or prior to the release of the equipment for manufacturing.
- .2 Source combination may include present and future motors and generators.
- .3 If applicable, include fault contribution of existing motors in the study. The Contractor shall obtain required existing equipment data, if necessary, to satisfy the study requirements.

## 2.4 ARC FLASH HAZARD ANALYSIS

- .1 The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in CSA Z462 Annex D.
- .2 The flash protection boundary and the incident energy shall be calculated at all significant locations in the electrical distribution system (switchboards, switchgear, panelboards, and splitters) where work could be performed on energized parts.
- .3 The Arc-Flash Hazard Analysis shall include all significant locations in 240 volt and 208 volt systems fed from transformers equal to or greater than 112.5 kVA where work could be performed on energized parts.
- .4 Safe working distances shall be based upon the calculated arc flash boundary considering an incident energy of 1.2 calories per square centimetre.
- .5 When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short-circuit and coordination study model. Ground overcurrent relays should not be taken into consideration when determining the clearing time when performing incident energy calculations.
- .6 The short-circuit calculations and the corresponding incident energy calculations for multiple system scenarios must be compared and the greatest incident energy must be uniquely reported for each equipment location. Calculations must be performed to represent the maximum and minimum contributions of fault current magnitude for all normal and emergency operating conditions. The minimum calculation will assume that the utility contribution is at a minimum and will assume a minimum motor contribution (all motors off). Conversely, the maximum calculation will assume a maximum contribution from the utility and will assume the maximum amount of motors to be



operating. Calculations shall take into consideration the parallel operation of synchronous generators with the electric utility, where applicable.

- .7 The incident energy calculations must consider the accumulation of energy over time when performing arc flash calculations on buses with multiple sources. Iterative calculations must take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors and generators should be decremented as follows:
  - .1 Fault contribution from induction motors should not be considered beyond 3-5 cycles.
- .8 Fault contribution from synchronous motors and generators should be decayed to match the actual decrement of each as closely as possible (e.g. contributions from permanent magnet generators will typically decay from 10 per unit to 3 per unit after 10 cycles).
- .9 For each equipment location with a separately enclosed main device (where there is adequate separation between the line side terminals of the main protective device and the work location), calculations for incident energy and flash protection boundary shall include both the line and load side of the main breaker.
- .10 When performing incident energy calculations on the line side of a main breaker (as required per above), the line side and load side contributions must be included in the fault calculation.
- .11 Mis-coordination should be checked amongst all devices within the branch containing the immediate protective device upstream of the calculation location and the calculation should utilize the fastest device to compute the incident energy for the corresponding location.
- .12 Arc Flash calculations shall be based on actual overcurrent protective device clearing time.
- .13 Maximum clearing time will be capped at 2 seconds based on IEEE 1584.
- .14 Where it is not physically possible to move outside of the flash protection boundary in less than 2 seconds during an arc flash event, a maximum clearing time based on the specific location shall be utilized.

## 2.5 REPORT SECTIONS

- .1 Incident energy and flash protection boundary calculations:
  - .1 Arcing fault magnitude.
  - .2 Protective device clearing time.
  - .3 Duration of arc.
  - .4 Arc flash boundary.
  - .5 Working distance.
  - .6 Incident energy.
  - .7 Hazard Risk Category.
  - .8 Recommendations for arc flash energy reduction.

## PART 3 - EXECUTION

### 3.1 FIELD ADJUSTMENT

- .1 Adjust relay and protective device settings according to the recommended settings table provided by the coordination study. Field adjustments to be completed by the engineering service division of the equipment manufacturer under the Startup and Acceptance Testing contract portion.
- .2 Make minor modifications to equipment as required to accomplish conformance with short circuit and protective device coordination studies.
- .3 Notify Owner in writing of any required major equipment modifications.



### 3.2 ARC FLASH WARNING LABELS

- .1 The contractor of the Arc Flash Hazard Analysis shall provide a 90 mm (3.5 in) by 125 mm (5 in) thermal transfer type label of high adhesion polyester for each work location analyzed.
- .2 All labels will be based on recommended overcurrent device settings and will be provided after the results of the analysis have been presented to the owner and after any system changes, upgrades or modifications have been incorporated in the system.
- .3 The label shall include the following information, at a minimum:
  - .1 Location designation.
  - .2 Nominal voltage.
  - .3 Flash protection boundary.
  - .4 Hazard risk category.
  - .5 Incident energy.
  - .6 Working distance.
  - .7 Engineering firm and issue date.
  - .8 Labels shall be machine printed, with no field markings.
- .4 Arc flash labels shall be provided in the following manner and all labels shall be based on recommended overcurrent device settings.
  - .1 For each 600 volt, and applicable 208 volt panelboard, one arc flash label shall be provided.
  - .2 For each motor control centre, one arc flash label shall be provided.
  - .3 For each low voltage switchboard, one arc flash label shall be provided.
  - .4 For each switchgear, one flash label shall be provided.
  - .5 For medium voltage switches one arc flash label shall be provided.
- .5 Arc Flash Warning Label General Instructions:
  - .1 Only qualified electricians who recognize and avoid the electrical and Arc Flash hazards are allowed to place the arc flash warning labels.
  - .2 Electricians should wear suitable PPE, such as electrical safety boots, Safety Glasses, etc. while performing labeling.
  - .3 Generally, arc flash label shall be put on a prominent pre-cleaned place on the front of the electrical equipment (such as switchgear, panel, disconnect switch, generator output breaker). Label should be visible and readable, displayed horizontally, attached flatly and securely, and not allowed to cover other signs or labels on the equipment.
  - .4 Under the special request of the client, labels could be put on the back of the panel door when the panel is located in clean and finished spaces such as an office area.
  - .5 When putting a label on small equipment with no space labeling on the wall just beside the equipment is allowed.
  - .6 Special request may be attached to this General Instruction. For examples, more than one identical label is applied for large equipment; different labels could be applied for different sections of one equipment; for a splitter with several disconnect switches only one label is placed on the splitter for this group.
  - .7 Take the pictures for each label to indicate both names of the label and equipment and labeling area of the equipment. Email these pictures to the Consultant for quality control and record.

**END OF SECTION**

## **PART 1 - GENERAL**

### **1.1 SECTION INCLUDES**

- .1 Electrical connections to equipment specified in other sections.

### **1.2 RELATED REQUIREMENTS**

- .1 Division 08 – Openings.
- .2 Division 11 – Equipment.
- .3 Division 22 – Plumbing.
- .4 Division 23 – Heating, Ventilating, and Air Conditioning.

### **1.3 REFERENCES**

- .1 NEMA WD 1 - General Colour Requirements for Wiring Devices.
- .2 NEMA WD 6 - Wiring Devices - Dimensional Requirements.

### **1.4 COORDINATION**

- .1 Coordinate work to Section 01.
- .2 Obtain and review shop drawings, product data, and manufacturer's instructions for equipment provided under other sections.
- .3 Determine connection locations and requirements.
- .4 Sequence rough-in of electrical connections to coordinate with installation schedule for equipment.
- .5 Sequence electrical connections to coordinate with start-up schedule for equipment.

### **1.5 SUBMITTALS**

- .1 Submit to Section 01.
- .2 Product Data: Provide wiring device manufacturer's catalogue information showing dimensions, configurations, and construction.
- .3 Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

### **1.6 REGULATORY REQUIREMENTS**

- .1 Provide products listed and classified by testing firm acceptable to authority having jurisdiction as suitable for purpose specified and shown.

## **PART 2 - PRODUCTS**

### **2.1 COMMON MOTOR REQUIREMENTS**

- .1 Motors up to and including 1/3 HP, shall be 1 phase, 60 Hz, 120 volts.
- .2 Motors 1/2 HP and above shall be 3 phase, 60 Hz, 575 volts or 208 volts.

## 2.2 CORDS AND CAPS

- .1 Attachment Plug Construction: Conform to NEMA WD 1.
- .2 Configuration: NEMA WD 6; match receptacle configuration at outlet provided for equipment.
- .3 Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.

## PART 3 - EXECUTION

### 3.1 WIRING OF EQUIPMENT PROVIDED UNDER OTHER DIVISIONS

- .1 Use the following procedure with regard to wiring of motors and equipment provided under other Divisions.
- .2 The following equipment shall be responsibility of the trade supplying the equipment unless otherwise noted, in accordance with the requirements laid out in the individual section, or this division:
  - .1 Motors.
  - .2 Starters.
  - .3 Variable Frequency Drives.
  - .4 Motor Control Centres.
  - .5 Control wiring.
- .3 In every instance, install starter, motor control centre, variable frequency drivers (VFD), etc. and wire to line side of the starter, the Motor Control Centre, or VFD. Extend wiring from starter, motor control centre or VFD to motor as indicated.
- .4 Provide all wiring for starters and VFD's from supply to starter to VFD and to motor. Coordinate requirements with the appropriate trade.
- .5 Provide 500 mm of liquid tight flexible metal conduit for final connection to motor. Provide disconnect switches where required by code, and as indicated on the drawings.
- .6 Where individual starters and controls are grouped together provide a panel for mounting this equipment. Provide a feeder, main fused disconnect and a splitter of adequate size and capacity and wire to line side of the starters on this panel and from starters to motors.
- .7 Equipment, General
  - .1 Ascertain exact locations of starters, motor control centres, motors, etc. from drawings and coordinate exact locations with the supplying trade.
  - .2 Control wiring shall be the responsibility of the supplying trade.
    - .1 Control wiring shall be in accordance with Section 26 05 19, and Section 26 05 23.
    - .2 Control wiring shall be installed in conduit in accordance with Section 26 05 33.13.
- .8 Conveying Equipment (e.g. Elevators): in accordance with Section 26 05 83.14.
- .9 Plumbing Equipment
  - .1 Ascertain exact locations of starters, motor control centres, motors, infra-red plumbing fixture controls from Mechanical Drawings and coordinate exact locations with plumbing trade.
  - .2 Provide branch circuit wiring and an outlet for each infra-red plumbing fixture control.
  - .3 Control wiring shall be the responsibility of the plumbing trade, as described above.
- .10 HVAC Equipment

- .1 Ascertain exact locations of starters, motor control centres, motors, motorized dampers, VAV boxes, and heating control valves from HVAC drawings and coordinate exact locations with HVAC Division.
- .2 In the case of unit heaters, reheat coils and cabinet unit heaters, terminate wiring on terminals provided. Control wiring, thermostats, or other control devices shall be the responsibility of the HVAC trade, as described above.
- .3 Provide branch circuit wiring and an outlet for each motorized damper, variable air volume (VAV) box, or heating control valve. Control wiring shall be the responsibility of the HVAC trade, as described above.

### **3.2 PROVISIONS FOR BUILDING MANAGEMENT SYSTEM**

- .1 Refer to drawing notes for requirements.
- .2 BMS work is under the work of Mechanical Divisions. From equipment as noted on drawings, extend suitable wiring in conduit from equipment contacts to designated BMS panel swerving area, terminating wiring and conduit in a junction box. Leave wiring un-terminated with slack coiled length of minimum 2 m (6') long. Clearly label junction box and wiring end for termination onto BMS panel by respective Mechanical Trade.
- .3 Coordinate work with Mechanical Division Contractor.

### **3.3 EXAMINATION**

- .1 Verify that equipment is ready for electrical connection, wiring, and energization.

### **3.4 ELECTRICAL CONNECTIONS**

- .1 Make electrical connections to equipment manufacturer's instructions.
- .2 Make conduit connections to equipment using flexible conduit. Use liquid-tight flexible conduit with watertight connectors in damp or wet locations.
- .3 Make wiring connections using wire and cable with insulation suitable for temperatures encountered in heat producing equipment.
- .4 Provide receptacle outlet where connection with attachment plug is indicated. Provide cord and cap where field-supplied attachment plug is indicated.
- .5 Provide suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.
- .6 Install disconnect switches, controllers, control stations, and control devices as indicated.
- .7 Modify equipment control wiring with terminal block jumpers as indicated.
- .8 Provide interconnecting conduit and wiring between devices and equipment where indicated.
- .9 Coolers and Freezers: Cut and seal conduit openings in freezer and cooler walls, floor, and ceilings.

### **3.5 GROUNDING AND BONDING**

- .1 Provide required grounding and bonding work in accordance with the drawings and in accordance with requirements of governing authorities, including the OESC. Review grounding requirements of project areas with specific requirements of use of areas as outlined in Contract Documents. Review exact requirements with Consultant prior to start of work.
- .2 Review medical equipment grounding with equipment vendor and provide requirements to suit.
- .3 Throughout the renovated areas, solidly ground and bond the system equipment and make all required grounding connections to all new electrical devices and apparatus. Ground conductors shall be insulated copper wire connected with approved fittings in accordance with the OESC.

- .4 All ground connections in slab shall be made using OESC approved welded copper connections - Cadweld as supplied by Erico Products or approved equal.
- .5 Service conductors exceeding 400 amperes shall be provided with minimum No. 3/0 AWG grounding conductors, unless otherwise noted.
- .6 Do not use conduit systems as ground conductors in patient care areas or in areas as per local governing electrical code requirements.
- .7 Ground and bond telecommunication components as required.
- .8 Provide conductors as sized on drawings and in accordance with OESC requirements, but which shall be of size no smaller than the requirements specified herein this article or on drawings.

**END OF SECTION**

## **PART 1 - GENERAL**

### **1.1 SECTION INCLUDES**

- .1 Occupancy and Vacancy sensors.
- .2 Power packs, and auxiliary relays, momentary switches.
- .3 Timers.
- .4 Daylight harvesting photo sensors.
- .5 Emergency lighting control units.

### **1.2 PRODUCTS INSTALLED BUT NOT SUPPLIED UNDER THIS SECTION**

- .1 Line voltage manual control devices, as described in Section 26 27 26 – Wiring Devices.

### **1.3 RELATED REQUIREMENTS**

- .1 Section 26 08 50 – Commissioning of Lighting.
- .2 Section 26 27 26 – Wiring Devices.
- .3 Section 26 51 19 – LED Interior Lighting.
- .4 Section 26 56 19 – LED Exterior Lighting.

### **1.4 REFERENCES**

- .1 CSA Group:
  - .1 CSA C22.1:24, Canadian Electrical Code, Part 1 (26th Edition), Safety Standard for Electrical Installations.
  - .2 Ontario Electrical Safety Code (29th edition/2024).
  - .3 CSA C22.2 No. 42 – General Use Receptacles.
  - .4 CSA C22.2 No. 42.1 – Cover Plates for Flush Mounted Wiring Devices.
  - .5 CSA C22.2 No. 141 – Emergency lighting equipment.
  - .6 CSA C22.2 No. 184 – Solid-State Lighting Controls.
  - .7 CSA C22.2 No. 184.1 – Solid State Dimming Controls.
- .2 Ontario Building Code.
- .3 UL 924 - Standard for Safety of Emergency Lighting and Power Equipment.
- .4 UL 2043 – Standard for fire test for heat and visible smoke release for discrete products and their accessories installed in air-handling spaces.
- .5 NEMA WD 7 – Occupancy motion sensors standard.

### **1.5 SUBMITTALS**

- .1 In accordance with Section 01 33 00.
- .2 Product Data:
  - .1 Submit manufacturer's descriptive literature and product specifications for each product.
  - .2 Manufacturer's product drawings.
  - .3 Manufacturer's installation instructions.

- .3 Where the lighting controls include the option for custom engraving, or custom touchscreen user interfaces on control devices, switches, or scene controllers, the Contractor is to submit proposed engraving/labelling/graphics as part of the shop drawing submittal, for review by the Owner.

## **1.6 CLOSEOUT SUBMITTALS**

- .1 Documentation of all lighting control system setpoints, sensor sensitivities, occupancy sensor timeouts, and as-programmed sequences of operation to aid in future troubleshooting.
- .2 Lighting controls functional test report.

## **1.7 QUALITY ASSURANCE**

- .1 Manufacturer Qualifications: Products free of defects in material and workmanship.

## **1.8 WARRANTY**

- .1 Product is warranted free of defects in material and workmanship.
- .2 Product is warranted to perform the intended function within design limits.

# **PART 2 - PRODUCTS**

## **2.1 MANUFACTURERS**

- .1 Wattstopper DLM (Basis of Design).
- .2 Acuity Brands Lighting nLight/Sensorswitch.
- .3 Lutron Vive.
- .4 Cooper Lighting Solutions Greengate DVLP.
- .5 Leviton.

## **2.2 GENERAL REQUIREMENTS OF ALL DEVICES**

- .1 Manufactured by an ISO 9002 certified manufacturing facility and shall have a defect rate of less than 1/3 of 1 per cent.
- .2 Five year warranty and CUL listed.
- .3 All devices specified shall have the ability to be connected on a digital loop and programmed separately.
- .4 All user input devices with two or more buttons have the ability to be programmed as multiple load switching or single load dimming.
- .5 The devices have the ability to be connected as a single room, and also scalable to an enterprise solution.

## **2.3 OCCUPANCY AND VACANCY SENSORS**

- .1 General:
  - .1 Sensors using passive infrared, ultrasonic, microphonic, and multi-technology adaptive technology.
  - .2 Configurable sensor timeouts.
  - .3 Rating: 24 VDC input voltage.
  - .4 Environmental:

- .1 Operating Temperature Range: 0 degrees C to 40 degrees C
- .2 Relative Humidity: 5 per cent to 95 per cent non-condensing.
- .5 Sensors shall connect with load controller via cat5e cabling with RJ45 terminations.
- .2 Dual Technology Wall Switch Sensor, 24V
  - .1 Available in one or two button configuration.
  - .2 Wattstopper LMDW-100 series (Basis of Design).
  - .3 Utilize a dual sensing verification principle for coordination between ultrasonic and Passive Infrared (PIR) Technologies to reduce likelihood of false triggering.
  - .4 Adjustable sensitivity, PIR 10-100%, Ultrasonic 10-100% in increments of 10%.
  - .5 Coverage up to 25 ft diameter for minor motion, and 35 ft diameter with a field view of 180 degrees.
  - .6 Adjustable automatic-ON or manual-ON operation.
  - .7 Adjustable detection and retrigger technology (PIR/Ultrasonic/both/either).
  - .8 Sensor shall have an adjustable time delay.
  - .9 Sensor shall fit in a single gang box with a typical decora faceplate.
- .3 Dual Technology Ceiling Mounted Sensor, 24V
  - .1 Wattstopper LMDC-100 series (Basis of Design).
  - .2 Adjustable sensitivity, PIR 10-100%, Ultrasonic 10-100% in increments of 10%.
  - .3 Coverage up to 20 ft diameter for minor motion, and 30 ft diameter with a field view of 360 degrees.
  - .4 Adjustable detection and retrigger technology (PIR/Ultrasonic/both/either).
  - .5 Sensor shall have an adjustable time delay.
  - .6 Sensor shall fit in a 1.5 in deep octagon box.
- .4 Dual Technology Corner Mount Sensor, 24V
  - .1 Ceiling or wall mounted as directed.
  - .2 Wattstopper LMDX-100 series (Basis of Design).
  - .3 Adjustable sensitivity, PIR 10-100%, Ultrasonic 10-100% in increments of 10%.
  - .4 Coverage up to 25 ft diameter for minor motion, and 40 ft diameter with a field view of 90 degrees.
  - .5 Adjustable detection and retrigger technology (PIR/Ultrasonic/both/either).
  - .6 Sensor shall have an adjustable time delay.
  - .7 Sensor shall fit in a 4 in square box with mounting plate and base.

## **2.4 DAYLIGHT HARVESTING PHOTO SENSORS**

- .1 Closed loop photosensor
  - .1 Ceiling mounted, recessed or surface (with bracket).
  - .2 Wattstopper LMLS-400 series (Basis of Design).
  - .3 Spatial response: 100 degrees.
  - .4 Sensor suitable between 1-1,553 foot candles.
  - .5 Environmental:



- .1 Operating Temperature Range: 0 degrees C to 55 degrees C
- .2 Relative Humidity: 0 per cent to 95 per cent non-condensing.
- .2 Open loop photosensor
  - .1 Ceiling or wall mounted, recessed or surface (with bracket).
  - .2 Wattstopper LMLS-500 series (Basis of Design).
  - .3 Spatial response: 60 degrees.
  - .4 Sensor suitable between 1-1,500 foot candles.
  - .5 Environmental:
    - .1 Operating Temperature Range: 0 degrees C to 55 degrees C
    - .2 Relative Humidity: 0 per cent to 95 per cent non-condensing.

## **2.5 DECORATOR LOW VOLTAGE MOMENTARY SWITCHES**

- .1 Wattstopper LMSW-100 series (Basis of Design).
- .2 Suitable for switching, dimming and scene selection.
- .3 Available in 1, 2, 3, 4, 5, and 8 button configurations.
- .4 Two RJ45 ports for daisy chaining multiple devices.
- .5 Switch shall fit in a single gang box with a typical decora faceplate.
- .6 Environmental:
  - .1 Operating Temperature Range: 0 degrees C to 55 degrees C
  - .2 Relative Humidity: 5 per cent to 95 per cent non-condensing.

## **2.6 POWER PACKS**

- .1 General:
  - .1 Power packs shall have the ability to be daisy chained on one digital loop.
  - .2 Internal relay controlling up to 20A for 120/277VAC or 15A for 347VAC ballast loads total per power pack.
  - .3 Power pack shall be available in 0-10V or forward phase dimming (120/277VAC only) technology.
  - .4 Models of 0-10V dimming technology shall have the option for one, two or three control channels.
  - .5 Power packs are digital and can be configured for pre-set scenes.
  - .6 Wattstopper LMRC-210 series (0-10V or switched) (Basis of Design)
  - .7 Wattstopper LMRC-220 series (forward phase) (Basis of Design)
  - .8 Power pack shall utilize Zero Crossing Circuitry to protect from the effects of inrush current and increase product longevity.
  - .9 Power pack shall be mounted on a 4 in square junction box and is plenum rated for ceiling installation.
  - .10 Power packs shall at minimum meet the following environmental specifications:
    - .1 Operating Temperature Range: 0 degrees C to 55 degrees C
    - .2 Relative Humidity: 5 per cent to 95 per cent non-condensing

## 2.7 PLUG LOAD CONTROLLER

- .1 Plug load controllers shall have the ability to be daisy chained on one digital loop.
- .2 Internal relay controlling up to 20A for 120VAC per power pack.
- .3 Wattstopper LMPL-201 series (Basis of Design)
- .4 Power pack shall utilize Zero Crossing Circuitry to protect from the effects of inrush current and increase product longevity.
- .5 Power pack shall be mounted on a 4 in square junction box and is plenum rated for ceiling installation.
- .6 Power packs shall at minimum meet the following environmental specifications:
  - .1 Operating Temperature Range: 0 degrees C to 55 degrees C
  - .2 Relative Humidity: 5 per cent to 95 per cent non-condensing

## 2.8 TIMER

- .1 Timer used to automatically switch lighting using time of day scheduling, independent of BAS or network controller.
- .2 Supports astronomical, time-based, and photocell based event types.
- .3 Connected by cat5e cable to sensors or controllers as part of the digital loop.
- .4 Complete with 120V input, one LMPB-100 power booster and internal barrier.
- .5 Can be installed in plenum space or wall mount in electrical room.
- .6 Wattstopper LMZC-300 series (Basis of Design)

## 2.9 EMERGENCY LIGHTING CONTROL UNIT

- .1 Description:
  - .1 Sequence of Operation: activate emergency lighting in the event of loss of normal utility power, regardless of control status of the luminaire.
  - .2 Provide all required functionality to allow any standard lighting control device to control emergency lighting in conjunction with normal lighting in any area within a building.
- .2 Device shall be listed to UL 924 to meet the intent of Ontario Building Code for "fail-safe operation", and be approved for use in Canada.
- .3 Wattstopper ELCU-200 series (Basis of Design).
- .4 Mounting: Able to fit in a standard junction box knockout.
- .5 Complete with remote test switch.
- .6 Sequence of Operation: automatically switch emergency lighting on and off as normal lighting is switched. When normal power is not available, force and hold emergency lighting on regardless of the state of any external control device until normal power is restored.
- .7 UL, cUL listed Emergency Lighting and Equipment; five year warranty.

## 2.10 SEQUENCES OF OPERATION

- .1 To Section 26 06 50.19.
- .2 [Vacancy Sensor Operation: Manual On, Manual/Auto Off.]
- .3 [In accordance with ASHRAE 90.1-2013].

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- .1 In accordance with manufacturer's instructions.
- .2 Low voltage lighting control cabling shall be cat5e
- .3 It shall be the contractor's responsibility to locate and aim sensors in the correct location required for complete and proper volumetric coverage within the range of coverage(s) of controlled areas per the manufacturer's recommendations. Rooms shall have 90 per cent to 100 per cent coverage to completely cover the controlled area to accommodate all occupancy habits of single or multiple occupants at any location within the room(s). The locations and quantities of sensors shown on the drawings are diagrammatic and indicate only the rooms which are to be provided with sensors. The contractor shall provide additional sensors if required to properly and completely cover the respective room.
- .4 It is the contractor's responsibility to arrange a pre-installation meeting with manufacturer's factory authorized representative, at Owner's facility, to verify placement of sensors and installation criteria.
- .5 Proper judgement must be exercised in executing the installation so as to ensure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference of structural components.
- .6 Install manual control devices and sensors in accordance with manufacturer's instructions for Vacancy Operation.

### 3.2 SYSTEM STARTUP

- .1 The lighting controls manufacturer's representative shall conduct system startup and submit startup report.

### 3.3 SITE TESTS AND INSPECTIONS

- .1 The lighting controls manufacturer's representative and Contractor shall conduct functional testing and provide report as described in ASHRAE 90.1-2013:
  - .1 Lighting control devices and control systems shall be tested to ensure that control hardware and software are calibrated, adjusted, programmed, and in proper working condition in accordance with the construction documents and manufacturer's installation instructions.
  - .2 When occupant sensors, time switches, programmable schedule controls, or photosensors are installed, at a minimum, the following procedures shall be performed:
    - .1 Occupant Sensors
      - .1 Certify that the sensor has been located and aimed in accordance with manufacturer recommendations.
      - .2 For projects with up to seven (7) occupancy sensors, all occupancy sensors shall be tested.
      - .3 For projects with more than seven (7) occupancy sensors, testing shall be done for each unique combination of sensor type and space geometry.
      - .4 For each sensor to be tested, verify the following:
        - .1 Status indicator (as applicable) operates correctly.
        - .2 Controlled lights turn off or dim down to the specified level within the required time (20 minutes, or as noted), as applicable to the space type.

- .3 For auto-on occupant sensors (occupancy mode), the lights turn on to the permitted level when someone enters the space.
- .4 For manual-on sensors (vacancy mode), the lights turn on only when manually activated.
- .5 The lights are not incorrectly turned on by movement in nearby areas or by HVAC operation.

.2 Automatic Time Switches

- .1 Confirm that the automatic time switch control is programmed with appropriate weekday, weekend, and holiday (as applicable) schedules.
- .2 Document for the owner automatic time switch programming, including weekday, weekend, and holiday schedules, as well as all setup and preference program settings.
- .3 Verify that correct time and date are properly set in the time switch.
- .4 Simulate occupied condition. Verify and document the following:
  - .1 All lights can be turned on and off by their respective area control switch.
  - .2 The switch only operates lighting in the enclosed space in which the switch is located.
- .5 Simulate unoccupied condition. Verify and document the following:
  - .1 All non-exempt lighting turns off.
  - .2 Manual override switch allows only the lights in the enclosed space where the override switch is located to turn on or remain on until the next scheduled shut off occurs.

.3 Daylight Controls

- .1 All control devices (photocontrols) have been properly located, field-calibrated, and set for appropriate set points and threshold light levels.
  - .2 Daylight controlled lighting loads adjust to appropriate light levels in response to available daylight.
  - .3 The location where calibration adjustments are made is readily accessible only to authorized personnel.
- .3 The individual(s) responsible for the functional testing shall not be directly involved in either the design or construction of the project and shall provide documentation certifying that the installed lighting controls meet or exceed all documented performance criteria.
- .2 Test lighting controls with fire alarm system in accordance with Section 28 08 46 and Section 28 46 51.
- .3 Commissioning:
- .1 [Upon completion of the installation, the system shall be completely commissioned to verify all adjustments and sensor placement to ensure a trouble-free lighting control system.]
  - .2 [Submit commissioning report to the Consultant and the commissioning authority for review.]
  - .3 [Provide the Consultant and Commissioning Authority with ten working days written notice of the scheduled commissioning date.]

### **3.4 TRAINING**

- .1 Provide training session of minimum 4 hours duration in accordance with Section 01 79 00.

**END OF SECTION**

## PART 1 - GENERAL

### 1.1 SUMMARY

- .1 This specification provides the technical requirements for the design manufacture and test of dry-type medium voltage substation transformers. Provide all accessories and equipment as described herein and shown on Project Drawings as necessary for a complete installation.

### 1.2 RELATED REQUIREMENTS

- .1 [Section 26 24 13 – Switchboards: close-coupled equipment.]

### 1.3 SUBMITTALS

- .1 The manufacturer shall provide the following information for review and evaluation by the Engineer:
  - .1 Shop Drawings showing outline, nameplate information and connection diagrams.
- .2 Manufacturer shall provide final, as-built drawings. Installation, Operation and Maintenance manuals shall also be supplied.

### 1.4 REFERENCE STANDARDS

- .1 The ventilated dry-type transformers and protection devices in this specification are designed and manufactured according to latest revision of the following standards.
  - .1 CSA C9:17 (R2022), Dry-type transformers.
  - .2 CAN/CSA C22.2 No. 47-13 (R2023), Air-cooled transformers (dry type).
  - .3 CAN/CSA-C802.2-18 (R2023), Test method and minimum efficiency values for dry-type transformers.
  - .4 DOE 10 CFR Part 431 Efficiency Standards; published in the Federal Register on April 18, 2013.
  - .5 IEEE C57.12.01 - General Requirements for Distribution, Power and Regulating Transformers.
  - .6 IEEE C57.12. 91-2020 - IEEE Standard Test Code for Dry-Type Distribution and Power Transformers.
  - .7 IEEE C57.110-2018 - IEEE Recommended Practice for Establishing Liquid Immersed and Dry-Type Power and Distribution Transformer Capability when Supplying Nonsinusoidal Load Currents: for non-linear loads.
  - .8 NRCan Energy Efficiency Regulations (SOR/2016-311 amendment 14).
  - .9 O. Reg. 404/12: Ontario Regulation for Energy and Water Efficiency - Appliances and Products.

### 1.5 SUBMITTALS

- .1 Submittals for Consultant's review:
  - .1 Outline, nameplate, and connection diagram drawings.
  - .2 Electronic 3D Models of outline drawings.
  - .3 Installation/Operation/Maintenance Manual
  - .4 Certified Production Test Report(s) containing minimum information per ANSI C57.12.91.
- .2 [Upon receipt of Consultant's review, submit shop drawings to the local electrical utility for their review and approval.]

## 1.6 QUALITY ASSURANCE

- .1 The manufacturer shall have a well-documented quality assurance program, which includes procedures for all activities in order entry, design, material procurement, manufacturing processes, testing, shipping, and post shipment.
- .2 The manufacturer shall have specialized in the design, manufacture, and assembly of dry-type distribution transformers for a minimum of 10 years.
- .3 The transformer shall be manufactured by a company, which is certified ISO 9001:2015, for design and manufacture of Power Dry Type Transformers.
- .4 The test floor shall have documented calibration program. All equipment shall receive regular calibrations. Records of all equipment calibration shall be made available to the Buyer upon request.
- .5 Measured values of electric power, voltage, current, resistance and temperatures are used in the calculations of reported data. To ensure sufficient accuracy in the measured and calculated data the test system accuracy requirements listed in ANSI C57.12.01 Table 3 shall be met as a minimum.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- .1 Handle and store equipment in accordance with manufacturer's Installation and Maintenance Manuals. One (1) copy of this document to be provided with the equipment at time of shipment.

## 1.8 WARRANTY

- .1 Equipment manufacturer warrants that all goods supplied are free of non-conformities in workmanship and materials for one year from date of shipment.

# PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- .1 Manufacturer List:
  - .1 Hammond Power Solutions (basis of design).
  - .2 Acme.
  - .3 Atlas.
  - .4 Delta.
  - .5 Rex Power Magnetics.
- .2 Substitutions: Other manufacturers considered upon request submitted by bidder to the Consultant during the tender period.

## 2.2 TECHNICAL REQUIREMENTS

- .1 Construction
  - .1 The transformer shall be of dry type Vacuum Pressure Impregnated (VPI) construction, dry type technology and shall be mounted in a suitably ventilated outdoor NEMA 3RE enclosure supplied with internal baffles and filtered louvers.
  - .2 Primary terminations shall be close coupled to High Voltage outdoor metal enclosed switchgear. Transformer manufacturer shall co-ordinate with High Voltage outdoor metal enclosed switchgear during design and drawing stage.
  - .3 Secondary terminations shall be cable type for connection to indoor switchboard.
  - .4 Sound levels shall be min 65 dB; -3 dB below CSA standard sound levels.

- .2 Core Design
  - .1 Transformer core shall be manufactured from quality non-aging, cold rolled, fully processed silicon steel laminations. Cores are to be precisely cut to close tolerances to eliminate burrs and improve performance. They will be step-lap, fully mitered construction for optimum energy efficiency and low noise level. Cores are to be carefully assembled and rigidly held secure with structural steel clamps to minimize gaps.
- .3 Temperature Rise
  - .1 The transformer shall be design for a temperature rise of 150°C with and shall be built utilizing Class 220°C insulation, regardless of the temperature rise specified. The transformer shall not exceed the specified temperature rise when the unit is operated continuously at full nameplate rating. The transformer shall be capable of carrying 100% of the nameplate rating in a 30°C average, not to exceed 40°C maximum ambient in any 24 hour period.
- .4 Coil Design
  - .1 The high voltage and low voltage windings shall be constructed using copper conductors. The conductors shall be insulated with 220°C insulation.
    - .1 Transformer primary winding shall have four 2-1/2 percent full capacity taps; two above and two below rated nominal voltage. No load tap connections shall be made by re-connectable links on the face of the primary winding and shall be located behind removable panels on the front of transformer enclosure. Taps shall be for de-energized operation only.
- .5 Core and Coil Assembly
  - .1 After installation of windings on core and stacking of the top yoke core steel, core and coil assembly is to be secured with a rigid frame. Primary and secondary coordination bus assemblies, as required for connection to associated switchgear are to be of welded or bolted construction.
- .6 Vacuum Pressure Encapsulation Process
  - .1 Each coil assembly shall be vacuum pressure impregnated in polyester varnish. The VPI process shall consist of two (2) cycles VPI on entire HV and LV coil assembly. This shall effectively impregnate the entire coil assembly that results in a unit which is virtually impermeable to moisture, dust, dirt, salt air and other industrial contaminants.
- .7 Dielectric Withstand
  - .1 The impulse rating of the transformer must equal or exceed the basic impulse level specified by [ANSI] [Table 9 of CSA C9] for the applicable voltage class. The basic impulse level shall be inherent to the winding design and is to be obtained without the use of supplemental surge arrestors.
  - .2 Basic Impulse rating of the transformer shall be coordinated with the upstream medium voltage switchgear BIL, but no less than the following values based on the transformer primary voltage:
    - .1 Less than 1.2 kV: 10 kV BIL.
    - .2 4.16 kV: [30 kV BIL] [60 kV BIL].
    - .3 13.8 kV: 95 kV BIL.
    - .4 27.6 kV: 125 kV BIL.
    - .5 34.5 kV: 150 kV BIL.
    - .6 44 kV: 200 kV BIL.
- .8 Vibration Isolation
  - .1 The transformer shall have in shear vibration isolation system to provide minimum static defection of 10 mm.



.9 Enclosure

- .1 The enclosure shall be constructed of heavy gauge sheet steel and shall be finished in ANSI 61 paint color applied using an electrostatically deposited dry powder paint system. All ventilating openings shall be in accordance with NEMA and NEC standards for ventilated enclosures. The base of the enclosure shall be furnished with ground pads located on opposite diagonal corners. The core shall be visibly grounded to the enclosure frame by means of a flexible grounding strap.
- .2 Outdoor NEMA 3RE protection including internal baffles and filtered louvers to provide a degree of protections against rain, sleet, and external ice construction.
- .3 Enclosure shall incorporate factory installed strip heater circuit for operation to repel moisture and condensation when transformer is not energized.

.10 Nameplate

- .1 Transformer shall be furnished with a non-corrosive diagrammatic nameplate per ANSI C57.12.01, permanently attached with non-corrosive hardware. The diagrammatic nameplate shall include the name of the transformer supplier as well as the location where the transformer was manufactured and tested.
- .2 The nameplate shall also indicate certification to CAN/CSA C22.2 No. 47.

**2.3 ACCESSORIES**

.1 Transformer accessories shall include:

- .1 Diagrammatic instruction nameplate.
- .2 Removable hinged enclosure doors front and rear for access.
- .3 Dial type thermometer.
- .4 In shear vibration isolation mounted to core and coil; minimum static deflection 10 mm.

**2.4 SOURCE QUALITY CONTROL**

- .1 After completion, each transformer shall undergo the following routine production tests per ANSI C57.12.01 and ANSI C57.12.91. Testing shall be accomplished using calibrated test equipment, which have recorded accuracy traceable to National Institute of Standards Technologies (NIST). Certification of Calibration shall be provided with test reports if requested.
  - .1 Megger.
  - .2 Ratio.
  - .3 Resistance.
  - .4 Phase relation.
  - .5 Load Loss, Impedance and Regulation.
  - .6 No Load Loss and Excitation Current.
  - .7 Applied Potential Test.
  - .8 Induced Potential Test.
- .2 Provide certified production test reports for all manufactured transformers.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- .1 [Review the plans and the site conditions, and sequence the construction so that the transformer can be delivered to site based the available openings. Where circumstances require, supply transformer coils separate from the enclosure for onsite assembly.]
- .2 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for transformers installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Owner.
  - .2 Inform Consultant of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from the Owner.

### 3.2 INSTALLATION

- .1 Locate, install, and ground transformers in accordance with manufacturer's instructions.
- .2 Set and secure transformers in place, rigid plumb and square.
- .3 Connect primary terminals to high voltage circuit, or bussing of close coupled equipment, as applicable.
- .4 Connect secondary terminals to secondary feeder, or bussing of close coupled equipment, as applicable.
- .5 Use flexible conduit to make connections to transformer.
- .6 Energize transformers and check secondary no-load voltage.
- .7 Adjust primary taps as necessary to produce rated secondary voltage at no-load.
- .8 Wire alarm contacts on winding temperature indicator to sound alarm when excessive temperature reached.
- .9 Locate and install cooling fans.
  - .1 Connect thermostat control.
  - .2 Connect sequence contacts of temperature indicator:
    - .1 First contact closure: start fan.
    - .2 Second contact closure: sound alarm.
    - .3 Third contact closure: trip secondary breaker.
- .10 Use torque wrench to adjust internal connections in accordance with manufacturers' recommended values.
- .11 Check transformer for dryness before putting it into service and if it has not been energized for some considerable time.

### 3.3 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 08 00.
- .2 Energize transformers and apply incremental loads:
  - .1 0% for 4 hours.
  - .2 10% for next 1 hour.

- .3 25% for next 2 hours.
- .4 50% for next 3 hours.
- .5 Full load.
- .3 At each load change, check and record enclosure, ventilating air, winding, and ambient temperatures.
- .4 Adjust cooling fan controls if required.

### **3.4 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 00.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools, and equipment in accordance with Section 01 74 00.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

### **3.5 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by transformers installation.

**END OF SECTION**

## **PART 1 - GENERAL**

### **1.1 SECTION INCLUDES**

- .1 Materials and components for dry type transformers up to 600 V primary, equipment identification and transformer installation.

### **1.2 REFERENCES**

- .1 ANSI/ASHRAE/IES Standard 90.1-2013 – Energy Standard for Buildings Except Low-Rise Residential Buildings.
- .2 CSA Group:
  - .1 CSA C22.1:21, Canadian Electrical Code, Part 1 (25th Edition), Safety Standard for Electrical Installations.
  - .2 Ontario Electrical Safety Code (28th edition/2021).
  - .3 CSA C22.2 No. 47-13 (R2018), Air-cooled transformers (dry type).
  - .4 CSA C9-17, Dry-type transformers.
  - .5 CSA C802.2-18, Minimum Efficiency Values for Dry-Type Transformers.
- .3 IEEE C57.110-2018, IEEE Recommended Practice for Establishing Liquid-Immersed and Dry-Type Power and Distribution Transformer Capability When Supplying Nonsinusoidal Load Currents: this standard defines how K-factor is calculated.
- .4 National Electrical Manufacturers Association (NEMA):
  - .1 NEMA ST-20-2014, Dry-Type Transformers for General Applications: sound levels.
- .5 NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment (published by the International Electrical Testing Association).
- .6 Ontario Building Code and its referenced standards.
- .7 UL 1561, Standard for Dry-Type General Purpose and Power Transformers.

### **1.3 ACTION SUBMITTALS**

- .1 Product Data: Provide outline and support point dimensions of enclosures and accessories, unit weight, voltage, power, and impedance ratings and characteristics, tap configurations, insulation system type, and rated temperature rise.

### **1.4 INFORMATIONAL SUBMITTALS**

- .1 Test Reports: Indicate loss data, efficiency at 25, 50, 75, and 100 per cent rated load, and sound level.
- .2 Submit manufacturer's installation instructions.
  - .1 Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements.
  - .2 Include instructions for storage, handling, protection, examination, preparation, and installation of product.

### **1.5 CLOSEOUT SUBMITTALS**

- .1 Record actual locations of transformers in project record documents.
- .2 Document test results from NETA ATS.

- .3 Copies of completed factory reports and testing reports.

## **1.6 DELIVERY, STORAGE, AND HANDLING**

- .1 Store and handle in strict compliance with manufacturer's instructions and recommendations. Protect from potential damage from weather and construction operations.
- .2 Store so condensation will not form on or in the transformer housing and if necessary, apply temporary heat where required to obtain suitable service conditions. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- .3 Handle to manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to transformer internal components, enclosure, and finish.
- .4 Handle transformer using proper equipment for lifting and handling, use when necessary lifting eye, and/or brackets provided for that purpose.

## **1.7 WARRANTY**

- .1 The transformer shall carry a 1 year warranty from the time of substantial performance.

# **PART 2 - PRODUCTS**

## **2.1 GENERAL**

- .1 Transformers shall be standard general purpose dry type unless otherwise indicated on drawings as K-Rated or Harmonic Mitigation type.
- .2 Use transformers of one manufacturer throughout project and in accordance with CSA C22.2 No. 47 and CSA C9.

## **2.2 MANUFACTURERS**

- .1 Manufacturer List:
  - .1 Bemag.
  - .2 Delta Transformer.
  - .3 Eaton.
  - .4 Hammond.
  - .5 Powersmiths.
  - .6 Rex Power Magnetics.
  - .7 Siemens.
  - .8 Schneider Electric.
  - .9 STI.
- .2 Substitutions: permitted if approved by the Consultant prior to Tender closing date.

## **2.3 REGULATORY REQUIREMENTS**

- .1 Products: Listed and classified by CSA (Canadian Standards Association).
- .2 Efficiency ratings:
  - .1 Meet or exceed the efficiency levels indicated in CSA C802.2-12, and ASHRAE 90.1-2013, Table 8.4.4.

## **2.4 GENERAL PURPOSE TRANSFORMERS**

- .1 NEMA ST-20, factory-assembled, air cooled low-inrush dry type transformer, ratings and voltages as indicated on drawings.
- .2 Single or three phase as indicated on drawings.
- .3 Type: AN/AA ventilated self-cooled.
- .4 Copper windings.
- .5 Finish: Final coating to be ANSI 61 Grey Epoxy Powder.
- .6 T-connected transformers are not acceptable.
- .7 Isolate core and coil from enclosure using vibration-absorbing mounts.
- .8 Impedance: standard (3% to 5% nominal for up to 75 kVA, 4% to 6% for transformers 112.5 kVA and greater).

## **2.5 K-FACTOR RATED TRANSFORMERS**

- .1 Provide where indicated on drawings.
- .2 K-Factor Rating: Transformers shall be K-Factor 7, 13, or higher rated and comply with UL 1561 requirements for non-sinusoidal load current-handling capability to the degree defined by designated K-factor.
  - .1 Unit shall not overheat when carrying full-load current with harmonic distortion corresponding to designated K-factor.
  - .2 Indicate value of K-factor on transformer nameplate.

## **2.6 PRIMARY VOLTAGE**

- .1 600 volts delta, 3 phase;

## **2.7 SECONDARY VOLTAGE**

- .1 120/208 volts, 3 phase wye.

## **2.8 INSULATION SYSTEM AND AVERAGE WINDING TEMPERATURE RISE**

- .1 1-15 kVA: Class 185 with [150] degrees C rise.
- .2 16-500 kVA: Class 220 with [150] degrees C rise.
- .3 Above 500 kVA: Class 220 with [150] degrees C rise.

## **2.9 CASE TEMPERATURE**

- .1 Limits in accordance with CSA C22.2 No. 47.

## **2.10 WINDING TAPS**

- .1 To NEMA ST-20.
- .2 Four full capacity 5 per cent adjustment taps, 2 at 2.5 per cent FCBN (full capacity below nominal) and 2 at 2.5 per cent FCAN (full capacity above nominal).

## **2.11 BASIC IMPULSE LEVEL**

- .1 10 kV BIL.

## **2.12 GROUNDING**

- .1 Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap.

## **2.13 MOUNTING**

- .1 1-15 kVA: suitable for wall mounting.
- .2 16-75 kVA: suitable for wall, or floor, as shown.
- .3 Larger than 75 kVA: suitable for floor mounting.

## **2.14 COIL CONDUCTORS**

- .1 Continuous windings with terminations brazed or welded.

## **2.15 ENCLOSURE**

- .1 NEMA ST-20, CSA type 2 ventilated, sprinkler-proof. Provide lifting eyes or brackets.
- .2 CSA type 3R for outdoor locations.

## **2.16 CATCHER/DRIP BASE PLATE**

- .1 Constructed from galvanized steel sheet metal having the minimum thickness as that of the transformer's enclosure.
- .2 To be provided for all transformers that are wall mounted, or suspended off the floor.

## **2.17 SOUND LEVELS**

- .1 To NEMA ST-20 for transformers up to 300 kVA:
  - .1 Up to 9 kVA: 40 dB.
  - .2 10 – 50 kVA: 45 dB.
  - .3 51 – 150 kVA: 50 dB.
  - .4 151 – 300 kVA: 55 dB.
- .2 Sound levels 3 dB less than NEMA ST-20 for transformers 301 kVA and greater:
  - .1 301 – 500 kVA: 57 dB.
  - .2 501 – 700 kVA: 59 dB.
  - .3 701 – 1000 kVA: 61 dB.
  - .4 Above 1000 kVA: 3 dB less than NEMA ST-20.

## **2.18 NAMEPLATE**

- .1 Transformer shall have embossed aluminum or stainless steel nameplate indicating, but not restricted to the following:
  - .1 kVA rating.
  - .2 Voltage rating.
  - .3 Impedance.
  - .4 Type.
  - .5 Insulation class.
  - .6 Temperature rise.

- .7 Connection diagram.
- .8 Serial number.

## **2.19 EQUIPMENT IDENTIFICATION**

- .1 Provide equipment identification in accordance with Section 26 05 53.

## **2.20 SOURCE QUALITY CONTROL**

- .1 Production test each unit according to NEMA ST-20.

# **PART 3 - EXECUTION**

## **3.1 INSTALLATION**

- .1 Mounting:
  - .1 Mount dry type transformers up to 75 kVA, on floor, wall, or suspended from ceiling, as indicated on plans.
  - .2 Maintain clear space as described in 2021 OESC Rule 2-312.
  - .3 Mount dry type transformers rated above 75 kVA on floor.
  - .4 For wall mounted transformers, provide rubber-in-shear isolation mounts above bracket-supported rails secured from the wall.
  - .5 For ceiling mounted transformers, provide trapeze hangers and provide rubber-in-shear isolation mounts.
  - .6 Where a transformer is wall mounted or suspended off the floor, provide a metal catcher/drip base plate, and bolt to the bottom of the transformer below the base channel to conform to CSA C22.2 No. 47. Install in accordance with transformer manufacturer's instructions and recommendations.
  - .7 Mount floor mounted transformers on concrete housekeeping pads, minimum 100 mm (4") thick, and extending a minimum of 150 mm (6") beyond the footprint of the transformer.
  - .8 Mount vibration isolating pads suitable for isolating the transformer noise from the building structure in accordance with Section 26 05 48.13.
- .2 Provide seismic restraints in accordance with Section 26 05 48.
- .3 Set transformer plumb and level.
- .4 Use flexible conduit, under the provisions of Section 26 05 33.13, 600 mm minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.
- .5 Provide grounding and bonding to Section 26 05 26.
- .6 Ensure adequate clearance around transformer for ventilation.
- .7 Install transformers in level upright position.
- .8 Remove shipping supports only after transformer is installed and just before putting into service.
- .9 Loosen isolation pad bolts until no compression is visible.
- .10 Make primary and secondary connections in accordance with wiring diagram.
- .11 Energize transformers after installation is complete.

## **3.2 FIELD QUALITY CONTROL**

- .1 Section 01 43 00: Field Inspection, Testing, Adjusting.



- .2 Perform inspections and tests listed in NETA ATS, Section 7.2.

### **3.3 ADJUSTING**

- .1 Measure primary and secondary voltages and make appropriate tap adjustments.

**END OF SECTION**

## **PART 1 - GENERAL**

### **1.1 SECTION INCLUDES**

- .1 Power distribution panelboards – Circuit breaker type.
- .2 Lighting and Appliance Branch Circuit Panelboards.

### **1.2 RELATED REQUIREMENTS**

- .1 Section 26 28 16.02 – Molded Case Circuit Breakers.
- .2 Section 26 43 13 – Surge Protective Devices for Low-Voltage Electrical Power Circuits.

### **1.3 REFERENCES**

- .1 CSA C22.1-12 - Canadian Electrical Code, Part I (22<sup>nd</sup> Edition), Safety Standard for Electrical Installations
- .2 Ontario Electrical Safety Code (25<sup>th</sup> Edition / 2012)
- .3 CSA C22.2 No.29 - Panelboards and Enclosed Panelboards.
- .4 NEMA AB1 - Molded Case Circuit Breakers, Molded Case Switches, and Circuit - Breaker Enclosures.
- .5 NEMA ICS 2 - Industrial Control and Systems: Controllers, Contactors, and Overload Relays Rated 600 Volts.
- .6 NEMA KS1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).
- .7 NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment (published by the International Electrical Testing Association).
- .8 The panelboards and circuit breakers referenced herein are designed and manufactured according to the latest revision of the following specifications.
  - .1 NEMA PB 1 - Panelboards
  - .2 NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.
  - .3 NEMA AB 1 - Molded Case Circuit Breakers
  - .4 CSA C22.2 No. 29-M1989 - Panelboards and Enclosed Panelboards
  - .5 CSA C22.2 No. 5-M91 - Molded Case Circuit Breakers

### **1.4 ACTION SUBMITTALS**

- .1 Submit in accordance with Section Division 01.
- .2 Shop drawings shall contain overall panelboard dimensions, interior mounting dimensions, and wiring gutter dimensions. The location of the main, branches, and solid neutral shall be clearly shown. In addition, the drawing shall illustrate one line diagrams with applicable voltage systems.
- .3 Shop drawings
  - .1 Indicate the following:
    - .1 Outline and support point dimensions
    - .2 Voltage
    - .3 Main bus ampacity
    - .4 Integrated short circuit ampere rating

- .5 Circuit breaker arrangement, types and sizes.
- .2 The following information shall be submitted to the Engineer:
  - .1 Breaker layout drawing with dimensions indicated and nameplate designation
  - .2 Component list
  - .3 Conduit entry/exit locations
  - .4 Assembly ratings including:
    - .1 Short-circuit rating
    - .2 Voltage
    - .3 Continuous current
  - .5 Cable terminal sizes
  - .6 Product data sheets
- .3 Where applicable, the following additional information shall be submitted to the Engineer:
  - .1 Key interlock scheme drawing and sequence of operations
- .4 Submittals for Construction
  - .1 The following information shall be submitted for record purposes:
    - .1 Installation information

#### **1.5 CLOSEOUT SUBMITTALS**

- .1 Refer to Section Division 01.
- .2 Record actual locations of panelboards and record actual circuiting arrangements in project record documents.
- .3 Maintenance Data: Include spare parts listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.
- .4 Final as-built drawings and information shall incorporate all changes made during the manufacturing and installation process.

#### **1.6 MAINTENANCE MATERIAL SUBMITTALS**

- .1 Manufacturer shall provide installation instructions and NEMA Standards Publication PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.
- .2 Equipment operation and maintenance manuals shall be provided with each assembly shipped and shall include instruction leaflets, instruction bulletins and renewal parts lists where applicable, for the complete assembly and each major component.
- .3 Provide two of each panelboard key.
- .4 Provide final panelboard schedules indicating panelboard data, phasing, breaker sizes, and loads served.

#### **1.7 QUALITY ASSURANCE**

- .1 Regulatory Requirements
  - .1 Products: Listed and classified by CSA (Canadian Standards Association).
- .2 Qualifications

- .1 Company specializing in manufacturing of panelboard products with a minimum of 20 years' experience.
- .2 The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.
- .3 For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.
- .4 The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

## **1.8 DELIVERY, STORAGE, AND HANDLING**

- .1 Inspect and report concealed damage to carrier within their required time period.
- .2 Handle carefully to avoid damage to panelboard internal components, enclosure, and finish.
- .3 Store in a clean, dry environment. Maintain factory packaging and, if required, provide an additional heavy canvas or heavy plastic cover to protect enclosure(s) from dirt, water, construction debris, and traffic.
- .4 Equipment shall be handled and stored in accordance with manufacturer's instructions. One copy of these instructions shall be included with the equipment at time of shipment.

## **1.9 MANUFACTURER WARRANTY**

- .1 Warrant specified equipment to be free from defects in materials and workmanship for eighteen (18) months from the date of purchase.

# **PART 2 - PRODUCTS**

## **2.1 GENERAL**

- .1 Description: CSA C22.2 No.29, circuit breaker type.

## **2.02 DISTRIBUTION PANELBOARDS – CIRCUIT BREAKER TYPE**

- .1 Manufacturers:
  - .1 Square D by Schneider Electric, I-LINE Series.
  - .2 Eaton Cutler-Hammer, PRL 3 and PRL4 Series.
  - .3 Equal by Siemens.
- .2 The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety. Products in compliance with the specification and manufactured by others not named will be considered only if pre-approved by the Consultant ten days prior to bid date.
- .3 Panelboard Bus:
  - .1 Copper, ratings as indicated.
  - .2 Provide copper neutral bus for panelboards indicated for 4-wire systems.
  - .3 Provide copper ground bus in each panelboard.
- .4 Short Circuit Ratings:

- .1 Panelboards rated 600 V shall have minimum integrated short-circuit ratings as shown on the drawings or as herein scheduled, but not less than 65 000 amperes RMS symmetrical.
- .2 Distribution panelboards with bolt-on devices contained therein shall have interrupting ratings as specified herein or indicated on the drawings.
- .3 Panelboards shall be fully rated.
- .4 Where indicated, provide circuit breakers ULC listed for application at 100 per cent of their continuous ampere rating in their intended enclosure.
- .5 Minimum integrated short circuit rating: Panelboards rated 240 V shall have minimum integrated short-circuit ratings as shown on the drawings or as herein scheduled, but not less than 10 000 amperes RMS symmetrical.
- .6 Molded Case Circuit Breakers: To Section 26 28 16.02.
- .7 Circuit Breaker Accessories: Trip units and auxiliary switches as indicated.
- .8 Cabinet Front: Surface type, fastened hinge and latch, metal directory frame, finished in manufacturer's standard gray enamel.
- .9 Enclosures: CSA type 2 sprinklerproof complete with drip hood, or as noted.
- .10 Trims shall be equipped with a flush lock.
- .11 Breaker positions labeled as "Spare" or "Space" shall constitute no less than 20 per cent of available breaker positions, whether indicated or not in panelboard schedules.
- .12 Each panel shall be complete with a directory which shall be mounted inside door in a metal frame with clear plastic cover and copy in each Data Book. Use final Room Numbers for directories.

## 2.2 BRANCH CIRCUIT PANELBOARDS

- .1 Manufacturers:
  - .1 Square D by Schneider Electric, NQ or NQOD Series.
  - .2 Eaton Cutler-Hammer, POW-R-LINE 1, POW-R-LINE 2, POW-R-LINE 3 Series.
  - .3 Equal by Siemens.
- .2 Description: CSA C22.2 No.29, circuit breaker type, lighting and appliance branch circuit panelboard.
- .3 Panelboard Bus:
  - .1 Copper, ratings as indicated.
  - .2 Provide double copper neutral bus in each panelboard.
  - .3 Provide copper ground bus in each panelboard.
  - .4 Provide insulated ground bus where scheduled.
- .4 Minimum Integrated Short Circuit Rating: 10 000 amperes RMS symmetrical for 240 volt panelboards, or as indicated.
- .5 Molded Case Circuit Breakers: NEMA AB 1, plug-on type thermal magnetic trip circuit breakers, with common trip handle for all poles, listed as Type SWD for lighting circuits, Type HACR for air conditioning equipment circuits, Class A ground fault interrupter circuit breakers where scheduled. Do not use tandem circuit breakers.
- .6 Current Limiting Molded Case Circuit Breakers where indicated: NEMA AB 1, circuit breakers with integral thermal and instantaneous magnetic trip in each pole, coordinated with automatically resetting current limiting elements in each pole. Interrupting rating 100,000 symmetrical amperes, let-through current and energy level less than permitted for same size Class RK-5 fuse.

- .7 Cabinet Front: Surface cabinet front with concealed trim clamps, concealed hinge, metal directory frame, and flush lock all keyed alike. Finish in manufacturer's standard gray enamel.
- .8 Enclosure shall be CSA type 2 sprinklerproof complete with drip hood, or as noted.
- .9 Trims shall be equipped with a flush lock
- .10 Breaker positions labeled as "Spare" or "Space" shall constitute no less than 20 per cent of available breaker positions, whether indicated or not in panelboard schedules.
- .11 Panelboards: to CSA C22.2 No.29 and product of one manufacturer.
  - .1 Install circuit breakers in panelboards before shipment.
  - .2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.
- .12 Panelboards rated 240 Vac or less shall have short-circuit ratings as shown on the drawings or as herein scheduled, but not less than 10,000 amperes RMS symmetrical.
- .13 Bus and breakers rated for symmetrical interrupting capacity, as indicated.
- .14 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.
- .15 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.
- .16 Two keys for each panelboard and key panelboards alike.
- .17 Copper bus with neutral of same ampere rating as mains.
- .18 Mains: suitable for bolt-on breakers.
- .19 Trim with concealed front bolts and hinges.
- .20 Trim and door finish: baked grey enamel.
- .21 The minimum short-circuit rating for branch circuit panelboards shall be as specified herein or as indicated on the drawings. Panelboards shall be fully rated.
- .22 Bolt-on type, heavy-duty, quick-make, quick-break, single- and multi-pole circuit breakers of the types specified herein, shall be provided for each circuit with toggle handles that indicate when unit has tripped.
- .23 Circuit breakers shall be thermal-magnetic type with common type handle for all multiple pole circuit breakers. Circuit breakers shall be minimum 100-ampere frame and through 100-ampere trip sizes shall take up the same pole spacing. Circuit breakers shall be ULC listed as type SWD for lighting circuits.
  - .1 Circuit breaker handle locks shall be provided for all circuits that supply exit signs, emergency lights, energy management, and control system (EMCS) panels and fire alarm panels.
- .24 Circuit breakers shall have a minimum interrupting rating of 10 000 amperes symmetrical at 240 volts, and 14 000 amperes symmetrical at 480 volts, unless otherwise noted on the drawings.
- .25 Each panel shall be complete with a directory which shall be mounted inside door in a metal frame with clear plastic cover and copy in each Data Book. Use final Room Numbers for directories.
- .26 Lighting and receptacle panels shall be surface or flush-mounting type, as shown.
- .27 Panels shall be dead front type in code gauge steel enclosures. All panels shall be sprinkler proof c/w drip hoods as required.
- .28 Panels shall have mains of voltage and capacity, and main and branch breakers, as shown on the drawings. Spaces shall include necessary bus work such that Owners, at a later date, need buy only the breakers.
- .29 Where panels exceed 42 circuits, use multi-section panel with main cross-over solid bus bars. Main bus capacity of each section shall be full size to match cross-over bus.

- .30 Breakers shall have bolted type connections. Multi-pole breakers shall be common trip type with a single handle, suitable for voltage applied and of same manufacture as single pole breakers.
- .31 Panels for 120/208 volt, 3-phase, 4-wire systems shall be complete with full size breakers.
- .32 Where shown on drawings or required by code, certain breakers shall include ground fault interrupter.
- .33 Provide lighting and receptacle panels, surface or flush-mounting type, as shown.
- .34 Provide locking bars on non-switched circuits where panels are used for switching lighting circuits.
- .35 Panels for non-linear loads shall be complete with lugs for double neutrals.
- .36 Panels shall be given a rust-resistant treatment to both tub and trim.
- .37 Flush panels shall have concealed hinges and flush type combination lock latch. Locks shall be chrome plated. Doors shall open minimum 135 degrees. Trims shall have fasteners concealed and shall be prime coated to receive room finish paint.
- .38 Surface mounted panels shall have manufacturer's standard surface door trim complete with lock and latch. Finish shall be grey.
- .39 Recessed panels shall have standard flush trims.
- .40 Co-ordinate panel finish with Room Finish Schedule.

## 2.3 MOLDED CASE CIRCUIT BREAKERS

- .1 Breakers: to Section 26 28 16.02.
- .2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.
- .3 Main breaker: separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.
- .4 Lock-on devices for 10 per cent of 15 A to 30 A breakers installed as indicated. Turn over unused lock-on devices to Owner.
- .5 Lock-on devices for fire alarm, security, and sprinkler circuits.
- .6 Provide shunt trips, bell alarms, and auxiliary switches as shown on the contract drawings.
- .7 Provide breakers for externally mounted Surge Protective Devices in accordance with Section 26 43 13.

## 2.4 CONSTRUCTION

- .1 General:
  - .1 Interiors shall be completely factory assembled. They shall be designed such that switching and protective devices can be replaced without disturbing adjacent units and without removing the main bus connectors.
  - .2 Surface trims shall be same height and width as box. Flush trims shall overlap the box by 3/4 of an inch on all sides.
  - .3 A temporary directory card with a clear plastic cover shall be supplied and mounted on the inside of each door.
  - .4 All locks shall be keyed alike. Key same as existing.
- .2 Branch Circuit Panelboards:
  - .1 Trims for branch circuit panelboards shall be supplied with a hinged door over all circuit breaker handles. Doors in panelboard trims shall not uncover any live parts. Doors shall have a semi flush cylinder lock and catch assembly. Door-in-door trim shall be provided. Both hinged trim and trim door shall utilize three point latching. No tools shall be required to install or remove

trim. Trim shall be equipped with a door-actuated trim locking tab. Equip locking tab with provision for a screw such that removal of trim requires a tool, at the owner's option. Installation shall be tamper resistant with no exposed hardware on the panelboard trim.

## **2.5 BUS**

- .1 Main bus bars shall be copper sized in accordance with CSA standards to limit temperature rise on any current carrying part to a maximum of 65 degrees C above an ambient of 40 degrees C maximum.
- .2 A copper system ground bus shall be included in all panelboards.
- .3 Full-size (100 per cent rated) insulated copper neutral bars shall be included for panelboards shown with neutral. Bus bar taps for panels with single-pole branches shall be arranged for sequence phasing of the branch circuit devices. Neutral busing shall have a suitable lug for each outgoing feeder requiring a neutral connection. 200 per cent rated neutrals shall be supplied for panels designated on drawings with oversized neutral conductors.

## **2.6 EQUIPMENT IDENTIFICATION**

- .1 Provide equipment identification in accordance with Section 26 05 53.
- .2 Nameplate for each panelboard size 4 engraved.
- .3 Nameplate for each branch circuit in distribution panelboards size 2 engraved.
- .4 Complete circuit directory with typewritten legend showing location and load of each circuit.
- .5 Provide an engraved nameplate for each panelboard section.
- .6 Provide copies of all circuit directories in Manuals.

# **PART 3 - EXECUTION**

## **3.1 INSTALLATION**

- .1 Install panelboards to CSA C22.1.
- .2 Install panelboards plumb.
- .3 Height: 1800 mm to top of panelboard; install panelboards taller than 1800 mm with bottom no more than 100 mm above floor.
- .4 Provide filler plates for unused spaces in panelboards.
- .5 Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads.
- .6 Provide engraved plastic nameplates under the provisions of Section 26 05 53.
- .7 Ground and bond panelboard enclosure according to Section 26 05 26.
- .8 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.
- .9 Install surface mounted panelboards on fire rated plywood backboards in accordance with Section 06 10 00. Where practical, group panelboards on common backboard.
- .10 Connect loads to circuits.
- .11 Connect neutral conductors to common neutral bus with respective neutral identified.
- .12 Deliver five (5) duplicate keys for each panel lock to Owner.
- .13 Mount electrical panels, where possible, with top of trim at uniform height of 2000 mm.
- .14 Cap ends of conduits in accessible locations in ceiling spaces above panels, to allow for future wiring.



- .15 The Contractors shall install all equipment per the manufacturer's recommendations and the contract drawings.
- .16 Install panelboards in accordance with manufacturer's written instructions, NEMA PB 1.1 and Electrical Code requirements.
- .17 After completion of wiring, type directory showing a clear description of each circuit being controlled from panel and place in metal frame inside door.
- .18 Provide revised directories for existing panels if revised.
- .19 Provide circuit breaker handle locks for all circuits that supply exit signs, emergency lights, energy management, and control system (EMCS) panels and fire alarm panels.

### **3.2 FIELD QUALITY CONTROL**

- .1 Perform inspections and tests listed in NETA ATS, Section 7.4 for switches, Section 7.5 for circuit breakers.
- .2 Inspect complete installation for physical damage, proper alignment, anchorage, and grounding.
- .3 Measure steady state load currents at each panelboard feeder; rearrange circuits in the panelboard to balance the phase loads within 20 per cent of each other. Maintain proper phasing for multi-wire branch circuits.
- .4 Check tightness of bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer's written specifications.

### **3.3 ADJUSTING**

- .1 Measure steady state load currents at each panelboard feeder; rearrange circuits in the panelboard to balance the phase loads to within 20 percent of each other.
- .2 Maintain proper phasing for multi-wire branch circuits.

### **3.4 FACTORY TESTING**

- .1 The following standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of NEMA and UL standards.

### **3.5 CLOSEOUTS**

- .1 Provide three 27 mm empty conduits from top of lighting, receptacle, telephone, signal and communication panels recessed in walls, to ceiling space.
- .2 Include a copy of each panelboard schedule in the Operation and Maintenance manual.

**END OF SECTION**

## **PART 1 - GENERAL**

### **1.1 SECTION INCLUDES**

- .1 Switches, receptacles, wiring devices, cover plates and their installation.

### **1.2 RELATED REQUIREMENTS**

- .1 Section 26 09 23 – Lighting Control Devices.

### **1.3 REFERENCES**

- .1 Canadian Standards Association
  - .1 CSA C22.1 - Canadian Electrical Code, Part I, Safety Standard for Electrical Installations.
  - .2 Ontario Electrical Safety Code.
  - .3 CSA-C22.2 No.42-99(R2004), General Use Receptacles, Attachment Plugs and Similar Devices.
  - .4 CAN/CSA-C22.2 No.42.1-00(R2004), Cover Plates for Flush-Mounted Wiring Devices (Bi-National standard, with UL 514D).
  - .5 CSA-C22.2 No.55-M1986 (R2003), Special Use Switches.
  - .6 CSA-C22.2 No.111-00(R2005), General-Use Snap Switches (Bi-national standard, with UL 20, twelfth edition).
- .2 International Electrotechnical Commission (IEC)
  - .1 IEC 60309 – Plugs, socket-outlets and couplers for industrial purposes.

### **1.4 ACTION SUBMITTALS**

- .1 Submit shop drawings and product data in accordance with Section 01 33 00.
- .2 Product Data: Provide manufacturer's catalogue information showing dimensions, colours, and configurations.

### **1.5 INFORMATIONAL SUBMITTALS**

- .1 Submit manufacturer's installation instructions.

### **1.6 REGULATORY REQUIREMENTS**

- .1 Provide products listed and classified by CSA (Canadian Standards Association).

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- .1 Hubbell Bryant.
- .2 Cooper Wiring Devices by Eaton.
- .3 Pass & Seymour (Legrand).

## 2.2 WALL SWITCHES

- .1 Single pole, double pole, three-way, four-way switches to: CSA-C22.2 No.55 and CSA-C22.2 No.111.
- .2 Description: CSA-C22.2 No.111, Commercial Spec Grade, AC only general-use snap switch.
- .3 Local switches shall be 20 ampere, silent, brown coloured, AC type and CSA certified, specification grade. Provide switches rated to suit system voltage 120 V or 347 V.
- .4 Manually-operated general purpose AC switches with following features:
  - .1 Terminal holes approved for 10 AWG wire.
  - .2 Silver alloy contacts.
  - .3 Urea or melamine moulding for parts subject to carbon tracking.
  - .4 Suitable for back and side wiring.
- .5 Voltage: 120 volt or 347 volt, AC as indicated.
- .6 Current: 20 amperes.
- .7 Body and Handle: plastic with toggle handle. Black color for normal power and Red color for emergency power.
- .8 Toggle operated fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads.
- .9 Example Products (Decorator style):
  - .1 120 volt:
    - .1 Hubbell HBL2121 series.
- .10 Example Products (Toggle style):
  - .1 120 volt:
    - .1 Hubbell HBL1221 (single pole).
    - .2 Hubbell HBL1222 (double pole).
    - .3 Hubbell HBL1223 (three-way).
    - .4 Hubbell HBL1224 (four-way).
- .11 Local switches and receptacles shall be of the same manufacturer throughout except where a specified item is not made by that manufacturer.

## 2.3 RECEPTACLES

- .1 General
  - .1 Description: CSA C22.2 No.42, Extra heavy duty hospital grade use receptacles with green dot symbol back and side wired, tamper-resistant, flush, thermoplastic polyester face/body construction, duplex U-ground, 15 ampere, 125 V, 2-pole, 3-wire grounding receptacles complete with one piece nickel-plated brass mounting strip with integral grounding clips, ground retention clips, nickel-plated brass wiring clamps with nickel-plated brass screws, front circuit identification area and reinforced thermoplastic base.
  - .2 Tamper-resistant receptacles shall permit current to flow only while a standard plug is in the proper position in the receptacle. All exposed screws shall be tamper-resistant.
  - .3 Black color for normal power and Red color for emergency power.
  - .4 Configuration: Type as specified and indicated.

- .5 GFCI Receptacle: Convenience receptacle with integral ground fault circuit interrupter to meet regulatory requirements.
- .6 Receptacles of one manufacturer throughout project.
- .2 Receptacles shall be extra heavy duty hospital grade, unless noted otherwise.
- .3 Other types of receptacles shall be provided as shown on Drawings.

## **2.4 COVER PLATES**

- .1 Cover plates for wiring devices to: CAN/CSA-C22.2 No.42.1.
- .2 Cover plates from one manufacturer throughout project.
- .3 Secure cover plates to the device frames with tamper-resistant screws to match the cover plate.
- .4 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.
- .5 Stainless steel, vertically brushed, cover plates, thickness 2.5 mm for wiring devices mounted in flush-mounted outlet box.
- .6 Cast cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.
- .7 Weatherproof double lift spring-loaded cast aluminum cover plates, complete with gaskets for duplex receptacles as indicated.
- .8 Weatherproof spring-loaded cast aluminum cover plates complete with gaskets for single receptacles or switches.
- .9 Wet Location and weatherproof devices: receptacles and cover plates shall be suitable for wet locations, and provide shielding with and without a plug inserted into the receptacle in accordance with OESC rule 26-702.

## **PART 3 - EXECUTION**

### **3.1 MOUNTING HEIGHTS**

- .1 In accordance with Section 26 05 00.

### **3.2 EXAMINATION**

- .1 Verify that outlet boxes are installed at proper height.
- .2 Verify that wall openings are neatly cut and will be completely covered by wall plates.
- .3 Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

### **3.3 PREPARATION**

- .1 Provide extension rings to bring outlet boxes flush with finished surface.
- .2 Clean debris from outlet boxes.

### **3.4 INSTALLATION**

- .1 Install to CSA C22.1.
- .2 Install devices plumb and level.
- .3 Install switches with OFF position down.
- .4 Install wall dimmers to achieve full rating specified and indicated after de-rating for ganging as instructed by manufacturer.

- .5 Do not share neutral conductor on load side of dimmers.
- .6 Install receptacles with grounding pole on bottom.
- .7 Connect wiring device grounding terminal to outlet box with bonding jumper.
- .8 Install decorative plates on switch, receptacle, and blank outlets in finished areas.
- .9 Connect wiring devices by wrapping conductor around screw terminal.
- .10 Use jumbo size plates for outlets installed in masonry walls.
- .11 Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.
- .12 Switches:
  - .1 Install single throw switches with handle in "UP" position when switch closed.
  - .2 Install switches in gang type outlet box when more than one switch is required in one location.
- .13 Receptacles:
  - .1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.
  - .2 Where split receptacle has one portion switched, mount vertically and switch upper portion.
  - .3 Connect receptacle grounding terminal to the outlet box with an insulated green ground strap.
  - .4 Receptacles to be black for devices connected to normal power circuits, red for devices connected to essential power circuits including isolated power centres. Isolated ground receptacles connected to circuits fed from uninterruptible power supply units to be orange colour. Generally, install receptacles in Patient Care Areas vertically with ground pins up.
  - .5 Safety shutter type receptacles to be located where shown and required by code and CSA Z32.
  - .6 In patient care areas, 15A/20A straight blade receptacles to be hospital grade.
  - .7 Comply with requirements of CSA Standard Z32, with regards to identifying circuit number and supplying panelboard, permanently identified at outlets. Identify this information in areas on front of each receptacle. In addition, provide typed label on wall below each device faceplate, identifying circuit number and panelboard from where each device is fed. Confirm nomenclature with Consultant prior to printing of labels and nameplates. Turn over label maker to Consultant/Owner prior to application for Certificate of Substantial Performance of the Work.
- .14 Cover plates:
  - .1 Protect cover plate finish with paper or plastic film until painting and other work is finished.
  - .2 Install suitable common cover plates where wiring devices are grouped.
  - .3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.
  - .4 Do not install plates until final painting of room or area is completed. Remove protective covering.
  - .5 Within special imaging/scanning unit type rooms, devices including mounting screws and hardware to be of non-ferrous construction as per unit manufacturer's instructions.
  - .6 Confirm exact material, finish, and colour of faceplates for devices in any particular area with Consultant prior to ordering. Submit sample board as per requirements of Part 1.
  - .7 Provide faceplates with printed self-adhesive label on inside face identifying circuit number and panel feeding device. Turn over label maker to Consultant prior to application for Certificate of Substantial Performance of the Work.
- .15 Circuit identification: to match existing facility standards.

### **3.5 FIELD QUALITY CONTROL**

- .1 Inspect each wiring device for defects.
- .2 Operate each wall switch with circuit energized and verify proper operation.
- .3 Verify that each receptacle device is energized.
- .4 Test each receptacle device for proper polarity.
- .5 Test each GFCI receptacle device for proper operation.
- .6 For all Patient Care receptacles, include for and arrange for third party independent testing company to perform Hospital Grade receptacle testing in accordance with CSA-Z23. Independent Testing Organizations:
  - .1 AC Tesla.
  - .2 Brosz and Associates.
  - .3 C-INTECH.
  - .4 Eastenghouse.
  - .5 Enkompass.
  - .6 G.T. Wood.
  - .7 Bender.

### **3.6 ADJUSTING**

- .1 Adjust devices and wall plates to be flush and level.

### **3.7 CLEANING**

- .1 Clean exposed surfaces to remove splatters and restore finish.

**END OF SECTION**

## PART 1 - GENERAL

### 1.1 SUBMITTALS

- .1 Provide electrical distribution system test reports.
- .2 Provide shop drawings for products specified in this Section.

### 1.2 BREAKERS

- .1 Size breakers as per drawings and/or schedules, but in absence of direction, size breakers to suit intended application, to suit coordination study requirements and in accordance with local governing electrical safety code.

### 1.3 EQUIPMENT WITHSTAND RATINGS

- .1 Electrical equipment, circuit protective devices, bussing and switches to be rated for interrupt and withstand short circuit faults greater than available fault current at its source of supply.

### 1.4 DELIVERY, STORAGE, AND HANDLING

- .1 Ship low voltage protective devices in original containers.
- .2 Do not ship low voltage protective devices installed in distribution equipment.
- .3 Store low voltage protective devices in original containers in storage cabinet.
- .4 Waste Management and Disposal:
  - .1 Separate waste materials for reuse and recycling in accordance with Section Division 00 and Division 01 requirements.

### 1.5 MAINTENANCE MATERIALS

- .1 Provide maintenance materials in accordance with Section 01.

## PART 2 - PRODUCTS

### 2.1 DISCONNECT SWITCHES MANUFACTURERS

- .1 Eaton;
- .2 Schneider;
- .3 Siemens;
- .4 General Electric.

### 2.2 DISCONNECT SWITCHES REQUIREMENTS

- .1 CSA approved heavy duty disconnect (safety) switches;
- .2 Front operated with a handle suitable for padlocking in "OFF" position and arranged so that enclosure cover cannot be opened while handle is in "ON" position
- .3 Operating mechanisms: quick-break, positive acting with visible blades and a line terminal shield;
- .4 Fusible units with fuse clips suitable for HRC fuses, unless otherwise noted;
- .5 Ampere rating, number of poles and fuse requirements as indicated on drawings;
- .6 Factory primed and painted switch enclosures.

- .7 Disconnects for variable speed drives to be suitable for use with such drives and include auxiliary switch/contact to de-energize control power circuit, as required and as applicable.
- .8 Enclosures for disconnects mounted in climate controlled areas and for standard non-climate controlled applications, to be minimum NEMA 3R.
- .9 Use NEMA 4X for corrosive environment applications.

### **2.3 ADDITIONAL DEVICES FOR EXISTING EQUIPMENT**

- .1 Products to be of types from existing equipment manufacturers.
- .2 Additional breakers for existing panelboards are to match existing device standards and be completely compatible to equipment in which they are installed.
- .3 During Bidding period, check and verify exact requirements of existing equipment to ensure that additional devices are accommodated.
- .4 Make necessary modifications to equipment to accommodate device and feeder installation.
- .5 Provide suitable engraved lamacoid identification nameplate on additional components.
- .6 Revise typed circuit directory cards on branch circuit panelboards.
- .7 Mount additional devices to standards of existing equipment manufacturer.
- .8 Refer to notes on drawings.
- .9 Provide additional retrofit work to existing equipment as noted on drawings.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION OF DISCONNECT SWITCHES**

- .1 Provide disconnects switches and install into locations and connect complete.
- .2 Ensure adequate clearance is provided as per code requirements and as required for access for operation and maintenance.
- .3 Install as follows:
  - .1 wherever shown on drawings and/or specified herein;
  - .2 wherever required by starter schedule drawings;
  - .3 for motorized equipment which cannot be seen from motor starter location or is more than 9 m (30') from starter location;
  - .4 for "packaged" equipment fed from a motor starter panel.
- .4 Ensure enclosure ratings are suitable for intended applications.
- .5 Provide engraved Lamacoid nameplate with nomenclature confirmed with Consultant.

**END OF SECTION**



## **PART 1 - GENERAL**

### **1.1 SECTION INCLUDES**

- .1 Materials for Molded-Case Circuit Breakers (MCCB).
- .2 Accessories

### **1.2 RELATED REQUIREMENTS**

- .1 Section 26 24 16 – Panelboards.

### **1.3 REFERENCES**

- .1 CSA C22.1:21, Canadian Electrical Code, Part 1 (25th Edition), Safety Standard for Electrical Installations.
- .2 Ontario Electrical Safety Code (28th edition/2021).
- .3 CSA C22.2 No. 5-16, Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures.
- .4 NEMA AB1 - Molded Case Circuit Breakers, Molded Case Switches, and Circuit - Breaker Enclosures.
- .5 NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment (published by the International Electrical Testing Association).

### **1.4 SUBMITTALS**

- .1 Submit product data in accordance with Section 01 33 00.
- .2 Include time-current characteristic curves for breakers with ampacity of 400 A and above, or with interrupting capacity of 22,000 A symmetrical (rms) and over at system voltage.
- .3 Include termination temperature rating in degrees C.
- .4 Certificate of Origin
  - .1 Prior to any installation of circuit breakers in either a new or existing installation, Contractor must submit three (3) copies of a certificate of origin from the manufacturer, duly signed by the factory and the local manufacturer's representative, certifying that all circuit breakers come from this manufacturer, they are new and they meet standards and regulations. These certificates must be submitted to the Consultant for review.
  - .2 A delay in the production of the certificate of origin won't justify any extension of the contract and additional compensation.
  - .3 Any work of manufacturing, assembly or installation should begin only after acceptance of the certificate of origin by the Consultant. Unless complying with this requirement, Consultant reserves the right to mandate the manufacturer listed on circuit breakers to authenticate all new circuit breakers under the contract, and that, to Contractor's expense.
  - .4 In general, the certificate of origin must contain:
    - .1 The name and address of the manufacturer, and the person responsible for authentication. The responsible person must sign and date the certificate;
    - .2 The name and address of the licensed dealer, and the person of the distributor responsible for the Contractor's account.
    - .3 The name and address of the Contractor, and the person responsible for the project.

- .4 The name and address of the local manufacturer's representative. The local representative must sign and date the certificate.
- .5 The name and address of the building where circuit breakers will be installed:
  - .1 Project title.
  - .2 End user's reference number.
  - .3 The list of circuit breakers.

## **PART 2 - PRODUCTS**

### **2.1 GENERAL**

- .1 Molded-case circuit breakers, Circuit breakers, and Ground-fault circuit-interrupters, Fused circuit breakers, and Accessory high-fault protectors: to CSA C22.2 No. 5.
- .2 Bolt-on Molded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.
- .3 Plug-in Molded case circuit breakers: quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.
- .4 Common-trip breakers: with single handle for multi-pole applications.
- .5 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.
  - .1 Trip settings on breakers with adjustable trips to range from 3-8 times current rating.
- .6 Circuit breakers with interchangeable trips.

### **2.2 INTERRUPTING CAPACITY**

- .1 Protective devices shall be fully rated, for required available fault current. Series rated shall not be used on this installation.
- .2 Refer to Section 26 24 13, and Section 26 24 16.

### **2.3 MOLDED CASE CIRCUIT BREAKERS – GENERAL**

- .1 Molded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.
- .2 NEMA AB 1, circuit breakers with integral thermal and instantaneous magnetic trip in each pole.
- .3 Provide circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.
- .4 1-, 2-, or 3-pole bolt on, single-handle common trip voltage as indicated on drawings.
- .5 Overcentre toggle-type mechanism, quick-make, quick-break action. Trip indication is by handle position.
- .6 Calibrate for operation in 40 degree C ambient temperature.

### **2.4 MOLDED CASE CIRCUIT BREAKERS – UP TO 150 AMPERE**

- .1 Permanent trip unit containing individual thermal and magnetic trip elements in each pole, unless noted otherwise on drawings.

## **2.5 ADDITIONAL FEATURES**

- .1 Provide as indicated on drawings:
  - .1 Shunt trip.
  - .2 Auxiliary switch.
  - .3 Motor-operated mechanism.
  - .4 Under-voltage release.
  - .5 On-off locking device.
  - .6 Handle mechanism.

## **2.6 ENCLOSED BREAKERS**

- .1 Molded case, front operated, automatic circuit breakers sized as specified on drawings each secured in a NEMA 1, flush wall mounting enclosure with steel front panel.
- .2 Voltage rating suitable for circuit phase to phase voltage as indicated on drawings.
- .3 Units to include solid state adjustable trip units and contactors. Contactors to be of rating and type to suit application.

## **2.7 CIRCUIT BREAKERS FOR EXISTING DISTRIBUTION EQUIPMENT**

- .1 Products to be of types from existing equipment manufacturers.
- .2 Additional breakers for existing panelboards are to match existing device standards and be completely compatible to equipment in which they are installed.
- .3 During Bidding period, check and verify exact requirements of existing equipment to ensure that additional devices are accommodated.
- .4 Make necessary modifications to equipment to accommodate device and feeder installation.
- .5 Provide suitable engraved lamaroid identification nameplate on additional components to suit existing.
- .6 Revise typed circuit directory cards on branch circuit panelboards.
- .7 Mount additional devices to standards of existing equipment manufacturer.
- .8 Refer to notes on drawings.
- .9 Provide additional retrofit work to existing equipment as noted on drawings.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- .1 Install circuit breakers as per related sections.

**END OF SECTION**

## **PART 1 - GENERAL**

### **1.1 SECTION INCLUDES**

- .1 Fusible and non-fusible enclosed low-voltage disconnect switches from 30 amps to 800 amps.

### **1.2 RELATED REQUIREMENTS**

- .1 Section 26 28 13 – Fuses.

### **1.3 REFERENCES**

- .1 CSA Group:
  - .1 CSA C22.1:21, Canadian Electrical Code, Part 1 (25th Edition), Safety Standard for Electrical Installations.
  - .2 Ontario Electrical Safety Code (28th Edition/2021).
  - .3 CAN/CSA-C22.2 No. 4-16 – Enclosed and Dead-Front Switches.
  - .4 CSA C22.2 No. 248 series – Low-voltage fuses.
- .2 NETA (International Electrical Testing Association) ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

### **1.4 SUBMITTALS**

- .1 Product Data: Provide switch ratings, and enclosure dimensions.

### **1.5 CLOSEOUT SUBMITTALS**

- .1 Record actual locations of enclosed switches in project record documents.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- .1 Eaton Cutler-Hammer.
- .2 Siemens.
- .3 Square D by Schneider Electric.

### **2.2 REGULATORY REQUIREMENTS**

- .1 Products: Listed and classified by CSA or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

### **2.3 DISCONNECT SWITCHES**

- .1 Provide dedicated disconnect switches at electrical equipment.
- .2 Fused or un-fused disconnect or safety switches: Type "A", quick-make, quick-break construction with provision for padlocking switches in either "ON" or "OFF" position.
  - .1 Quick-make, quick-break.
  - .2 Heavy duty industrial type.
  - .3 Lockable with up to 3 padlocks.

- .4 Cover interlocked with switch mechanism.
- .5 Viewing window for viewing blades.
- .3 Fused switches equipped with fuse clips designed for Class "J" fuses and designed to reject standard NEC fuses.
- .4 Enclosure: CSA Type 1 sprinkler-proof, or as noted.
- .5 Switches throughout project of same manufacturer.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- .1 Provide fused or un-fused safety or disconnect switches as shown and as required by Code.
- .2 Install disconnect switches complete with fuses, if applicable, to CSA C22.1.
- .3 Apply neatly typed adhesive tag on inside door of each fusible switch indicating NEMA fuse class and size installed.
- .4 Coordinate fuse ampere rating with installed equipment. Fuse ampere rating variance between original design information and installed equipment, size in accordance with Bussmann Fusetron 40 degree C recommendations. Do not provide fuses of lower ampere rating than motor starter thermal units.

**END OF SECTION**

## PART 1 - GENERAL

### 1.1 SECTION INCLUDES

- .1 Common requirements for all electric lighting, including interior, exterior, and emergency lighting.

### 1.2 RELATED REQUIREMENTS

- .1 Section 26 09 23 – Lighting Control Devices.

### 1.3 REFERENCES

- .1 Canadian Standards Association (CSA)
  - .1 CSA C22.1-12, Canadian Electrical Code, Part 1 (22<sup>nd</sup> edition), Safety Standard for Electrical Installations.
  - .2 Ontario Electrical Safety Code, 25<sup>th</sup> Edition / 2012.
  - .3 CSA C22.2 No. 9.0 - General Requirements for Luminaires.
  - .4 CSA C22.2 No. 250.0 - Luminaires (Bi-National Standard, with UL 1598).
  - .5 CAN/CSA E920 - Ballasts for Tubular Fluorescent Lamps - General and Safety Requirements (Adopted IEC 920:1990, first edition, including Amendment 1:1993 and Amendment 2:1995, with Canadian deviations).
  - .6 CAN/CSA-E928 - Auxiliaries for Lamps - A.C. Supplied Electronic Ballasts for Tubular Fluorescent Lamps - General and Safety Requirements (Adopted IEC 928:1995, second edition, with Canadian deviations).
  - .7 CAN/CSA-E61347-2-3 - Lamp Controlgear - Part 2-3: Particular Requirements for A.C. Supplied Electronic Ballasts for Fluorescent Lamps (Adopted CEI/IEC 61347-2-3:2000, first edition, 2000-10, with Canadian deviations).
  - .8 Design Lights Consortium (DLC).
  - .9 Technical Requirements Table v2.1, or latest edition.
  - .10 While the specifications do not explicitly call for DLC qualified LED luminaires, the technical criteria provided in the DLC Technical Requirements provide the basis of the requirements for this section of the Specification.
  - .11 Energy Star
- .2 Illumination Engineering Society (IES)
  - .1 IES HB-10-11 – The Lighting Handbook, 10<sup>th</sup> Edition.
  - .2 IES LM-79-08 – Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products.
  - .3 IES LM-80-08 – IES Approved Method for Measuring Lumen Maintenance of LED Light Sources.
- .3 TM-21-11- IES Technical Memorandum on Projecting Long Term Lumen Maintenance of LED Light Sources.
- .4 National Electrical Manufacturer's Association (NEMA)
- .5 SSL-1-10 – Electronic Drivers for LED Devices, Arrays, or Systems.
- .6 NEMA WD 6 - Wiring Devices - Dimensional Requirements.

#### 1.4 MENTAL HEALTH AREAS

- .1 Products accessible to patients in mental health area and any other areas subject to abuse shall include the following features:
  - .1 Anti-ligature;
  - .2 Tamper-resistant exposed mounting hardware;
  - .3 Impact resistant.

#### 1.5 SUBMITTALS FOR REVIEW

- .1 Refer to Section 01.
- .2 General
  - .1 The Contractor shall be responsible for supplying equipment product data, and as indicated in the specification, partial or complete working samples of the specified equipment in a timely fashion for design team approval, prior to releasing orders on equipment. Contractor shall be responsible for coordinating all aspects of order placement, deposits, shop drawing procurement, order release, order follow-up, delivery tracking, etc. with Distributor in a timely fashion. Some luminaires may require at least 12 to 16 weeks of lead time or more- the Contractor is responsible for allowing sufficient time for the order-and-deposit process, shop drawing procurement, submittal, and review process. Substitutions will not be accepted on the basis of the contractor's obligation to make any deadlines, contractual or otherwise, agreed by the contractor toward the completion of this project. Lamp submittals are as important and necessary as luminaire submittals and must be supplied by the Contractor to assure correct lamp wattage, color and efficacy.
  - .2 All submittals shall be generated by respective factories with their seals or other authentication marks and each submittal sheet shall be clearly labeled with respective luminaire type, complete catalog number relevant to submitted luminaire, date of submittal generation and name, phone number, and email address of submittal author in order to track provenance of information. The Consultant may contact respective factory submittal source.
  - .3 The lighting equipment specified herein has been carefully chosen for its ability to meet the luminous environment requirements of this project. Calculations were typically made to determine luminances, luminance ratios, and/or horizontal and vertical illuminances and uniformities. In some instances, virtual reality "images" were generated with lighting calculation software to assist the Design Team and/or the Client in assessing the lighting quality of the spaces or areas. Equipment and/or manufacturers which have been shown to comply with the established criteria, including ASHRAE/IES 90.1 or California Title 24 or other such energy code as applicable by ordinance, code, Federal law, or mandate, and/or intended LEED or other green-building certification, is specified herein. Substitutions in all likelihood will be unable to meet all or some of the salient criteria as the specified equipment.
  - .4 Where permitted, substitution submittals shall consist of a physical description, detailed dimensioned drawing and complete photometric and electric data of the proposed lamp, ballast, driver, or transformer as required, and luminaire. Working samples of lamp and luminaire substitutions must also be supplied at time of substitution request for visual check of finish, operating and photometric characteristics, and functional and aesthetic design. Photometric reports must list the actual candela values of the luminaire's distribution with specified or similar lamp in at least five horizontal planes with elevation angles in increments not greater than 5° from nadir to zenith. If additional data is required to account for asymmetric distributions, then this shall also be supplied. Candela curves, lux or footcandle and lumen tables and iso-lux-or-footcandle contours are not acceptable. The Contractor shall be responsible for negotiation with the client, Consultant, Lighting Designer, and Electrical Engineer prior to substitution submittal to as assure fees are available for: redesign project based on proposed substitution ; or review by Consultant, Lighting Designer and Electrical Engineer of all photometric, sample, design and calculation documentation and virtual reality renderings (provided by Contractor) for proposed

substitutions. All substitutions must be identified and approved prior to bid date; and all contractor negotiations re: additional fees for redesign work due to substitutions must occur prior to bid date. A Substitution Request Form shall be completed, submitted, and postmarked along with all relevant documentation required on the Substitution Request Form two weeks prior to bid date. No substitutions will be considered without compliance with this paragraph. Contractor's bid value and/or schedule commitments shall not be based on substitutions in expectation of design team approval, nor on Contractor estimated value of specified equipment. If submitted substitution fails to comply with any specification requirements or is rejected for any or no reason whatsoever, Contractor will furnish specified equipment at no additional cost or delay to the Owner.

- .5 The Contractor shall be responsible for obtaining from his supplying lighting manufacturers, for each luminaire, a recommended maintenance manual including:
  - .1 Vendor and local representative's contact information
  - .2 Tools required
  - .3 Instructions
  - .4 Types of cleaners to be used
  - .5 Replacement parts identification lists
  - .6 Equipment product data (high-quality reproducible copies)
  - .7 Warranty documentation
- .3 Shop Drawings:
  - .1 Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
  - .2 Wiring diagrams for power, signal and control wiring.
- .4 Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes and the following:
  - .1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 The product literature shall provide an explanation of all options and descriptors in the catalog number as submitted.
  - .3 Include luminaire weight.
  - .4 Provide complete photometric data prepared by independent testing laboratory for each luminaire, for approval by Engineer.
  - .5 Physical description of lighting fixtures including dimensions.
  - .6 Ballast, including BF.
  - .7 Energy-efficiency data, including ballast input wattage.
  - .8 Life, output (lumens, CCT and CRI), and energy efficiency data for lamps.
- .5 Photometric Data and Calculations
  - .1 Provide Luminaire Data Photometric Testing performed by an independent agency complying with IESNA Lighting Measurement Testing and Calculation Guides.
  - .2 Submit photometric calculations for typical areas based on layouts as indicated on the drawings.
    - .1 Submit a photometric calculation for the typical areas based on the existing conditions.
    - .2 Submit a photometric calculation for the same typical areas based on the proposed new fixtures.



- .3 Clearly indicate mounting heights, heights of calculation zones, light loss factors and surface reflectance values.
- .4 Use the follow photometric parameters:
  - .1 Recoverable Light Loss Factors: 0.8
  - .2 Ceiling reflectance values of 80 per cent.
  - .3 Wall reflectance value of 50 per cent.
  - .4 Floor reflectance value of 20 per cent.
- .3 Submittals shall be in PDF format, and the native file of the software used to make the photometric analysis.
- .4 Submit IES photometric data files for the existing and proposed luminaires.

#### **1.6 SUBMITTALS FOR CLOSEOUT**

- .1 Section 01: Submittals for project closeout.
- .2 Submit manufacturer's operation and maintenance instructions for each product.
- .3 Provide a list of all lamp types used on the project, use ANSI and manufacturer's codes.

#### **1.7 DEFINITIONS**

- .1 BF: Ballast factor.
- .2 CCT: Correlated colour temperature.
- .3 CRI: Colour-rendering index.
- .4 LER: Luminaire efficacy rating.
- .5 LED: Light Emitting Diode.
- .6 Lumen: Measured output of lamp and luminaire, or both.
- .7 Luminaire: Complete lighting fixture, including ballast housing if provided.

#### **1.8 QUALIFICATIONS**

- .1 Manufacturer: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.

#### **1.9 REGULATORY REQUIREMENTS**

- .1 Products shall be listed and classified by CSA (Canadian Standards Association), ULC (Underwriter's Laboratories of Canada), or certified by recognized independent testing organizations that test to CSA standards.
- .2 All equipment and parts specified herein shall bear the "ULC Approved" label (or other NRTL label) indicating compliance with UL requirements or as otherwise allowed by the Authority Having Jurisdiction. All luminaires shall be ULC/ NRTL or CSA listed and labeled for installation in fireproof or non-fireproof construction, dry, damp, or wet locations as required.
- .3 Recessed fixtures mounted in an insulated ceiling shall be listed for use in insulated ceilings.

#### **1.10 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

- .3 Disposal and recycling of fluorescent lamps as per local regulations.

#### 1.11 EXTRA MATERIALS

- .1 Refer to Section 01.
- .2 Provide the following additional equipment as listed herein.
  - .1 Provide an additional 2 per cent spare luminaires of each new type to be provided.
  - .2 Provide 1 per cent of each plastic lens type.
  - .3 Provide 2 per cent replacement lamps for each lamp type.
  - .4 Provide 1 per cent of each ballast type.
  - .5 Provide 1 per cent of each LED driver type.
  - .6 Provide three of each type of any special tools required for system use and maintenance.

#### 1.12 WARRANTY

- .1 Refer to Section 01 and Section 26 05 00.
- .2 The manufacturer shall provide a warranty against loss of performance and defects in materials and workmanship for the luminaires for a period of 5 years after acceptance of the luminaires. Warranty shall cover all components comprising the luminaire.
- .3 All warranty documentation shall be provided to customer prior to the first shipment.
- .4 LED Luminaires shall have a manufacturer's warranty for a period of not less than five years.
- .5 LED boards, drivers and associated components shall have a warranty of 5 years on the LEDs, 5 years on the driver, 10 years on the paint finish.

### PART 2 - PRODUCTS

#### 2.1 LUMINAIRES

- .1 Provide luminaires in accordance with Schedule of Luminaires found on drawings. Luminaires are to be CSA approved or have special local electrical authority approval.
- .2 Where luminaires are noted to be supplied by others, typically lamps (except LEDs) are not included and are to be provided in scope of this Contract.
- .3 Provide thickness of metal as indicated in Schedule of Luminaires and details, or as required so that luminaires are rigid, stable and resists deflection, twisting, warping or bending under normal installation procedures, re-lamping etc., or no less than requirements specified herein the specifications.
- .4 Unless otherwise noted, linear and continuous linear architectural LED luminaires bodies to be constructed of extruded aluminum and of rigid construction. Unless otherwise noted, provide body finishes of corrosion resistant, chemically treated and electrostatically applied post powder coat finish. Efficiency not to be less than 69%.
- .5 Unless otherwise noted, vandal resistant luminaires to be constructed of heavy duty extruded aluminum rails and die cast end caps, complete with stainless steel torx with centre reject pin and Allen head set screws. Screw heads to be mounted and concealed under lens. Lens to be extruded UV stabilized polycarbonate lens with internal linear ribbed design.
- .6 Provide neoprene or silicone gasketing, barriers and stops where required to prevent light leaks or water/water vapour penetration.
- .7 Fabricate housings to allow for easy accessibility and replacement of parts.

- .8 Fabricate fixtures with a minimum number of joints. Make unexposed joints by acceptable method such as welding, brazing, screwing or bolting. Soldered joints are unacceptable. Do not use blind metal tapping methods or rivets for fastening parts which must be removed during service, or for fastening electrical components and supports. Cast parts, including die-cast members, to be of uniform quality, close grained, rigid, true to pattern, free from blow holes, pores, discoloration, hard spots, shrinkage defects, and cracks or other imperfections that affect strength and appearance or are indicative of inferior metals or alloys.
- .9 Reflectors and reflecting cones or baffles to be free of any tooling marks, spinning lines or marks by other assembly techniques. Finishes to be equal to first quality polished, baffled and anodised "Alzak".
- .10 Lenses and louvres to comply with local governing building code and other local governing code flame spread rating requirements.
- .11 Recessed luminaires with replaceable/serviceable parts to be accessible from lens side (ie. room side) of fixtures to allow for proper accessibility.
- .12 Luminaires to be factory assembled and tested prior to delivery on site.
- .13 Exposed parts and hardware of luminaires located in non-climate controlled areas to be corrosion resistant and weather resistant. Hardware to be tamper-proof.
- .14 When requested, submit luminaire samples.
- .15 Dimensions for coves, valances, and strips as shown on drawings are for bidding purposes only. Job measure for exact dimensions of louvres, lenses and strips.
- .16 Dimensions for linear and continuous linear LED as shown on drawings are for bidding purposes only. Job measure for exact dimensions requirements to suit installation location.
- .17 Review exact colours and finishes of luminaires with Consultant after award of contract but prior to ordering. Obtain information in time to meet installation schedule.
- .18 Coordinate with LED/driver manufacturers and dimmer/occupancy control manufacturers to ensure that components are compatible with each other and that interconnections do not affect performance, life or any warranties.
- .19 Products of same specified type to be of same manufacturer.

## **2.2 INDOOR LED LUMINAIRES, GENERAL**

- .1 Initial delivered lumens – thermal losses should be less than 10 per cent when operated at a steady state at an average ambient operating temperature of 25 degrees C, and optical losses should be less than 15 per cent.
- .2 Average Delivered Lumens – Average delivered lumens over 50 000 hours should be minimum of 85 per cent of initial delivered lumens.
- .3 All luminaires shall be tested per LM79/80 and published L70 data.
- .4 Available in 3500 K correlated colour temperature, CRI greater than or equal to 80, or as indicated.
- .5 Accessibility and Maintenance:
  - .1 All LED luminaires shall be field serviceable, with LED arrays, LED modules, drivers, etc. fully serviceable and easily accessible. In the case of recessed ceiling mounted, and in the case of surface mounted ceiling fixtures, these components must be accessible from below. Luminaires in which any of these components are accessible only from above are not acceptable.
  - .2 Ballasts, drivers, LED arrays, LED modules, and lamps shall be serviceable while the fixture is in its normally installed position. Ballasts or drivers shall not be mounted to removable reflectors or wireway covers unless so specified. In the case of ceiling mounted luminaires, the serviceable components must be accessible from below.
- .6 Housings:

- .1 Formed to prevent warping and sagging. Housing, trim and lens frame shall be true, straight (unless intentionally curved), and parallel to each other as designed.
- .2 Sheet steel housings to be minimum 20 gauge.
- .3 Wireways and fittings: free of burrs and sharp edges, and shall accommodate internal and branch circuit wiring without damage to the wiring.
- .4 When installed, any exposed fixture housing surface, trim frame, door frame, and lens frame shall be free of light leaks.
- .5 Hinged door frames shall operate smoothly without binding. Latches shall function easily by finger action without the use of tools.
- .6 Drivers shall not be mounted to removable reflectors or wireway covers unless so specified.
- .7 Mechanical Safety: Lighting fixture closures (lens doors, trim frame, hinged housings, etc.) shall be retained in a secure manner by captive screws, chains, aircraft cable, captive hinges, or fasteners such that they cannot be accidentally dislodged during normal operation or routine maintenance.
- .8 Metal Finishes:
  - .1 Fixture finish and construction to meet ULC listings and CSA certifications related to intended installation.
  - .2 All metal components of fixtures shall be painted after fabrication to mitigate raw metal edges, and thus prevent premature corrosion.
  - .3 The manufacturer shall apply standard finish (unless otherwise specified) over a corrosion-resistant primer, after cleaning to free the metal surfaces of rust, grease, dirt and other deposits. Edges of pre-finished sheet metal exposed during forming, stamping or shearing processes shall be finished in a similar corrosion resistant manner to match the adjacent surface(s). Fixture finish shall be free of stains or evidence of rusting, blistering, or flaking, and shall be applied after fabrication.
  - .4 Interior light reflecting finishes shall be white with not less than 85 per cent reflectance, except where otherwise shown on the drawing.
- .9 Wiring:
  - .1 Lighting fixtures shall have a specific means for grounding metallic wireways and housings to an equipment grounding conductor.
  - .2 Supplied complete with a luminaire disconnect plug.

## **2.3 DRIVERS, GENERAL**

- .1 CSA approved, ULC listed and labelled;
- .2 Electronic LED drivers shall be integral to the luminaire, and be designed to be accessible in the field for replacement and servicing.
- .3 Input Voltage:
  - .1 Driver with a voltage range of (120-277) +/- 10% or (347-480) +/- 10%.
  - .2 Refer to lighting fixture schedule.
  - .3 For luminaires connected to a 347 volt circuit and utilizing a natively 120-277 volt driver, provide an appropriately sized step down transformer.
- .4 Input frequency 60 Hz.
- .5 Load regulation: +/- 1 per cent from no load to full load.
- .6 Output ripple less than 10 per cent.
- .7 Output should be isolated.

- .8 Case temperature: rated for -40 degrees C through +80 degrees C.
- .9 Overheat protection, self-limited short circuit protection and overload protected.
- .10 Primary fused.
- .11 Driver life rating not less than 50 000 hours
- .12 Power Factor and Total Harmonic Distortion
  - .1 Power factor of greater than or equal to 0.9 at full load.
  - .2 THD of less than or equal to 20 per cent at full load.
- .13 Dimming Control:
  - .1 Coordinate with Section 26 09 23.
  - .2 0-10 V dimming control typical for all fixtures unless otherwise noted.
  - .3 Control range: 10 per cent to 100 per cent typical, unless noted otherwise.
  - .4 Provide a mock-up to demonstrate the luminaire is free of flicker throughout the dimming range when used with the dimming controllers described in related sections.

## **2.4 INTERIOR WALL-WASH LED LUMINAIRES**

- .1 Minimum Light Output: 575 lm.
- .2 Zonal lumen density:
  - .1 Minimum 60 per cent between 0 degrees and 90 degrees from nadir.
- .3 Minimum 60 per cent of the lumens must be produced in the "forward" hemisphere, towards the wall.
- .4 Minimum luminaire efficacy: 45 lumens per watt.
- .5 Correlated Colour Temperature (CCT): 3500 K

## **2.5 COLOUR RENDITION INDEX (CRI): 80 CRI MINIMUM.**

- .1 Minimum L70 lumen maintenance to occur at 50 000 hours in accordance with LM-80 testing data and TM-21 extrapolation.

## **2.6 DOWNLIGHT LUMINAIRES**

- .1 Minimum Light Output: 500 lm.
- .2 Zonal lumen density: Minimum 75 per cent between 0 degrees and 60 degrees from nadir.
- .3 Minimum luminaire efficacy: 45 lumens per watt.
- .4 Correlated Colour Temperature (CCT): 3500 K
- .5 Colour Rendition Index (CRI): 80 CRI minimum.
- .6 Minimum L70 lumen maintenance to occur at 50 000 hours in accordance with LM-80 testing data and TM-21 extrapolation.

## **2.7 LUMINAIRES**

- .1 In accordance with related sections.

## PART 3 - EXECUTION

### 3.1 VERIFICATION OF CONDITIONS

- .1 Coordinate the lighting system installation with the relevant trades so as to eliminate interferences with hangers, mechanical ducts, sprinklers, piping, steel, etc.

### 3.2 INSTALLATION

- .1 Install lighting equipment, including but not limited to luminaires, controls, auxiliary devices and the integration of same in strict conformance with all manufacturers' recommendations and instructions the securing of which shall be the responsibility of the Contractor.
- .2 Luminaires shall be integrated with controls in accordance with respective luminaire manufacturers' and controls manufacturers' recommendations and instructions and to provide a complete, trouble-free operation without compromising safety, code and UL/CSA/NOM requirements.
- .3 The Contractor shall coordinate the lighting system installation with the relevant trades so as to eliminate interferences with hangers, mechanical ducts, sprinklers, pipes, steel, etc.
- .4 For installation in suspended ceilings, ensure that the luminaires are supported such that there is no resultant bowing or deflection of the ceiling system greater than 1/360 of the length of the total span of the ceiling member.
- .5 Mounting heights and configuration of the luminaires shall be as specified in the Luminaire Schedule portion of the Specification or indicated on the drawings, and where conflicts exist, as approved by the Consultant.
- .6 All luminaires shall be installed plumb and true and level as viewed from all directions unless specifically identified otherwise in the Luminaire Schedule. Luminaires shall remain plumb and true without continual adjustment or visibly obvious means beyond what is shown on luminaire submittal drawings.
- .7 Suspended luminaires shall be installed plumb and true and level unless specifically identified otherwise in the Luminaire Schedule portion of this Specification and at a height from finished floor as specified on the drawings, details and Luminaire Schedule. In cases where this is impractical, refer to the Consultant for a decision. All appurtenances shall be consistently organized for a neat, uniform appearance.
- .8 Luminaire finishes which are disturbed in any way during construction shall be touched up or refinished in a manner satisfactory to the Consultant.
- .9 Reflector cones, louvers, baffles, lenses, trims and other decorative elements shall be installed after completion of ceiling tile installation, plastering, painting and general cleanup.
- .10 Whenever a luminaire or its hanger canopy is installed directly to a surface mounted junction box, a finishing ring painted to match the ceiling, shall be used to conceal the junction box.
- .11 All lamps shall be seasoned for a minimum of 12 hours and a maximum of 100 hours in full-on mode without dimming. All lamps used for convenience lighting during construction shall be replaced with identical new lamps, which shall then be seasoned as described above, immediately prior to the date of substantial completion as determined by the Consultant.
- .12 All accessories shall be properly installed and adjusted by Contractor in accordance with specification and installation instructions. Any spare items shall be clearly labeled (indicate type of accessory and associated luminaire types).
- .13 Locate and install luminaires as indicated.
- .14 Provide adequate support to suit ceiling system.
- .15 For fluorescent lighting, provide instant start ballasts for all areas with no occupancy sensors and program rapid start in areas with occupancy sensors.

- .16 Install suspended luminaires and exit signs using pendants supported from swivel hangers. Provide pendant length required to suspend luminaire at indicated height.
- .17 Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.
- .18 Install clips to secure recessed grid-supported luminaires in place.
- .19 Install wall mounted luminaires at height as indicated.
- .20 Install accessories provided with each luminaire.
- .21 Install specified lamps in luminaire.
- .22 Clean and re-lamp existing luminaires to be reused.
- .23 Check lighting luminaires and mountings for their electrical and physical characteristics in relation to conditions due to building construction and mechanical equipment. Make necessary adjustments to luminaires or hanging arrangement without expense to Owners. Give notification at time of shop drawings and before construction if decision on necessary changes is required.
- .24 Do not mount luminaires above pipes, ducts or equipment. In event of unavoidably tight locations, provide hangers to clear obstruction. Check layouts of other trades on job and plan co-operatively. Luminaires in any room shall hang at one height. Obtain approval before any changes are made to layouts shown.
  - .1 Existing luminaires designated to be relocated and reused, to be:
    - .1 disconnected, removed and stored in a safe area as designated by Owner and reviewed with Consultant until ready for re-installation;
    - .2 inspected, cleaned, repaired and re-lamped;
    - .3 identified to Consultant of requirement for replacement parts for broken lenses, faulty ballasts, broken mounting hardware, etc., as necessary to return luminaires to good working condition; identify cost to Consultant for repair/replacement parts.
- .25 Provide seismic restraints to suspended luminaires, in accordance with latest local governing building code requirements.
- .26 Provide dimming drivers/ballasts in luminaries to be dimmed. Coordinate between dimming system vendor and luminaire vendors to ensure 100% compatibility.
- .27 Ground and bond luminaires as per local governing electrical code requirements.

### 3.3 TESTING AND ADJUSTMENT

- .1 As required, all adjustable luminaires shall be aimed, focused, locked, etc., by the Contractor under the observation of the Consultant. As aiming and adjusting is completed, locking setscrews and bolts and nuts shall be tightened securely by the Contractor.
- .2 All ladders, scaffolds, lifts, etc. required for aiming and adjusting luminaires shall be furnished by the Contractor.
- .3 Where possible, units shall be focused during the normal working day. However, where daylight interferes with seeing lighting effects, aiming shall be accomplished at night.

### 3.4 WIRING

- .1 Install luminaire disconnect plugs on all new luminaires not provided as such from the manufacturer.
- .2 Connect luminaires to branch circuit outlets provided under Section 26 05 33.13 using flexible conduit.
- .3 Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.



- .4 Bond products and metal accessories to branch circuit equipment grounding conductor.

### 3.5 LUMINAIRE SUPPORTS

- .1 Provide adequate support to suit ceiling system.
- .2 Support luminaires independently of ceiling framing, unless ceiling is certified by the manufacturer to support weight of installed devices. Confirm if T-bar ceilings are metric or imperial and provide luminaires to suit ceiling dimensions.
- .3 Provide chain hangers for new and existing luminaires.
- .4 Install clips to secure recessed grid supported luminaires in place.
- .5 Fixtures supported by suspended ceiling systems shall be securely fastened to the ceiling framing member by mechanical means, such as bolts, screws, or rivets. Ceiling framing members must be securely attached to each other and to the building structure as required by all applicable codes and standards. Use of integral clips is not acceptable.

### 3.6 LUMINAIRE ALIGNMENT

- .1 Locate recessed ceiling luminaires as indicated on reflected ceiling plan. Recessed luminaires shall be installed to permit removal from below. Include accessories and materials to meet applicable codes and regulatory requirements.
- .2 Align luminaires mounted in continuous rows to form straight uninterrupted line.
- .3 Align luminaires mounted individually parallel or perpendicular to building grid lines.
- .4 Install surface mounted luminaires plumb and adjust to align with building lines and with each other. Secure to prevent movement.

### 3.7 FIELD QUALITY CONTROL

- .1 Operate each luminaire after installation and connection. Inspect for proper connection and operation.
- .2 Wiring connections to the branch circuit shall be made using building wire with insulation suitable for temperature conditions within luminaire.
- .3 Fixtures supported by suspended ceiling systems shall be securely fastened to the ceiling framing member by mechanical means, such as bolts, screws, or rivets. Ceiling framing members must be securely attached to each other and to the building structure as required by all applicable codes and standards. Use of integral clips is not acceptable.
- .4 Occupancy Sensors
  - .1 Locate and aim sensors in the correct location required for complete and proper volumetric coverage within the range of coverage(s) of controlled areas.
  - .2 Rooms shall have 90 per cent to 100 per cent coverage to completely cover the controlled area to accommodate all occupancy habits of single or multiple occupants at any location within the room(s).
  - .3 Exercise proper judgment in executing the work to ensure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference of structural components.

### 3.8 CLEANING

- .1 All luminaires and accessories shall be thoroughly cleaned after being installed. All fingerprints, dirt, tar, smudges, drywall mud and dust, etc. shall be removed by the Contractor from the luminaire bodies, reflectors, trims, and lens or louvers prior to final acceptance. All reflectors shall be free of



paint other than factory-applied, if any. All reflectors, cones and lenses shall be cleaned only according to manufacturers' instructions.

- .2 Clean electrical parts to remove conductive and deleterious materials.
- .3 Remove dirt and debris from enclosures.
- .4 Clean photometric control surfaces as recommended by manufacturer.
- .5 Clean finishes and touch up damage.
- .6 Luminaire finishes which are disturbed in any way during construction shall be touched up or refinished in a manner satisfactory to the Consultant.

### **3.9 PROTECTION OF FINISHED WORK**

- .1 Re-lamp luminaires that have failed lamps.
- .2 Re-lamp luminaires used for temporary lighting at Substantial Completion.

### **3.10 COMMISSIONING**

- .1 Measure samples of each new luminaire type to be replaced as described in PART 1 of this section for demonstration of energy savings.
- .2 Sensor placement and orientation for all sensor types.
- .3 Occupancy sensor function, sensitivity, and time delays.
- .4 Manual control placement and operation.
- .5 Automated control operation, including scheduled on/off functions and dimming trims and presets.
- .6 Override operation, access, and functionality.
- .7 Centralized control interfaces and operation.
- .8 Documentation archived to client.

**END OF SECTION**

## **PART 1 - GENERAL**

### **1.1 SECTION INCLUDES**

- .1 Solid state, light emitting diode (LED) source interior luminaires.
- .2 New, fully integrated luminaires for indoor applications.

### **1.2 RELATED REQUIREMENTS**

- .1 Section 26 09 23 – Lighting Control Devices.
- .2 Section 26 52 13.13 – Emergency Lighting.

### **1.3 REFERENCES**

- .1 CSA Group:
  - .1 CSA C22.1:24, Canadian Electrical Code, Part 1 (26th Edition), Safety Standard for Electrical Installations.
  - .2 Ontario Electrical Safety Code (29th edition/2024).
  - .3 CSA C22.2 No. 250.0 - Luminaires (Bi-National Standard, with UL 1598).
- .2 DesignLights Consortium (DLC):
  - .1 Solid-State Lighting Technical Requirements v5.1, or latest edition.
  - .2 Where the specifications do not explicitly call for DLC qualified LED luminaires, the technical criteria provided in the DLC Technical Requirements provide the basis of the requirements for this section of the Specification.
- .3 Energy Star:
  - .1 Program Requirements for Luminaires - Eligibility Criteria, Version 1.2, or latest edition.
- .4 Illuminating Engineering Society (IES):
  - .1 IES HB-10-11 – The Lighting Handbook, 10th Edition.
  - .2 IES LM-79-08 – Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products.
  - .3 IES LM-80-08 – IES Approved Method for Measuring Lumen Maintenance of LED Light Sources.
  - .4 IES TM-21-11 – IES Technical Memorandum on Projecting Long Term Lumen Maintenance of LED Light Sources.
  - .5 IES TM-30-15 – IES Method for Evaluating Light Source Color Rendition.
- .5 IEEE 1789-2015 – IEEE Recommended Practices for Modulating Current in High-Brightness LEDs for Mitigating Health Risks to Viewers.
- .6 National Electrical Manufacturer's Association (NEMA):
  - .1 SSL-1-10 – Electronic Drivers for LED Devices, Arrays, or Systems.
  - .2 WD 6 - Wiring Devices - Dimensional Requirements.

### **1.4 DEFINITIONS**

- .1 CCT: Correlated colour temperature.
- .2 CRI: Colour-rendering index.
- .3 LED: Light Emitting Diode.

- .4 Lumen: Measured output of lamp and luminaire, or both.
- .5 Luminaire: Complete lighting fixture, including ballast housing if provided.

### 1.5 ACTION SUBMITTALS

- .1 Refer to Section 01 33 00.
- .2 [Manufacturer reports: Provide a point-by-point photometric analysis of the [pool] [all areas], in accordance with the procedures laid out in IES recommended practices to demonstrate compliance with OBC [and LTC design manual] illumination requirements as described in 2012 OBC 3.11.10.1.(3)(a)(i).]
- .3 [Manufacturer reports: Provide a point-by-point photometric analysis of [all areas of the Long Term Care home], in accordance with the procedures laid out in IES recommended practices to demonstrate compliance with OBC illumination requirements as described in 2012 OBC 3.11.10.1.(3)(a)(i) and the LTC Design Manual.]
- .4 [Manufacturer reports: Provide a point-by-point photometric analysis of the [parking garage], in accordance with the procedures laid out in IES recommended practices to demonstrate compliance with OBC and municipal parking garage illumination requirements.]
- .5 Product submittals shall be accompanied by product specification sheets or other documentation that includes the designed parameters as detailed in this specification. These parameters include (but not limited to):
  - .1 Maximum power in Watts.
    - .1 If a transformer is used in conjunction with a driver (for example on some 347 volt lighting circuits), the maximum power shall include the transformer losses.
  - .2 L70 in hours, when extrapolated for the worse case operating temperature. TM-21 report shall be submitted to demonstrate this.
  - .3 Product submittals shall be accompanied by performance data that is derived in accordance with appropriate IESNA testing standards and tested in a laboratory that is NVLAP accredited for Energy Efficient Lighting Products.

### 1.6 INFORMATIONAL SUBMITTALS

- .1 Installation instructions.

### 1.7 CLOSEOUT SUBMITTALS

- .1 Section 01 78 00: Submittals for project closeout.
- .2 Submit manufacturer's operation and maintenance instructions for each product.
- .3 Warranty information.

### 1.8 QUALIFICATIONS

- .1 Manufacturer: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.

### 1.9 REGULATORY REQUIREMENTS

- .1 Products shall be listed and classified by CSA (Canadian Standards Association), ULC (Underwriter's Laboratories of Canada), or certified by recognized independent testing organizations that test to CSA standards.

- .2 Products shall be certified by a recognized testing agency accredited by the Standards Council of Canada and bear a certification mark from that agency.
- .3 All luminaires shall be listed and labeled for installation in fireproof or non-fireproof construction, dry, damp, or wet locations as required.
- .4 Recessed fixtures mounted in an insulated ceiling shall be listed for use in insulated ceilings.

#### **1.10 DELIVERY, STORAGE, AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

#### **1.11 EXTRA STOCK MATERIALS**

- .1 Refer to Section 01 78 00.
- .2 Provide the following additional equipment as listed herein.
  - .1 Provide an additional 2 per cent spare luminaires of each new type to be provided.
  - .2 Provide 1 per cent of each plastic lens type.
  - .3 Provide three of each type of any special tools required for system use and maintenance.

#### **1.12 WARRANTY**

- .1 Refer to Section 01 78 00 and Section 26 05 00.
- .2 The manufacturer shall provide a warranty against loss of performance and defects in materials and workmanship for the luminaires for a period of 5 years after acceptance of the luminaires. Warranty shall cover all components comprising the luminaire.
- .3 All warranty documentation shall be provided to customer prior to the first shipment.
- .4 LED Luminaires shall have a manufacturer's warranty for a period of not less than five years.
- .5 LED boards, drivers and associated components shall have a warranty of 5 years on the LEDs, 5 years on the driver, 10 years on the paint finish.

### **PART 2 - PRODUCTS**

#### **2.1 MANUFACTURERS**

- .1 As noted on Lighting Fixture Schedule.

#### **2.2 INDOOR LED LUMINAIRES, GENERAL**

- .1 Initial delivered lumens – thermal losses should be less than 10 per cent when operated at a steady state at an average ambient operating temperature of 25 degrees C, and optical losses should be less than 15 per cent.
- .2 Average Delivered Lumens – Average delivered lumens over 50 000 hours should be minimum of 85 per cent of initial delivered lumens.
- .3 All luminaires shall be tested per IES LM-79 and IES LM-80, and include published L70 data.
- .4 Colour rendition:
  - .1 Interior luminaires with a CRI greater than or equal to [80] [90], or as indicated on the lighting fixture schedule.

- .2 Where minimum 90 CRI is indicated, the following may be considered acceptable in lieu, subject to confirmation with the Consultant by means of a Request for Interpretation during the bid period:
  - .1 CRI (Ra)  $\geq$  90.
  - .2 CRI (Ra)  $\geq$  80 and R9 (R9)  $\geq$  50.
  - .3 IES Rf  $\geq$  78, IES Rg  $\geq$  100,  $-1\% \leq$  IES Rcs,h1  $\leq$  15%.
- .5 [Correlated colour temperature as indicated on the lighting fixture schedule.]
- .6 Accessibility and Maintenance:
  - .1 All LED luminaires shall be field serviceable, with LED arrays, LED modules, drivers, etc. fully serviceable and easily accessible. In the case of recessed ceiling mounted, and in the case of surface mounted ceiling fixtures, these components must be accessible from below. Luminaires in which any of these components are accessible only from above are not acceptable.
  - .2 Ballasts, drivers, LED arrays, LED modules, and lamps shall be serviceable while the fixture is in its normally installed position. Ballasts or drivers shall not be mounted to removable reflectors or wireway covers unless so specified. In the case of ceiling mounted luminaires, the serviceable components must be accessible from below.
- .7 Housings:
  - .1 Formed to prevent warping and sagging. Housing, trim, and lens frame shall be true, straight (unless intentionally curved), and parallel to each other as designed.
  - .2 Sheet steel housings to be minimum 20 gauge.
  - .3 Wireways and fittings: free of burrs and sharp edges, and shall accommodate internal and branch circuit wiring without damage to the wiring.
  - .4 When installed, any exposed fixture housing surface, trim frame, door frame, and lens frame shall be free of light leaks.
  - .5 Hinged door frames shall operate smoothly without binding. Latches shall function easily by finger action without the use of tools.
  - .6 Drivers shall not be mounted to removable reflectors or wireway covers unless so specified.
- .8 Mechanical Safety: Lighting fixture closures (lens doors, trim frame, hinged housings, etc.) shall be retained in a secure manner by captive screws, chains, aircraft cable, captive hinges, or fasteners such that they cannot be accidentally dislodged during normal operation or routine maintenance.
- .9 Metal Finishes:
  - .1 Fixture finish and construction to meet ULC listings and CSA certifications related to intended installation.
  - .2 All metal components of fixtures shall be painted after fabrication to mitigate raw metal edges, and thus prevent premature corrosion.
  - .3 The manufacturer shall apply standard finish (unless otherwise specified) over a corrosion-resistant primer, after cleaning to free the metal surfaces of rust, grease, dirt, and other deposits. Edges of pre-finished sheet metal exposed during forming, stamping, or shearing processes shall be finished in a similar corrosion resistant manner to match the adjacent surface(s). Fixture finish shall be free of stains or evidence of rusting, blistering, or flaking, and shall be applied after fabrication.
  - .4 Interior light reflecting finishes shall be white with not less than 85 per cent reflectance, except where otherwise shown on the drawing.
- .10 Wiring:

- .1 Lighting fixtures shall have a specific means for grounding metallic wireways and housings to an equipment grounding conductor.
- .2 Supplied complete with a luminaire disconnect plug.
- .11 Control of Visual Perceptions of Temporal Light Modulation (flicker):
  - .1 All electric lights (except decorative lights, emergency lights and other special-purpose lighting) used in regularly occupied spaces meet at least one of the following requirements for flicker:
    - .1 A minimum frequency of 90 Hz at all 10% intervals from 10% to 100% light output.
    - .2 LED products with a "low risk" level of flicker (light modulation) of less than 5%, especially below 90 Hz operation as defined by IEEE standard 1789-2015 LED.

## 2.3 DRIVERS, GENERAL

- .1 Electronic LED drivers shall be integral to the luminaire, and be designed to be accessible in the field for replacement and servicing.
- .2 Input Voltage:
  - .1 Driver with a voltage range of (120-277)  $\pm 10\%$  or (347-480)  $\pm 10\%$ .
  - .2 Refer to lighting fixture schedule.
  - .3 For luminaires connected to a 347 volt circuit and utilizing a natively 120-277 volt driver, provide an appropriately sized step down transformer.
- .3 Input frequency 60 Hz.
- .4 Load regulation:  $\pm 1$  per cent from no load to full load.
- .5 Output ripple less than 10 per cent.
- .6 Output should be isolated.
- .7 Case temperature: rated for  $-40^{\circ}\text{C}$  through  $+80^{\circ}\text{C}$ .
- .8 Overheat protection, self-limited short circuit protection and overload protected.
- .9 Primary fused.
- .10 Driver life rating not less than 50 000 hours
- .11 Power Factor and Total Harmonic Distortion
  - .1 Power factor of greater than or equal to 0.9 at full load.
  - .2 THD of less than or equal to 20 per cent at full load.
- .12 Dimming Control:
  - .1 Coordinate with Section 26 09 23.
  - .2 0-10 V dimming control typical for all fixtures unless otherwise noted.
  - .3 Control range: 10 per cent to 100 per cent typical, unless noted otherwise.
  - .4 Provide a mock-up to demonstrate the luminaire is free of flicker throughout the dimming range when used with the dimming controllers described in related sections.

## 2.4 INTERIOR WALL-WASH LED LUMINAIRES

- .1 Minimum Light Output: 575 lm.
- .2 Zonal lumen density:
  - .1 Minimum 60 per cent between 0 degrees and 90 degrees from nadir.

- .2 Minimum 60 per cent of the lumens must be produced in the "forward" hemisphere, towards the wall.
- .3 Minimum luminaire efficacy: 45 lumens per watt.
- .4 Correlated Colour Temperature (CCT): 3500 K.
- .5 Colour Rendition Index (CRI): 80 CRI minimum.
- .6 Minimum L70 lumen maintenance to occur at 50 000 hours in accordance with IES LM-80 testing data and IES TM-21 extrapolation.

## **2.5 TRACK OR MONO-POINT DIRECTIONAL LED LUMINAIRES**

- .1 Minimum Light Output: 250 lm.
- .2 Zonal lumen density:
  - .1 Minimum 85 per cent between 0 degrees and 90 degrees from nadir.
- .3 Minimum luminaire efficacy: 45 lumens per watt.
- .4 Correlated Colour Temperature (CCT): 3500 K.
- .5 Colour Rendition Index (CRI): 80 CRI minimum.
- .6 Minimum L70 lumen maintenance to occur at 50 000 hours in accordance with IES LM-80 testing data and IES TM-21 extrapolation.

## **2.6 DOWNLIGHT LUMINAIRES**

- .1 Minimum Light Output: 500 lm.
- .2 Zonal lumen density: Minimum 75 per cent between 0 degrees and 60 degrees from nadir.
- .3 Minimum luminaire efficacy: 45 lumens per watt.
- .4 Correlated Colour Temperature (CCT): 3500 K.
- .5 Colour Rendition Index (CRI): 80 CRI minimum.
- .6 Minimum L70 lumen maintenance to occur at 50 000 hours in accordance with IES LM-80 testing data and IES TM-21 extrapolation.

## **2.7 NOMINAL 610 MM BY 610 MM (2 FT BY 2 FT) LUMINAIRES FOR AMBIENT LIGHTING OF INTERIOR SPACES**

- .1 Minimum Light Output: 2 000 lm.
- .2 Zonal lumen density:
  - .1 Minimum 75 per cent between 0 degrees and 60 degrees from nadir.
- .3 Spacing Criteria:
  - .1 0 degrees to 180 degrees: 1.0 to 2.0
  - .2 90 degrees to 270 degrees: 1.0 to 2.0
- .4 Minimum luminaire efficacy: 85 lumens per watt.
- .5 Correlated Colour Temperature (CCT): 3500 K.
- .6 Colour Rendition Index (CRI): 80 CRI minimum.
- .7 Minimum L70 lumen maintenance to occur at 50 000 hours in accordance with IES LM-80 testing data and IES TM-21 extrapolation.

**2.8 NOMINAL 305 MM BY 1220 MM (1 FT BY 4 FT) LUMINAIRES FOR AMBIENT LIGHTING OF INTERIOR SPACES**

- .1 Minimum Light Output: 1 500 lm.
- .2 Zonal lumen density:
  - .1 Minimum 75 per cent between 0 degrees and 60 degrees from nadir.
- .3 Spacing Criteria:
  - .1 0 degrees to 180 degrees: 1.0 – 2.0
  - .2 90 degrees to 270 degrees: 1.0 – 2.0
- .4 Minimum luminaire efficacy: 85 lumens per watt.
- .5 Correlated Colour Temperature (CCT): 3500 K.
- .6 Colour Rendition Index (CRI): 80 CRI minimum.
- .7 Minimum L70 lumen maintenance to occur at 50 000 hours in accordance with IES LM-80 testing data and IES TM-21 extrapolation.

**2.9 NOMINAL 610 MM BY 1220 MM (2 FT BY 4 FT) LUMINAIRES FOR AMBIENT LIGHTING OF INTERIOR SPACES**

- .1 Minimum Light Output: 3 000 lm.
- .2 Zonal lumen density:
  - .1 Minimum 75 per cent between 0 degrees and 60 degrees from nadir.
- .3 Spacing Criteria:
  - .1 0 degrees to 180 degrees: 1.0 – 2.0
  - .2 90 degrees to 270 degrees: 1.0 – 2.0
- .4 Minimum luminaire efficacy: 85 lumens per watt.
- .5 Correlated Colour Temperature (CCT): 3500 K.
- .6 Colour Rendition Index (CRI): 80 CRI minimum.
- .7 Minimum L70 lumen maintenance to occur at 50 000 hours in accordance with IES LM-80 testing data and IES TM-21 extrapolation.

**2.10 LINEAR AMBIENT LUMINAIRES: INDIRECT**

- .1 Minimum Light Output: 500 lm per foot.
- .2 Zonal lumen density:
  - .1 Minimum 50 per cent between 90 degrees and 150 degrees from nadir.
- .3 Minimum luminaire efficacy: 85 lumens per watt.
- .4 Correlated Colour Temperature (CCT): 3500 K.
- .5 Colour Rendition Index (CRI): 80 CRI minimum.
- .6 Minimum L70 lumen maintenance to occur at 50 000 hours in accordance with IES LM-80 testing data and IES TM-21 extrapolation.

**2.11 LINEAR AMBIENT LUMINAIRES: INDIRECT/DIRECT**

- .1 Minimum Light Output: 500 lm per foot.
- .2 Zonal lumen density:



- .1 Minimum 25 per cent between 0 degrees and 60 degrees from nadir.
- .2 Minimum 50 per cent between 90 degrees and 150 degrees from nadir.
- .3 Minimum luminaire efficacy: 85 lumens per watt.
- .4 Correlated Colour Temperature (CCT): 3500 K.
- .5 Colour Rendition Index (CRI): 80 CRI minimum.
- .6 Minimum L70 lumen maintenance to occur at 50 000 hours in accordance with IES LM-80 testing data and IES TM-21 extrapolation.

#### **2.12 LINEAR AMBIENT LUMINAIRES: DIRECT/INDIRECT**

- .1 Minimum Light Output: 500 lm per foot.
- .2 Zonal lumen density:
  - .1 Minimum 40 per cent between 0 degrees and 60 degrees from nadir.
  - .2 Minimum 35 per cent between 90 degrees and 150 degrees from nadir.
- .3 Minimum luminaire efficacy: 85 lumens per watt.
- .4 Correlated Colour Temperature (CCT): 3500 K.
- .5 Colour Rendition Index (CRI): 80 CRI minimum.
- .6 Minimum L70 lumen maintenance to occur at 50 000 hours in accordance with IES-LM-80 testing data and IES TM-21 extrapolation.

#### **2.13 LINEAR AMBIENT LUMINAIRES: DIRECT**

- .1 Minimum Light Output: 375 lm per foot.
- .2 Zonal lumen density:
  - .1 Minimum 40 per cent between 0 degrees and 60 degrees from nadir.
- .3 Minimum luminaire efficacy: 85 lumens per watt.
- .4 Correlated Colour Temperature (CCT): 3500 K.
- .5 Colour Rendition Index (CRI): 80 CRI minimum.
- .6 Minimum L70 lumen maintenance to occur at 50 000 hours in accordance with IES LM-80 testing data and IES TM-21 extrapolation.

#### **2.14 HIGH-BAY LUMINAIRES FOR COMMERCIAL AND INDUSTRIAL BUILDINGS**

- .1 Minimum Light Output: 10 000 lm.
- .2 Zonal lumen density:
  - .1 Minimum 30 per cent between 20 degrees and 50 degrees from nadir.
- .3 Minimum luminaire efficacy: 80 lumens per watt.
- .4 Correlated Colour Temperature (CCT): 4000 K.
- .5 Colour Rendition Index (CRI): 70 CRI minimum.
- .6 Minimum L70 lumen maintenance to occur at 35 000 hours in accordance with IES LM-80 testing data and IES TM-21 extrapolation.

#### **2.15 LOW-BAY LUMINAIRES FOR COMMERCIAL AND INDUSTRIAL BUILDINGS**

- .1 Minimum Light Output: 5 000 lm.

- .2 Zonal lumen density:
  - .1 Minimum 30 per cent between 20 degrees and 50 degrees from nadir.
- .3 Minimum luminaire efficacy: 80 lumens per watt.
- .4 Correlated Colour Temperature (CCT): 4000 K.
- .5 Colour Rendition Index (CRI): 70 CRI minimum.
- .6 Minimum L70 lumen maintenance to occur at 35 000 hours in accordance with IES LM-80 testing data and IES TM-21 extrapolation.

## **2.16 HIGH-BAY AISLE LUMINAIRES**

- .1 Minimum Light Output: 10 000 lm.
- .2 Zonal lumen density:
  - .1 Minimum 30 per cent between 0 degrees and 20 degrees from nadir.
  - .2 Minimum 50 per cent between 20 degrees and 50 degrees from nadir.
- .3 Minimum luminaire efficacy: 80 lumens per watt.
- .4 Correlated Colour Temperature (CCT): 4000 K.
- .5 Colour Rendition Index (CRI): 70 CRI minimum.
- .6 Minimum L70 lumen maintenance to occur at 35 000 hours in accordance with IES LM-80 testing data and IES TM-21 extrapolation.

## **PART 3 - EXECUTION**

### **3.1 VERIFICATION OF CONDITIONS**

- .1 Coordinate the lighting system installation with the relevant trades so as to eliminate interferences with hangers, mechanical ducts, sprinklers, piping, steel, etc.

### **3.2 INSTALLATION**

- .1 Install lighting equipment, including but not limited to luminaires, controls, auxiliary devices and the integration of same in strict conformance with all manufacturers' recommendations and instructions the securing of which shall be the responsibility of the Contractor.
- .2 Integrate luminaires with controls in accordance with respective luminaire manufacturers' and controls manufacturers' recommendations and instructions and to provide a complete, trouble-free operation without compromising safety, code and CSA requirements.
- .3 Seal all luminaires for wet locations (i.e. all knock-outs, all pipe and wire entrances, etc.) as is standard industry practice to prevent water from entering luminaires.
- .4 Luminaire Alignment:
  - .1 Locate recessed ceiling luminaires as indicated on reflected ceiling plan. Install recessed luminaires to permit removal from below. Include accessories and materials to meet applicable codes and regulatory requirements.
  - .2 Align luminaires mounted in continuous rows to form straight uninterrupted line.
  - .3 Align luminaires mounted individually parallel or perpendicular to building grid lines.
  - .4 Install surface mounted luminaires plumb and adjust to align with building lines and with each other. Secure to prevent movement.

- .5 Locate and install luminaires as indicated. Mounting heights and configuration of the luminaires shall be as specified in the Luminaire Schedule portion of the Specification or indicated on the drawings, and where conflicts exist, as approved by the Consultant.
- .6 Installed all luminaires plumb and true and level as viewed from all directions unless specifically identified otherwise in the Lighting Fixture Schedule. Luminaires shall remain plumb and true without continual adjustment or visibly obvious means beyond what is shown on luminaire submittal drawings.
- .7 For installation in suspended ceilings, ensure that the luminaires are supported such that there is no resultant bowing or deflection of the ceiling system greater than 1/360 of the length of the total span of the ceiling member.
- .5 Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.
- .6 Whenever a luminaire or its hanger canopy is installed directly to a surface mounted junction box, use a finishing ring painted to match the ceiling to conceal the junction box.
- .7 Suspended Luminaires:
  - .1 Install suspended luminaires and exit signs using pendants supported from swivel hangers. Provide pendant length required to suspend luminaire at indicated height.
  - .2 Suspended luminaires shall be installed plumb and true and level unless specifically identified otherwise in the Luminaire Schedule portion of this Specification and at a height from finished floor as specified on the drawings, details and Luminaire Schedule. In cases where this is impractical, refer to the Consultant for a decision. All appurtenances shall be consistently organized for a neat, uniform appearance.
- .8 Install wall mounted luminaires at height as indicated.
  - .1 [For wall mounted luminaires in parking garage ramps, install luminaires with the underside of light fixture 2.2 m above top of slab (TOS). Elevation of luminaires to follow the slope of the ramp.]
- .9 Accessories:
  - .1 Reflector cones, louvers, baffles, lenses, trims and other decorative elements shall be installed after completion of ceiling tile installation, plastering, painting and general cleanup.
  - .2 Install accessories provided with each luminaire.
  - .3 All accessories shall be properly installed and adjusted by Contractor in accordance with specification and installation instructions. Any spare items shall be clearly labeled (indicate type of accessory and associated luminaire types).

### 3.3 TESTING AND ADJUSTMENT

- .1 As required, all adjustable luminaires shall be aimed, focused, locked, etc., by the Contractor under the observation of the Consultant. As aiming and adjusting is completed, locking setscrews and bolts and nuts shall be tightened securely by the Contractor.
- .2 For luminaires with field selectable lumen output and/or CCT, ensure the correct setting matches the intended set points.
- .3 All ladders, scaffolds, lifts, etc. required for aiming and adjusting luminaires shall be furnished by the Contractor.
- .4 Where possible, units shall be focused during the normal working day. However, where daylight interferes with seeing lighting effects, aiming shall be accomplished at night.

### 3.4 LUMINAIRE SUPPORTS

- .1 Provide adequate support to suit ceiling system.

- .2 Support luminaires independently of ceiling framing, unless ceiling is certified by the manufacturer to support weight of installed devices. Confirm if T-bar ceilings are metric or imperial and provide luminaires to suit ceiling dimensions.
- .3 Provide chain hangers for new and existing luminaires.
- .4 Install clips to secure recessed grid-supported luminaires in place.
- .5 Fixtures supported by suspended ceiling systems shall be securely fastened to the ceiling framing member by mechanical means, such as bolts, screws, or rivets. Ceiling framing members must be securely attached to each other and to the building structure as required by all applicable codes and standards. Use of integral clips is not acceptable.

### 3.5 WIRING

- .1 Use SPC90 conductors for final connections to luminaires (including 0-10 V dimming conductors for applicable luminaires).
- .2 Install luminaire disconnect plugs on all new luminaires not provided as such from the manufacturer.
- .3 Connect luminaires to branch circuit outlets provided under Section 26 05 33.13 using flexible conduit.
- .4 Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.
- .5 Bond products and metal accessories to branch circuit equipment grounding conductor.

### 3.6 FIELD QUALITY CONTROL

- .1 Operate each luminaire after installation and connection. Inspect for proper connection and operation.
- .2 Make wiring connections to the branch circuit using building wire with insulation suitable for temperature conditions within luminaire.
- .3 Occupancy Sensors.
  - .1 Locate and aim sensors in the correct location required for complete and proper volumetric coverage within the range of coverage(s) of controlled areas.
  - .2 Rooms shall have 90 per cent to 100 per cent coverage to completely cover the controlled area to accommodate all occupancy habits of single or multiple occupants at any location within the room.
  - .3 Exercise proper judgment in executing the work to ensure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference of structural components.

### 3.7 CLEANING

- .1 Thoroughly clean all luminaires and accessories after installation. All fingerprints, dirt, tar, smudges, drywall mud, dust, etc. shall be removed by the Contractor from the luminaire bodies, reflectors, trims, and lens or louvers prior to final acceptance. All reflectors shall be free of paint other than factory-applied, if any. All reflectors, cones and lenses shall be cleaned only according to manufacturers' instructions.
- .2 Clean electrical parts to remove conductive and deleterious materials.
- .3 Remove dirt and debris from enclosures.
- .4 Clean photometric control surfaces as recommended by manufacturer.
- .5 Clean finishes and touch up damage.

- .6 Luminaire finishes which are disturbed in any way during construction shall be touched up or refinished in a manner satisfactory to the Consultant.

### **3.8 COMMISSIONING**

- .1 In accordance with Section 26 08 50.

**END OF SECTION**

## **PART 1 - GENERAL**

### **1.1 CONDITIONS AND REQUIREMENTS**

- .1 Refer to the General Conditions, Supplementary General Conditions, and General Requirements.
- .2 Provisions of this Section shall apply to all Sections of Division 27.
- .3 Refer to Consultant's drawings for exact location of electrical equipment and devices. Refer to Designer drawings for additional notes which complement these specifications.
- .4 The Division 26 specification documents shall be followed in conjunction with the specification in this section.
- .5 Coordinate with the Division 26 contractor (hereafter referred to as the "electrical contractor").

### **1.2 RELATED DIVISIONS**

- .1 Division 26 – Electrical.

### **1.3 INTENT**

- .1 Include all material, labour, equipment, and plant construction as necessary to make a complete installation as shown and specified hereinafter. Sections of this specification are not intended to delegate functions nor to delegate work and supply to any specific Trade. It shall be your responsibility to ensure that the systems specified hereafter are complete and operative.

### **1.4 CODES AND STANDARDS**

- .1 The equipment, material and installation shall conform to the latest version of the applicable Codes, Standards (including technical service bulletins and addenda) and regulations of authorities having jurisdiction.
- .2 Work for PACS, KIDNET and Telephone network systems shall where applicable comply with the latest editions of the following listed in this section.
- .3 BICSI
  - .1 Telecommunications Distribution Methods Manual
  - .2 Cabling Installation Manual
  - .3 Outside Plant Manual
- .4 Canadian Standards Association (CSA)
  - .1 CSA C22.1 – Canadian Electrical Code, Part 1
  - .2 CSA T529 – Commercial Building Telecommunications Cabling Standard (ANSI/EIA/TIA-568-B).
  - .3 CSA T530 – Commercial Building Standard For Telecommunications Pathways And Spaces (TIA/EIA 569-A).
  - .4 CSA T528 – Administration Standard For The Telecommunications Infrastructure Of Commercial Buildings (ANSI/EIA/TIA-606).
  - .5 CSA T527 – Commercial Building Grounding and Bonding Requirements For Telecommunications (ANSI/EIA/TIA-607).
  - .6 CSA C22.2 No. 214 – Communications Cables.
  - .7 CSA C22.2 No. 232-M – Fibre Optic Cables.
  - .8 CSA C22.2 No. 182.4-M90 – Plugs, Receptacles, and Connectors for Communication Systems.

- .5 ANSI/TIA-568-C., family of Telecommunications Standards, including: TIA/EIA-568-B.1 – Commercial Building Telecommunications Cabling Standard
  - .1 ANSI/TIA-568-C.0 - Generic Telecommunications Cabling for Customer Premises;
  - .2 ANSI/TIA-568-C.1 - Commercial Building Telecommunications Cabling Standard;
  - .3 ANSI/TIA-568-C.2 - Balanced Twisted-Pair Telecommunication Cabling and Components Standard;
  - .4 ANSI/TIA-568-C.3 - Optical Fiber Cabling Components Standard;
  - .5 Issued addenda.
- .6 ISO
  - .1 ISO/IEC IS 11801A – Generic Cabling for Customer Premises.
- .7 CENELEC EN 50173 – Performance Requirements for Generic Cabling Schemes.
- .8 IEC
  - .1 IEC 603-7, PART 7 – Detailed Specification For Connectors, 8-Way, Including Fixed And Free Connectors With Common Mating Features.
  - .2 IEC 807-8 – Rectangular Connectors For Frequencies Below 3 MHz, Part 8: Detailed Specification For Connectors, Four-Signal Contacts And Earthing Contacts For Cable Screens, First Edition.
- .9 FIPS PUB 174 – Commercial Building Telecommunications Wiring Standard. Federal Information Standard Publication.
- .10 UL 444 and 13 – Adopted Test and Follow-Up Service Requirements For the Optional Qualification of 100Ω Twisted-Pair (Cables).
- .11 NEMA WC 63 – Performance Standard For Field Testing Of Unshielded Twisted-Pair Cabling System.
- .12 ANSI/EIA/TIA
  - .1 ANSI/EIA/TIA-492AAAA – Detailed Specification For 62.5µm Core Diameter / 125µm Cladding Diameter Class 1a Multimode, Graded-Index Optical Waveguide fibres.
  - .2 ANSI/EIA/TIA-492BAAA – Detailed Specifications For Class Iva Dispersion-Unshifted Singlemode Optical Waveguide Fibres Used In Communication Systems.
  - .3 ANSI/EIA/TIA-472CAAA – Detailed Specifications For All Dielectric (Construction 1) Fibre optic Communications Cable For Indoor Plenum Use, Containing Class 1a, 62.5µm Core Diameter / 125µm Cladding Diameter Fibre optic(s).
  - .4 ANSI/EIA/TIA-472DAAA – Detailed Specifications For All Dielectric Fibre optic Communications Cable For Outdoor Plant Use, Containing Class 1, 62.5µm Core Diameter / 250µm Cladding Diameter Fibre optic(s).
  - .5 ANSI/EIA/TIA-455 – Test Procedures For Fibre optics, Cables And Transistors.
  - .6 ANSI/TIA/EIA-526-7 - Optical Power Loss Measurements of Installed Singlemode Fiber Cable Plant;
  - .7 ANSI/TIA-526-14-B - Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant;
  - .8 ANSI/EIA/TIA-569-C (CSA T530) - Commercial Building Standards for Telecommunications Pathway and Spaces;
  - .9 ANSI/EIA/TIA-598 – Colour Coding of Fibre Optic Cables.
  - .10 ANSI/EIA/TIA-604-3 – FOCIS 3 Fibre Optic Connector Intermateability Standard.
  - .11 ANSI/EIA/TIA-606-B (CSA T528) – Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.

- .12 ANSI/EIA/TIA-607-C (CSA T527) – Grounding and Bonding Requirements for Telecommunications in Commercial Buildings;
- .13 ANSI Z136.2 – American Standards For The Safe Operation of Fibre optic Communication Systems Utilizing Laser Diode And LED Sources.
- .14 TIA-1179-A (September 2017) Healthcare Facility Telecommunications Infrastructure Standard
- .15 ANSI/CEA
  - .1 ANSI/ICEA S-83-640 – Fibre Optic Outside Plant Communications Cable.
  - .2 ANSI/ICEA S-83-596 – Fibre Optic Premises Distribution Cable.
- .16 Work to be in compliance with requirements of this Section and of Owner's standard – The Hospital for Sick Children Specifications for Data/Voice and other Low Voltage Communications standards.
- .17 Where discrepancies exist between requirements herein this Section and Owner's Standard obtain direction from Owner but typically Owner's Standards to rule.
- .18 Anywhere cabling standards conflict with one another or with electrical or safety codes, Contractor shall defer to the NEC and any applicable local codes or ordinances, or default to the most stringent requirements listed by either.
- .19 Knowledge and execution of applicable standards and codes is the sole responsibility of the Contractor.
- .20 Any violations of applicable standards or codes committed by the Contractor shall be remedied at the Contractor's expense.

## **1.5 WORK SEQUENCE**

- .1 Prior to start of each work period in occupied area, temporary protection shall be installed to prevent damage to any personal property or furnishing. Coordinate with Owner's representative if any furniture must be relocated to facilitate work.
- .2 Owner's representative shall approve temporary protection plan prior to use.
- .3 Necessary steps shall be taken by contractor to ensure that required firefighting apparatus is accessible at all times. Flammable materials shall be kept in suitable places outside the building.

## **1.6 INSPECTIONS**

- .1 The Engineer and/or the Project Manager will carry out inspections and prepare deficiency list for action by the Contractor, during and on completion of project.

## **1.7 DRAWINGS AND SPECIFICATIONS**

- .1 The drawings and specifications are complementary each to the other and what is called for by one to be binding as if called for by both. Should any discrepancy appear between the drawings and specifications which leaves the Contractor in doubt as to the true intent and meaning of plans and specifications, a ruling is to be obtained from the Engineer in writing before submitting Tender. If this is not done, the maximum, the most expensive alternate or option will be provided in base tender bid.
- .2 All drawings and all Divisions of these specifications shall be considered as a whole and work of this Division shown anywhere therein shall be furnished under this Division.
- .3 Drawings are diagrammatic and indicate the general arrangement of equipment and pathways. Most direct routing of cabling is not assured. Exact requirements shall be governed by architectural, structural, and mechanical conditions of the job. Consult all other drawings in preparation of the bid. Extra lengths of wiring or addition of pull and junction boxes, etc. necessitated by such conditions shall be included in the bid. Check all information and report and apparent discrepancies before submitting the bid.



- .4 Contractor shall determine the exact locations of equipment and rough-ins, and the exact routing of pathways so as to best fit the layout of the job.
- .5 Scaling off the drawings will not be sufficient or accurate for determining these locations. Where job conditions require reasonable changes in indicated arrangement and locations, such changes shall be made by the Contractor at no additional cost to the Owner.
- .6 Before ordering any conduit, cable tray, cables, fittings, etc., this Contractor shall verify all pertinent dimensions at the job site and be responsible for their accuracy.

## **1.8 MATERIAL**

- .1 This contractor is responsible to ensure that all items submitted meet all requirements of the drawings and specification, and fits in the allocated space. The final determination of a product being acceptable shall be determined by the Engineer.

## **1.9 TESTING DATA**

- .1 The contractor shall provide a complete testing report utilizing a testing device as specified in the applicable TIA/EIA standard with the correct adapter and test. All copper tests shall be compliant to the current TIA/EIA standards: Perm Link or Channel.
- .2 The Summary report shall be provided to the end user in a universal format so that there is no need to purchase any software to read and print the report.
  - .1 Utilizing Adobe Acrobat is an acceptable manner.

## **1.10 PAINTING AND FINISHES**

- .1 Minor damages to finish on factory finished equipment shall be touched up to the Engineer's satisfaction. Items suffering major damage to finish shall be replaced at the direction of the Engineer. Protect work so that finishes will not be damaged or marred during construction. Maintain the necessary protection until completion of the work.

## **1.11 SAFETY**

- .1 The Contractor shall be responsible for the safety of his workmen and the equipment on the project in accordance with all applicable safety legislation passed by Federal, Provincial, and local authorities governing construction safety. The more stringent regulations shall prevail.

## **1.12 WARRANTY**

- .1 Contractor shall provide a 25-year Panduit Certification PlusSM System Warranty on all copper and fiber links and/or channels.
- .2 Panduit® Certification PlusSM warranty shall meet the following criteria.
  - .1 A 25-year guarantee that the installed cabling system will pass the Commercial Building Telecommunications Standards cited in this document.
  - .2 This warranty will cover all registered links and/or channels.
  - .3 Contractor shall indicate in warranty documentation whether registered links are to be link or channel.
    - .1 If links are covered, this warranty may be invoked only if the links are comprised entirely of Panduit components and cable.
    - .2 If channels are covered, this warranty may be invoked only if entire channel links are comprised of continuous Panduit components and cable, including patch cords.

- .4 The communications Contractor will correct any problems and malfunctions that are warranty-related issues without charge for the entire warranty period.
- .5 If the Certification PlusSM warranty is needed by Hospital for Sick Children within the warranted period and the original installer is no longer in business, Panduit shall find a substitute Panduit ONESM certified contractor and assume costs to fulfill the obligations of the warranty.
- .6 Upon acceptance of the warranty paperwork and test results from the Contractor, Panduit will mail a notification letter to the installer and a notification letter with warranty certificate to Hospital for Sick Children.
- .3 The warranty period shall commence following the final acceptance of the project by Hospital for Sick Children and written confirmation of warranty from Panduit.
- .4 System manufacturers to provide a minimum twenty (20) year full parts, labour, and performance warranty on all passive components including structural cabling system. These warranties to be provided in written certificate form and that guarantee following:
  - .1 passive system components, e.g. patch panels, UTP cable and outlet jacks, are free from manufacturing defects in material or workmanship;
  - .2 approved cabling systems exceed specifications of TIA-EIA 568B.2.1 standards for specified category, in particular for attenuation and near-end cross-talk, loss and bandwidth requirements;
  - .3 installation supports applications for which it was originally designed as well as future versions of system performance specifications and any future applications using TIA/EIA 586B.2.1 component and cabling standards;
  - .4 replacement or repair of any originally installed registered system component to be completed at no cost for parts and labour to Owner during warranty period. Any components repaired or replaced to be warranted for remainder of warranty.
- .5 System manufacturers to provide in writing to Consultant for Owner, that in event of demise or failure or change in approved status of installing certified system installer/vendor, manufacturer to be responsible for providing another certified system installer/vendor to fulfil remainder of warranty conditions.
- .6 Claim for repair procedure to comprise of contractor being notified of a problem and who will conduct necessary tests and repairs to correct problem. Should contractor be unable to resolve problem, contractor to contact system supplier who will take necessary action and provide any technical support to correct problem.
- .7 Initial response time to a repair claim for a registered system to be within 4 hours from time Contractor was notified of system fault.
- .8 Ensure that selected network cabling component manufacturer includes a system warranty that is a true "end-to-end" structured cabling system warranty from a single manufacturer, which includes data/voice communications outlet and patch cord at workstation, horizontal copper cabling, and patch panel and patch cords at LAN room. In addition, this warranty is to be valid with selected fibre optic cabling solution.

## PART 2 - PRODUCTS

### 2.1 MATERIAL APPROVAL

- .1 The design, manufacture and testing of electrical equipment and materials shall conform to or exceed the latest applicable CSA, IEEE, and ANSI standards.
- .2 All materials must be new and be ULC or CSA listed. Any materials not covered by the aforementioned listing standards shall be tested and approved by an independent testing laboratory, Technical Inspection Services, or other government agency.

## **2.2 SHOP DRAWINGS**

- .1 Submit shop drawings for equipment and accessories specified in this Section. Shop drawings shall include connection wiring schematic drawings for each system, system design drawings including dimensions and layouts, system riser drawings and copies of manufacturer's component literature sheets.
- .2 Include data sheets for cabling, faceplates, terminal cabinets, racks, etc., and proposed cabling testing sheets.
- .3 Submit following:
  - .1 proof that final installation drawings have been reviewed by a Registered Communications Distribution Designer (RCDD);
  - .2 samples of each type of data/voice jack complete with faceplate;
  - .3 samples of patch cord;
  - .4 sample of fibre optic cabling with proposed terminations, and horizontal copper cabling;
  - .5 sample of proposed labelling of components and wiring;
  - .6 sample of proposed test sheet;
  - .7 copy of tester calibration certificate;
  - .8 written confirmation that telecommunication system vendor is manufacturer's valid certified system vendor for at least duration of contract work and is in good standing at time of Bid submission;
  - .9 written evidence (copies of certificates) of vendor and technician qualifications;
  - .10 copy of system manufacturer's warranty.

**2.3** Refer to additional requirements in Section 26 05 00.

## **2.4 AS-BUILT DRAWINGS**

- .1 To suit Division 01 requirements.
- .2 Red lines, mark-ups by this contractor.

## **2.5 OPERATION AND MAINTENANCE MANUALS**

- .1 Refer to Division 01.

# **PART 3 - EXECUTION**

## **3.1 WORKMANSHIP AND CONTRACTOR'S QUALIFICATIONS**

- .1 Only first class workmanship will be accepted, not only in regards to durability, efficiency and safety, but also in regards to neatness of detail. Present a neat and clean appearance on completion to the satisfaction of the Engineer. Any unsatisfactory workmanship will be replaced at no extra cost.
- .2 Conform to the best practices applicable to this type of work. Install all equipment and systems in accordance with the manufacturer's recommendations, but consistent with the General Requirements of this Specification. This Contractor will be held responsible for all damage to the work of his own or any other trade, resulting from the execution of his work. Store all equipment and materials in dry locations.
- .3 Provide foreman in charge of this work at all times.

- .4 The contractor shall be fully liable to provide and maintain in force during the life of this Contract, such insurance, including Public Liability Insurance, Product Liability Insurance, Auto Liability Insurance, Worker's Compensation, and Employer's Liability Insurance.
- .5 Vendor responsible for provision of system to have following qualifications:
  - .1 being current approved Belden Certified Installer in good standing
  - .2 being established communications and electronics contractor that has and currently maintains a locally run and operated business for at least five years and holds applicable provincial and local licenses;
  - .3 be authorized Distributor or established franchisee for manufacturer of product/system proposed with full manufacturer's warranty privileges and be capable of providing post warranty service;
  - .4 employ technicians who have attended and successfully completed manufacturer's technical certification classes for proposed system;
  - .5 show satisfactory evidence, upon request, that they maintain a fully equipped service organization capable of furnishing adequate inspection and service to system on a 24-hour/7-day basis;
  - .6 maintain at their facility necessary spare parts in proper proportion as recommended by manufacturer to maintain and service equipment being supplied.
- .6 Submit written evidence of qualifications with shop drawings submission.
- .7 Vendors not meeting any of above qualifications may be disqualified at Owner's discretion and be replaced with qualified vendor acceptable to Owner.

### 3.2 INSTALLATION - GENERAL

- .1 Prior to start of work, notify Owner's Network Integrator/Project Manager and submit in writing the following information:
  - .1 name of installation contractor;
  - .2 name of supervisor on site;
  - .3 description of scope of work;
  - .4 duration of work;
  - .5 location of telecommunication closet / room number;
  - .6 name of project and location.
- .2 Obtain permission of Owner's Network Integrator / Project Manager before commencing any work or accessing any telecom closet.
- .3 Properly handle and install structured network cabling in accordance with manufacturer's specifications. Avoid undue pulling tension, abrasion, or rough handling to ensure that cables will permit transmission up to required category rating design speed for cables. Install cables without splices or cuts to ensure elimination of reflections, discontinuities, impedance mismatches, etc. maximum horizontal length of copper cabling from workstation to network switch is not to exceed 90 m (295') or less if recommended by system manufacturer to meet required category grade rating performance standards. Maximum length of patch cables (either cross connects or interconnecting with electronic equipment to connect devices at work area outlet), to be a total of 10 m (30'). Maintain system manufacturer's minimum channel lengths as confirmed with system manufacturer. Provide cable loops in accordance with manufacturer's instructions.
- .4 Run horizontal, UTP cables continuous from end to end with no splices. Install horizontal cables in Star topology, emanating from rack mounted patch panel(s) and terminating on data outlet faceplates in rooms or other workstation locations.
- .5 Terminations to involve as little outer jacket removal as possible and cable pairs "untwisting" is to not exceed 6 mm (1/4").
- .6 Unless otherwise noted or where cable tray is shown for such use, run cabling in conduit. Install pull cords for future use, in conduits extending between floors.

- .7 Provide slack cable to allow for minor workstation relocations. Provide a coil of slack cable of an approximate 2 m (6') length for each workstation outlet run.
- .8 Generally, no more than two (2) 90-degree changes in direction are recommended for cable installed in conduit without pull boxes and not more than 40% fill ratio. Confirm exact conduit bending radii restrictions and fill ratios with system manufacturer and comply with those standards.
- .9 With consideration in minimizing alien crosstalk to levels as per BICSI standards and manufacturer's standards, dress cables in a neat and orderly fashion from entrance of communications closet to relay racks using vertical and horizontal cable management trays and paths. Do not exceed manufacturer's distance limitations to maintain required category rating performance standards.
- .10 Care to be taken to ensure that during installation, nicks, abrasions, burning and scuffing of cable is prevented. Replace cables found to be damaged regardless of whether cable passes category grade rating or fibre performance testing standards.
- .11 Secure bundled cables transitioning between floors via ladder cable tray, to vertical ladder sections with Velcro wraps. Use waterfall (rounded transition) fittings for cable changing from a horizontal path to a vertical one. This is to maintain minimum bend radius for cabling system. Support cables running through risers between floors such that they are properly supported for their weight, especially in situations with high pair count cables and large bundles.
- .12 Electrical Contractor and telecommunication system vendor to provide coordination of structured cabling system with other systems as required. Review data drop interconnections with various trades and provide data drop to equipment as required.
- .13 Required necessary drilling and anchoring components to be installed before any horizontal cable is installed.
- .14 Route horizontal cable into equipment racks/enclosures and neatly bundle with Velcro cable ties. Maximum number of cables per bundle to be 25.
- .15 Securely mount fire retardant plywood on wall in each telecommunications room or closet.
- .16 Review installation of conduits and boxes and advise Electrical Contractor where products do not comply with specified category rating standards. Ensure that products are replaced as required to meet standards.
- .17 Where conduits and/or cable tray is not being provided, conductors within accessible ceiling spaces to be properly bundled using "Velcro" type wraps and supported with "J" hooks. Secure "J" hooks to ceiling slab structure. Install conductors following building lines. Do not fastened conductors to suspended ceiling support systems. Obtain Consultant's approval in use of "J" hooks. Unless otherwise noted, drops down from ceiling spaces to consist of cabling installed in vertical conduits running down within walls to outlet boxes and terminating onto jacks.
- .18 For horizontal copper backbone cabling, multi- pair conductor cabling is preferred. If available only in limited number of pair cabling, provide multiple runs to provide quantity as identified on drawings, and increase conduit diameters to suit exact number requirements, in accordance with of standards and codes.
- .19 Cables wraps are to be Velcro type and are not to be over tightened.
- .20 Provide grounding and bonding requirements as specified.

### 3.3 COORDINATION

- .1 Coordinate work with other trades.
- .2 Verify equipment dimensions and requirements with provision specified under this Section. Check actual job conditions before fabricating work. Report all necessary changes in time to prevent needless work. Changes or additions subject to additional compensation, which are made without written authorization and an agreed price, shall be at Contractor's risk and expense.

- .3 Read specifications and drawings of other trades and conform with their requirements before proceeding with any work specified in this Division related to other trades. Cooperate with all other trades on the job, so that all equipment can be satisfactorily installed, and so that no delay is caused to any other Trades.

### **3.4 MANUFACTURERS' INSTRUCTIONS**

- .1 Where the specifications call for an installation to be made in accordance with Manufacturer's recommendations, a copy of such recommendations shall be at all times be kept on the job site and be available to the Owner's Representative.
- .2 Follow manufacturer's instructions where they cover points now specifically indicated on the drawings and specifications. If they are in conflict with the drawings and specifications obtain clarification from the Consultant before starting work.

### **3.5 QUALITY ASSURANCE**

- .1 See General Provisions of the Contract.
- .2 The specifications contained herein are set forth as the minimum acceptable requirements. This does not relieve the Contractor from executing other quality assurance measures to obtain a complete operating system within the scope of this project.
- .3 The Contractor shall ensure that all workmanship, all materials employed, all required equipment and the manner and method of installation conforms to accepted construction and engineering practices, and that each piece of equipment is in satisfactory working condition to satisfactorily perform its functional operation.
- .4 Provide quality assurance tests and operational check on all components of the electrical distribution system, all lighting fixtures, and communication systems.

### **3.6 LABELS AND SIGNS**

- .1 Labelling shall be as per ANSI/EIA/TIA-606-B (CSA T528) – Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.

### **3.7 ADJUST AND CLEAN-UP**

- .1 The Contractor and associated sub trades, at all times during construction, to keep the site free of all debris, boxes, packing, etc., resulting from work of this Trade. At the completion of this work, the installation is to be left in a clean and finished condition to the satisfaction of the Engineer.

### **3.8 TESTS AND ACCEPTANCE**

- .1 The operation of the equipment does not constitute an acceptance of the work by the Owner. The final acceptance is to be made after the Contractor has adjusted his equipment and demonstrated that it fulfils the requirements of the drawings and the specifications.
- .2 Testing of all systems shall be performed in the presence of the Owner's designated representative. The contractor shall give 72 hours advance notice to the Owner before beginning the tests.
- .3 Upon completion of the installation, the Contractor shall furnish certificates of approval from all authorities having jurisdiction, as applicable. Contractor shall demonstrate that work is complete and in perfect operating condition. In the presence of the Owner, the Contractor shall demonstration the proper operation of all miscellaneous systems.

**END OF SECTION**



## PART 1 - GENERAL

### 1.1 SUMMARY

- .1 Provide a complete system of empty conduit, pull boxes, outlets, and sleeves for enclosure of wiring by communications cabling.

### 1.2 RELATED REQUIREMENTS

- .1 Section 26 05 33.13 – Conduit for Electrical Systems.
- .2 Section 26 05 33.16 – Boxes for Electrical Systems.

### 1.3 REFERENCES

- .1 Latest BISC Telecommunications Distribution Methods Manual.

## PART 2 - PRODUCTS

### 2.1 OUTLETS

- .1 Wall outlets shall be 115 mm square boxes with plaster rings to suit single gang devices unless otherwise noted.
- .2 Provide 53 mm conduit through walls as noted.

### 2.2 CONDUITS

- .1 Conduit size shall be in accordance with recommended standard for conduits in Building as published by BICSI.
- .2 Minimum conduit size shall be 21 mm diameter.
- .3 Minimum space requirements in pull boxes for 90 degree pulls, shall be as follows:

Maximum conduit size	Size of pull boxes in millimetres			For each additional conduit size increase width by:
	Width	Length	Depth	
21 mm	150 mm	300 mm	100 mm	50 mm
27 mm	200 mm	400 mm	150 mm	75 mm
35 mm	250 mm	450 mm	200 mm	75 mm
41 mm	300 mm	600 mm	250 mm	100 mm
53 mm	350 mm	750 mm	300 mm	125 mm

- .4 Plenum cables are permitted in accessible ceilings. Provide 'J' hooks in these locations for later cable installation by others.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- .1 Vertically mount outlet boxes, unless noted otherwise, 300 mm to centre above floor, or 150 mm above counter top where shown at counters or benches.
- .2 Fish conduit, clear blockages and outlet and clean out pull boxes at completion of installation. Leave conduit free of water or excess moisture. Install No. 12 gauge galvanized soft iron pull wire, or 1/8 inch nylon pull cord continuously from outlet to outlet, through conduit and fasten at each box.

- .3 Conduit shall have a bending radius of not less than nine times conduit diameter. Ream out conduit and identify ends with green paint.
- .4 Install additional steel pull boxes in such a manner that, throughout entire system, there shall be not more than two 90 degree or equivalent bends or more than 30 000 mm in each run, so that wire or cables may be pulled in or withdrawn with reasonable ease. Minimum space requirements in pull boxes having one conduit each in opposite ends of the box, shall be as follows:

Maximum conduit size	Size of pull boxes in millimetres			For each additional conduit size increase width by:-
	Width	Length	Depth	
21 mm	150 mm	300 mm	100 mm	50 mm
27 mm	200 mm	400 mm	150 mm	75 mm
35 mm	250 mm	450 mm	200 mm	75 mm
41 mm	300 mm	600 mm	250 mm	100 mm
53 mm	350 mm	750 mm	300 mm	125 mm

- .5 Show as-installed conduit routing and location of all pull boxes on the record drawings at project completion.

**END OF SECTION**



## **PART 1 - GENERAL**

### **1.1 SUMMARY**

- .1 The work covered under this section consists of the furnishing of all necessary labor, supervision, materials, equipment, and services to completely execute the system of non-continuous cable supports ("J-Hooks") as described in this specification.

### **1.2 SCOPE**

- .1 Non-continuous cable supports.
- .2 Adjustable non-continuous cable support sling.
- .3 Multi-tiered non-continuous cable support assemblies.
- .4 Non-continuous cable support assemblies from drop wire/ceiling.
- .5 Non-continuous cable support assemblies from beam, flange.
- .6 Non-continuous cable support assemblies from C & Z Purlin.
- .7 Non-continuous cable support assemblies from wall, concrete, or joist.
- .8 Non-continuous cable support assemblies from threaded rod.
- .9 Raised floor non-continuous cable support assemblies.
- .10 Cantilever-Mounted Option for non-continuous cable supports.
- .11 Installation accessories for non-continuous cable supports.

### **1.3 DEFINITIONS**

- .1 UTP: Unshielded twisted pair.
- .2 ANSI: American National Standards Institute
- .3 ASTM: American Society for Testing and Materials
- .4 EIA: Electronic Industries Alliance
- .5 TIA: Telecommunications Industry Association
- .6 cULus: Listed by Underwriters Laboratories based on both Canadian and US (United States) standards requirements.

### **1.4 SUBMITTALS**

- .1 Submit product data on non-continuous cable support devices, including attachment methods. Product data to include, but not limited to materials, finishes, approvals, load ratings, and dimensional information.

### **1.5 QUALITY ASSURANCE**

- .1 Non-continuous cable supports and cable support assemblies shall be listed by Underwriters Laboratories for both Canadian and US standards (cULus).
- .2 Non-continuous cable supports shall have the manufacturers name and part number stamped on the part for identification.
- .3 Manufacturer: Company specializing in manufacturing products specified in this section with a minimum of five years documented experience in the industry, and certified ISO 9000.

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- .1 PANDUIT.
- .2 ERICO, Inc.
- .3 Approved equal.

### 2.2 REFERENCES

- .1 ASTM B633 Standard Specification for Electro-deposited Coatings of Zinc on Iron and Steel
- .2 ASTM B 695-90 Standard Specification for coatings of Zinc Mechanically Deposited on Iron and Steel
- .3 ASTM A123 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
- .4 ASTM A924/A924M Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
- .5 ASTM A109 Standard Specification for Steel, Strip, Carbon, Cold-Rolled
- .6 ASTM A167 Standard Specification for Stainless and heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
- .7 ASTM A480/A480M Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.
- .8 ASTM A568 Standard Specification for Steel, Sheet, Carbon, and High-Strength, Low-Alloy Hot-Rolled and Cold-Rolled
- .9 A653 G60-Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-coated (Galvannealed) by the Hot-Dip process
- .10 ASTM A666 Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar
- .11 ASTM A682 Standard Specification for Steel, Strip, High-Carbon, Cold-Rolled, Spring Quality
- .12 ASTM A879 Standard Specification for Steel Sheet, Zinc Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass on Each Surface
- .13 ASTM B117 Standard Method of Salt Spray (Fog) Testing
- .14 ASTM D610 Standard test Method for Evaluating Degree of Rusting on Painted Steel Surfaces UL 2043 - Standard for Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces.
- .15 ANSI/ TIA/ EIA 568 Commercial Building Telecommunications Cabling Standard, current revision level.
- .16 ANSI/ TIA/ EIA 569 Commercial Building Standard for Telecommunications Pathways and Spaces, current revision level.
- .17 NFPA 70 National Electrical Code®

### 2.3 NON-CONTINUOUS CABLE SUPPORT SYSTEMS

- .1 Non-continuous cable supports
  - .1 Non-continuous cable supports shall provide a bearing surface of sufficient width to comply with required bend radii of high-performance cables; cULus Listed.

- .2 Non-continuous cable supports shall have flared edges to prevent damage while installing cables.
- .3 Non-continuous cable supports sized 1 5/16" and larger shall have a cable retainer strap to provide containment of cables within the hanger. The cable retainer strap shall be removable and reusable and be suitable for use in air handling spaces.
- .4 Non-continuous cable supports shall have an electro-galvanized or G60 finish and shall be rated for indoor use in non-corrosive environments.
- .5 Stainless Steel non-continuous cable supports are intended for indoor and outdoor use in non-corrosive environments or where only mildly corrosive conditions apply.
- .6 Non-continuous cable supports shall be ERICO CableCat™ J-hook series CAT12, CAT21, CAT32, CAT64, CAT21SS, CAT32SS, CAT64SS; CAT-CMTM Double J-Hook CAT100CM; CAT-CMTM U-hook series CAT200CMLN, CAT300CMLN; and CAT-CMTM retainer CATRT200CM, CATRT300CM or approved equal.
- .2 Adjustable non-continuous cable support sling
  - .1 Constructed from steel and woven laminate; sling length can be adjusted to hold up to 425 4-pair UTP; rated for indoor use in non-corrosive environments. Rated to support Category 5 and higher cable, or optical fiber cable; cULus Listed.
  - .2 Adjustable non-continuous cable support sling shall have a static load limit of 100 lbs.
  - .3 Adjustable non-continuous cable support sling shall be suitable for use in air handling spaces.
  - .4 If required, assemble to manufacturer recommended specialty fasteners including beam clips, flange clips, C and Z purlin clips.
  - .5 Acceptable products: ERICO CADDY CableCat™ CAT425; or approved equal.
- .3 Multi-tiered non-continuous cable support assemblies
  - .1 Multi-tiered non-continuous cable support assemblies shall be used where separate cabling compartments are required. Assemblies may be factory assembled or assembled from pre-packaged kits. Assemblies shall consist of a steel angled hanger bracket holding up to six non-continuous cable supports, rated for indoor use in non-corrosive environments; cULus Listed.
  - .2 If required, the multi-tier support bracket may be assembled to manufacturer recommended specialty fasteners including beam clamps, flange clips, C and Z purlin clips.
  - .3 The multi-tiered support bracket shall consist of ERICO CADDY CATHBA and CableCat™ J-Hooks with screws; or approved equal.
- .4 Non-continuous cable support assemblies from beam, flange
  - .1 Fastener to beam or flange with one non-continuous cable support, factory or jobsite assembled; rated for indoor use in non-corrosive environments; cULus Listed.
  - .2 Acceptable products: ERICO CableCat™ J-hook series CAT12, CAT21, CAT32, CAT64 with CADDY beam clamps and CADDY flange clips; or approved equal.
- .5 Non-continuous cable support assemblies from C & Z Purlin
  - .1 Fastener to C or Z purlin with one non-continuous cable support, factory or jobsite assembled; rated for indoor use in non-corrosive environments, cULus Listed.
  - .2 Acceptable products: ERICO CableCat™ J-hook series CAT12, CAT21, CAT32, CAT64 with CADDY Purlin hangers; or approved equal.
- .6 Non-continuous cable support assemblies from wall, concrete, or joist
  - .1 Fastener to wall, concrete, or joist with one non-continuous cable support, factory or jobsite assembled; rated for indoor use in non-corrosive environments, cULus Listed.
  - .2 Acceptable products: ERICO CableCat™ J-hook series CAT12, CAT21, CAT32, CAT64, with CADDY angle bracket; or approved equal.

- .7 Non-continuous cable support assemblies from threaded rod
  - .1 Fastener to threaded rod with one non-continuous cable support, factory or jobsite assembled, rated for indoor use in non-corrosive environments, cULus Listed.
  - .2 The multi-tiered support bracket shall have a static load limit of 300 lbs.
  - .3 U-hooks and Double J-hook shall attach directly to threaded rod using standard nuts.
  - .4 Acceptable products: ERICO CableCat™ J-hook, CAT12, CAT21, CAT32, CAT64 with CADDY CATHBA series; CAT-CMTM Double J-hook CAT100CM, CAT-CMTM Direct mount U-hook CAT200CMLN, CAT300CMLN; or AFAB series; or approved equal.
- .8 Raised floor non-continuous cable support assemblies
  - .1 Fastener to raised (access) floor pedestal with one non-continuous cable support, factory or jobsite assembled, rated for indoor use in non-corrosive environments; cULus Listed.
  - .2 Acceptable products: ERICO CADDY CAT12CD1B, CAT21CD1B or CAT32CD1B; CAT64CD1B; or approved equal.
- .9 Cantilever-Mounted cable supports
  - .1 U-hook shall be able to be assembled to a wide variety of wall mount brackets.
  - .2 Spacing of individual U-hooks as needed, max of 4' to 5' apart.
  - .3 U-hooks may have the optional attachment of a cable roller for ease in pulling cables.
  - .4 Acceptable products: ERICO CAT-CMTM U-hooks CAT200CMLN, CAT300CMLN: CAT-CM roller assemblies CATRL200CM, CATRL300CM; CATWMCM bracket; or approved equal.
- .10 Installation accessories for non-continuous cable supports
  - .1 Cable Pulley
    - .1 Non-continuous cable supports may be used as an installation tool when a removable pulley assembly is included. The pulley shall be made of plastic and be without sharp edges. The pin and bail assembly must be able to be secured to the J-Hook during cable installation. The pulley must remain secured while cables are being pulled.
    - .2 The pin and roller assembly must be removed after cables are installed.
    - .3 Acceptable products: ERICO CADDY CAT32PLR, CAT64PLR, or approved equal.
  - .2 Cable Protector
    - .1 The protective steel tube shall fit over threaded rod and be at least 4" in length.
    - .2 The tube shall prevent damage to cables placed in or pulled through CAT-CMTM U-hooks. The tube shall not inhibit the pulling of cables.
    - .3 Acceptable products: ERICO CAT-CMTM CATTBCM, or approved equal.

## 2.4 FINISHES

- .1 ASTM B633 Standard Specification for Electro-deposited Coatings of Zinc on Iron and Steel
- .2 ASTM B 695 Standard Specification for coatings of Zinc Mechanically Deposited on Iron and Steel
- .3 ASTM A123 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
- .4 ASTM A924/A924M Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
- .5 Non-continuous cable supports used where only mildly corrosive conditions apply shall be stainless steel, AISI type 304.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- .1 Installation and configuration shall conform to the requirements of the current revision levels of ANSI/ EIA/TIA Standards 568 & 569, NFPA 70 (National Electrical Code), applicable local codes, and to the manufacturer's installation instructions.
- .2 Install cables using techniques, practices, and methods that are consistent with Category 5 or higher requirements and that supports Category 5 or higher performance of completed and linked signal paths, end to end.
- .3 Install cables without damaging conductors, shield, or jacket.
- .4 Do not bend cables, in handling or in installing, to smaller radii than minimums recommended by manufacturer.
- .5 Pull cables without exceeding cable manufacturer's recommended pulling tensions. Use pulling means that will not damage media.
- .6 Do not exceed load ratings specified by manufacturer.
- .7 Adjustable non-continuous support sling shall have a static load limit of 100 lbs.
- .8 Follow manufacturer's recommendations for allowable fill capacity for each size non-continuous cable support.

**END OF SECTION**

## PART 1 - GENERAL

### 1.1 SECTION INCLUDES

- .1 Firestopping through penetrations in fire rated assemblies.

### 1.2 RELATED REQUIREMENTS

- .1 Division 26 – Electrical.
- .2 Section 27 05 28 - Pathways for Communications Systems.
- .3 Section 27 05 29 - Hangers and Supports for Communications Systems.
- .4 Section 27 05 44 - Sleeves and Sleeve Seals for Communications Pathways and Cabling.
- .5 Section 27 05 53 - Identification for Communications Systems.
- .6 Section 27 13 23 - Communications Optical Fiber Backbone Cabling.
- .7 Section 27 15 13 - Communications Copper Horizontal Cabling.

### 1.3 REFERENCES

- .1 ASTM E 84, "Surface Burning Characteristics of Building Materials".
- .2 ASTM E 119, "Fire Tests of Building Construction and Materials".
- .3 ASTM E 814, "Fire Tests of Penetration Firestop Systems".
- .4 ANSI/UL263, "Fire Tests of Building Construction and Materials".
- .5 ANSI/UL723, "Surface Burning Characteristics of Building Materials".
- .6 ANSI/UL1479, "Fire Tests of Through Penetration Firestops".
- .7 Underwriters Laboratories Inc. (UL) – Fire Resistance Directory

### 1.4 PERFORMANCE REQUIREMENTS

- .1 Fire rated pathway devices shall be the preferred product and shall be installed in all locations where frequent cable moves, add-ons and changes will occur, such devices shall:
  - .1 Meet the hourly rating of the floor or wall penetrated.
  - .2 Permit the allowable cable load to range from 0% to 100% visual fill thereby eliminating the need to calculate allowable fill ratios.
  - .3 Not require any additional action on the part of the installer to open or close the pathway device or activate the internal smoke and fire seal, such as, but not limited to:
    - .1 Opening or closing of doors.
    - .2 Twisting an inner liner.
    - .3 Removal or replacement of any material such as, but not limited to, sealant, caulk, putty, pillows, bags, foam plugs, foam blocks, or any other material.
  - .4 Permit multiple devices to be ganged together to increase overall cable capacity.
  - .5 Allow for retrofit to install around existing cables.
  - .6 Include an optional means to lengthen the device to facilitate installation in thicker barriers without degrading fire or smoke sealing properties or inhibiting ability of device to permit cable moves, add-ons, or changes.

- .2 Where single cables (up to 0.27 in. (7 mm) diameter) penetrate gypsum board/stud wall assemblies, a fire-rated cable grommet may be substituted. Acceptable products shall be molded from plenum-grade polymer and conform to the outer diameter of the cable forming a tight seal for fire and smoke. Additionally, acceptable products shall lock into the barrier to secure cable penetration.
- .3 Where non- mechanical products are utilized, provide products that upon curing do no re-emulsify, dissolve, leach, breakdown or otherwise deteriorate over time from exposure to atmospheric moisture, sweating pipes, ponding water or other forms of moisture characteristic during or after construction.
- .4 Where it is not practical to use a mechanical device, openings within floors and walls designed to accommodate telecommunications and data cabling shall be provided with re-enterable products that do not cure or dry.
- .5 Cable trays shall terminate at each barrier and resume on the opposite side such that cables pass independently through fire-rated pathway devices. Cable tray shall be rigidly supported independent from fire-rated pathway devices on each side of barrier.

## **1.5 SUBMITTALS**

- .1 In accordance with Section 27 05 00 - Common Work Results for Communications

## **1.6 QUALITY ASSURANCE**

- .1 In accordance with Section 27 05 00 - Common Work Results for Communications

## **1.7 DELIVERY, STORAGE, AND HANDLING**

- .1 In accordance with Section 27 05 00 - Common Work Results for Communications

## **1.8 PROJECT CONDITIONS**

- .1 Do not install firestopping products when ambient or substrate temperatures are outside limitations recommended by manufacturer.
- .2 Do not install firestopping products when substrates are wet due to rain, frost, condensation, or other causes.
- .3 Maintain minimum temperature before, during, and for a minimum 3 days after installation of materials.
- .4 Do not use materials that contain flammable solvents.
- .5 Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.
- .6 Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.
- .7 Schedule installation of firestopping after completion of penetrating item installation but prior to covering or concealing of openings.

# **PART 2 - PRODUCTS**

## **2.1 MANUFACTURERS**

- .1 Specified Technologies Inc., 200 Evans Way, Somerville, NJ 08876. Tel: (800) 992-1180, Fax: (908) 526-9623, Email: [specseal@stifirestop.com](mailto:specseal@stifirestop.com), Website: [www.stifirestop.com](http://www.stifirestop.com).
- .2 Substitutions: as approved by the Engineer prior to tender closing.



- .3 Single Source: Obtain firestop systems for each type of penetration and construction condition indicated only from a single manufacturer.

## **2.2 MATERIALS**

- .1 General: Use only firestopping products that have been tested for specific fire resistance rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire rating involved for each separate instance.

## **2.3 FIRE RATED CABLE PATHWAYS**

- .1 Steel raceway with intumescent foam pads allowing 0 to 100 percent cable fill, the following products are acceptable:
  - .1 Specified Technologies Inc. (STI) EZ-PATH Fire Rated Pathway.

# **PART 3 - EXECUTION**

## **3.1 EXAMINATION**

- .1 Before beginning installation, verify that substrate conditions previously installed under other sections are acceptable for installation of firestopping in accordance with manufacturer's installation instructions and technical information.
- .2 Surfaces shall be free of dirt, grease, oil, scale, laitance, rust, release agents, water repellants, and any other substances that may inhibit optimum adhesion.
- .3 Provide masking and temporary covering to protect adjacent surfaces.
- .4 Do not proceed until unsatisfactory conditions have been corrected.

## **3.2 INSTALLATION**

- .1 General: Install through-penetration firestop systems in accordance with Performance Criteria and in accordance with the conditions of testing and classification as specified in the published design.
- .2 Manufacturer's Instructions: Comply with manufacturer's instructions for installation of firestopping products.

## **3.3 FIELD QUALITY CONTROL**

- .1 Inspections: Owner will attain qualified independent inspection agency to inspect through-penetration firestop systems installed by the contractor.
- .2 Keep areas of work accessible until inspection by authorities having jurisdiction.
- .3 Where deficiencies are found, repair firestopping products so they comply with requirements.

## **3.4 ADJUSTING AND CLEANING**

- .1 Remove equipment, materials, and debris, leaving area in undamaged, clean condition.
- .2 Clean all surfaces adjacent to sealed openings to be free of excess firestopping materials and soiling as work progresses.

**END OF SECTION**



## **PART 1 - GENERAL**

### **1.1 SECTION INCLUDES**

- .1 Labelling and identification requirements for communications systems.

### **1.2 REFERENCES**

- .1 ANSI/TIA/EIA-606-A – Administration Standard for Commercial Telecommunications Infrastructure.
- .2 UL 969 – Marking and Labeling Systems.

## **PART 2 - PRODUCTS**

### **2.1 ACCEPTABLE MANUFACTURERS**

- .1 The Contractor will provide and install identification labeling for the project's communications systems, including all components from the TR to the work outlet and between telecommunications spaces.
- .2 Approved Manufacturer: Panduit
- .3 This is a performance-based specification developed from the experience of the Hospital for Sick Kids Network and Support services in providing exceptional solutions for all our facilities and departments. As such, substitution of specified products or systems is not allowed.

### **2.2 SUMMARY**

- .1 Adhesive cable labels to meet the legibility, defacement, and adhesion requirements specified in UL 969 (Ref. D-16). In addition, the labels shall meet the general exposure requirements in UL 969 for indoor use.
- .2 Self-laminating vinyl construction cable labels with a white printing area and a clear tail that self laminates the printed area when wrapped around a cable. The clear area should be of sufficient length to wrap around the cable at least one and one-half times.
- .3 ANSI/EIA/TIA-606 for colour codes shall be followed. Labels are to be mechanically printed using a laser printer. Handwritten labels will not acceptable.

### **2.3 LABEL PRINTER**

- .1 Thermal Transfer Printer shall print high quality, industrial labels on a wide variety of materials for electrical and network applications such as wire/cable, components, safety and facility identification.
- .2 Laminated Adhesive Label Cassettes:
  - .1 For flat label applications.
  - .2 Polyester material.
- .3 Non-Laminated Adhesive Label Cassettes:
  - .1 For marking wire and cable and flat label applications.
  - .2 Polyester material
- .4 Example Products:
  - .1 Panduit LS7 series hand-held printer.
  - .2 Panduit LS8 series hand-held printer.

## **2.4 NAMEPLATES**

- .1 Engraved three-layer laminated plastic, letters on contrasting background:
- .2 Rack and Cabinet ID labels: 25 mm (1") high White Text on Black Background

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- .1 Cable identification labels should appear at the following locations with the numbers indicated on the cable schedule and drawings:
  - .1 300 mm (12 inches) from each end of the cable – after termination.
  - .2 Front of patch panels.
  - .3 Front of IDC termination blocks.
  - .4 Front of workstation/communications outlet faceplates.
  - .5 Each end of each Telecommunications Conduit.
- .2 Fibre Optic safety labels shall appear at the following locations:
  - .1 Along the length of the conduit or innerduct at 3 m (10 foot) intervals.
  - .2 At all junction boxes
  - .3 At all pull boxes.
  - .4 On all fibre optic patch panels.
- .3 Provide 25 per cent additional labels to be left in each telecommunications room on site for future growth.
- .4 Provide two Rack/Cabinet nameplates. Mount one on the front, and one on the rear of the rack.

### **3.2 IDENTIFICATION CONVENTIONS**

- .1 All cabling will be labelled with the closet letter, followed by a dash and the wire number (i.e. A-001 would be the first wire in closet A).
- .2 Labelling for backbone wiring will be preceded with BB followed by the wire number (i.e. BB-001 would be the first backbone).
- .3 Obtain Owner's approval of identification formats, prior to start of work. Submit proposed identification system and nomenclature with shop drawing submission.
- .4 All cable and workstation identification shall be recorded in excel "CABLE IDENTIFICATION LOG" which is to be provided to the Owner after cable testing and certification is complete. A duplicate copy shall also be forwarded to the Consultant.

**END OF SECTION**

## **PART 1 - GENERAL**

### **1.1 REFERENCES**

- .1 Refer to Section 27 05 00 for references.

### **1.2 SUBMITTALS FOR REVIEW**

- .1 Submit shop drawings for equipment and accessories specified in this Section. Shop drawings shall include connection wiring schematic drawings for each system, system design drawings including dimensions and layouts, system riser drawings and copies of manufacturer's component literature sheets.
- .2 Include data sheets for cabling, faceplates, terminal cabinets, racks, etc., and proposed cabling testing sheets.
- .3 Submit following:
  - .1 proof that final installation drawings have been reviewed by a Registered Communications Distribution Designer (RCDD);
  - .2 samples of each type of data/voice jack complete with faceplate;
  - .3 samples of patch cord;
  - .4 sample of fibre optic cabling with proposed terminations, and horizontal copper cabling;
  - .5 sample of proposed labelling of components and wiring;
  - .6 sample of proposed test sheet;
  - .7 copy of tester calibration certificate;
  - .8 written confirmation that telecommunication system vendor is manufacturer's valid certified system vendor for at least duration of contract work and is in good standing at time of Bid submission;
  - .9 written evidence (copies of certificates) of vendor and technician qualifications;
  - .10 copy of system manufacturer's warranty.

- 1.3 Refer to additional requirements in Section 26 05 00.

## **PART 2 - PRODUCTS**

### **2.1 ACCEPTABLE MANUFACTURERS**

- .1 Panduit CAT 6A series.

### **2.2 NETWORK CABLING SYSTEMS - GENERAL**

- .1 Work involves new network cabling from existing IT infrastructure to serve new and renovated areas. Base cabling systems on Panduit Category 6A horizontal copper cabling types.
- .2 Work must be installed by system manufacturer's certified system installers/vendors who are certified and experienced in implementing selected data cabling system and to perform related testing programs.
- .3 In addition, provide structured cabling system for auxiliary building systems such as intercom systems and BAS, AV, Intercom, WAP's and security systems. Coordinate work between system vendors. Cabling for these systems are to be based on Owner's standard herein this section unless otherwise approved in writing by Owner. Coordinate work with respective equipment vendors.
- .4 Work includes but is not to be limited to following:

- .1 provision of fibre optic cabling system; provision of fibre optic cabling for risers and intra-building backbone between LAN closets and for applications as noted on drawings; use of fibre optic backbone cabling to augment system if more than one (1) network switch is used and distance between switches exceeds 90 m (295') and for applications as shown and as required by BICSI standards;
  - .2 provision of category grade rating Category 6A cabling system for a complete networking within complex which can support use of intelligent network switches with Network Management capabilities;
  - .3 organized wiring in a structured cabling system using point to point distribution system incorporating modular terminations;
  - .4 provision of data and voice cabling, data and voice communications outlets, patch panels, patch cords and associated equipment;
  - .5 system testing and verification;
  - .6 coordination of system requirements and integration requirements with integrated systems;
  - .7 provision of required ancillary devices as required to complete various system extensions work.
  - .8 provision of required infrastructure of conduits, boxes, raceways, etc., necessary to support system.
- .5 The local area network system to be "protocol neutral" and provide users access into a variety of resources from any location within building. Ethernet backbone to be utilized for system with intelligent network switches coordinating and managing data flow. Wiring configuration is based on "physical star" topology in which cabling runs emanate in radial pattern from data communications room in which intelligent switches are located.
- .6 Network cabling system vendor to coordinate with Electrical Contractor to ensure that properly sized conduits, back boxes outlet boxes, junction boxes and floor boxes are provided of sufficient size as per EIA/TIA Standards to accommodate CAT 6 required Category rating system wiring and devices, with particular emphasis on bending radii of cabling. Conduit and boxes not meeting required Category rating standard requirements to be replaced to suit.
- .7 System to be designed to support minimum 802.11a/b/g/n/ac standards.

## 2.3 HORIZONTAL COPPER CABLING

- .1 Copper cable shall be Panduit's Vari-MaTriX Cable (Cat 6A, UTP horizontal cable). The inside 4 pair horizontal cable for facilities shall be blue jacketed plenum "LP" rated TX6Atm UTP Copper Cable with Vari-MaTriX Technology. In addition, performance Category 6A UTP Copper Cable must meet the following mechanical and performance criteria:
  - .1 Exceeds requirements of ANSI/TIA-568-C.2 Category 6A and ISO 11801 Class EA channel standards in a 4-connector configuration up to 100 meters
  - .2 Exceeds requirements of ANSI/TIA-568-C.2 and IEC 61156-5 Category 6A component standards
  - .3 Third party tested to comply with ANSI/TIA-568-C.2
  - .4 Meets requirements of IEEE 802.3af, IEEE 802.3at and IEEE 802.3bt for PoE applications
  - .5 UL Limited Power (LP) rated CMP-0.7A which eliminates the need to consult the PoE ampacity table in the NEC 2017 code regarding maximum bundle sizes
  - .6 Nominal cable diameter must not exceed 0.250"
  - .7 The nominal cable cross-sectional area must not exceed 0.05 in<sup>2</sup>. Per the NEC 40% fill guidelines, the following minimum cable fill is required:

- .1 --3/4" conduit = 4
- .2 --1" conduit = 7
- .3 --2" conduit = 27
- .4 --4" conduit = 119
- .8 Installation temperature range: 32°F to 140°F (0°C to 60°C)
- .9 Operating temperature range: -4°F to 221°F (-20°C to 105°C)
- .10 Weight of cable not to exceed 32 lbs./1000 ft.
- .11 The UTP cable must include an electrically discontinuous metallic barrier (Vari-MaTriX) to suppress the effect of alien cross talk allowing 10 Gb/s transmission. The metallic barrier is not bonded/grounded. The continuity of the metallic barrier is to be partitioned along the cable's length into segments of varying length such that EMI immunity is uncompromised.
- .12 To minimize jobsite floor space and reduce shipping expenses, one full 44"x 44" pallet must consist of 36 1000' reels
- .13 Descending length cable markings enable easy identification of remaining cable which reduces installation time and scrap
- .2 Certified channel performance in a 4-connector configuration up to 100 meters and exceeds the requirements of ANSI/TIA-568-C.2 Category 6A and ISO 11801 Class EA standards swept up to 650 MHz for supporting 10GBASE-T transmission over twisted-pair cabling systems as part of the Panduit ® TX6A™ 10Gig UTP Copper Cabling System Certified component performance up to 100 meters and exceeds the ANSI/TIA-568-C.2 Category 6A and IEC 61156-5 Category 6A standards for supporting 10GBASE-T transmission over twisted-pair cabling systems

## 2.4 DATA/VOICE OUTLETS

- .1 Data/voice outlets: Panduit CAT 6A Mini-Com TX6A series and meeting following specifications:
  - .1 flush wall mounting faceplate to fit on single gang recessed outlet box, complete with device bracket or provisions to hold jacks securely in place; with top and bottom labelling windows;
  - .2 faceplates: to match existing either stainless steel type or constructed of high impact, flame retardant, thermoplastic, as approved by Owner and reviewed by Consultant; mounted to outlet box and with bracket and matching screws; for unused ports provide blank inserts;
  - .3 faceplates for wall mount phone applications to include suitable mounting studs;
  - .4 modules: Category 6A, eight-position, RJ-45, T568A configuration pinned; Mini-Com TX6A modular style jacks to match existing as approved by Owner and reviewed with Consultant;
  - .5 modules to be of specific colours to identify each system and reviewed with Consultant and approved by Owner.
    - .1 Blue for Kidnet Data outlets,
    - .2 Yellow for Patient Monitoring Data Outlets,
    - .3 Confirm colors for other systems with Consultant prior to order.
- .2 Modular furniture faceplates:
  - .1 modular furniture faceplates to be Panduit Mini-Com series and installed in furniture outlets that have a modular furniture knockout and unless otherwise noted, to consist of a minimum of 3 ports;
  - .2 each outlet to be installed with specified and designated termination modules; provide blank cover insert on unused openings;

- .3 each outlet to relate to home run wiring back to designated patch panel; do not splice wiring runs;
- .4 verify furniture manufacturer and model, and modular faceplate requirements prior to placing order;
- .5 final colour and finishes approved by Owner and reviewed with Consultant.
- .3 Wall mounted telephone outlets to include features as follows:
  - .1 required Category rating modular jack;
  - .2 wall plate of stainless steel construction;
  - .3 mounting studs on plate which are positioned to mount standard wall mount telephones with keystone adaptation flush to wall surface;
  - .4 accepts wall mountable phones with short patch cord connections to jack module.
- .4 Telephone/voice jacks: Panduit; provided with suitable telephone wiring as approved by Owner and reviewed with Consultant; mount jacks on faceplates to Owner's standards, onto recessed outlet boxes; prior to ordering, confirm with Owner if telephone/voice jacks are to be revised to Cat 6A types same as data jacks.

## 2.5 PATCH PANELS

- .1 Angled Patch panels: Panduit as follows:
  - .1 Modular angled patch panels model: CPPA48FMWBLY or CPPA24FMBLY, standard 8-position, RJ-45 style, FCC-compliant receptacle; panel frames to be black powder coated steel and sized in 24 or 48 port configurations for each rack mount unit.
  - .2 Mini Com TX6a modular jacks to match existing as approved by Owner and reviewed with Consultant;
  - .3 Panels to have individual port identification numbers on front and rear of panel.
  - .4 Provide separate panels for each system.
- .2 Each jack connector module to have a T568A eight pin RJ 45 jack on front and IDC type connectors on back. Panels to mount onto standard EIA 19-inch racks or cabinets and have capability to be stacked in larger systems. Horizontal data and voice cabling for various telecom rooms to terminate onto patch panels provided into floor standing or wall mounting equipment enclosures, as detailed and as required.
- .3 Patch panel system to include required accessories such as bezels, harnesses, pigtails, connectors, jumpers, and retaining rings, interlay racking panels, horizontal wire managers etc., to provide for patch cord management.

## 2.6 COPPER PATCHCORDS

- .1 Patch cords: Panduit "CAT6A" TX6A-SD (work station) and TX6A-28 (TR) as follows:
  - .1 Category 6A patch cords constructed with polycarbonate 8-position plug, having vertically staggered, trifurcated gold-plated contacts;
  - .2 Patented tangled-free latch prevents snag and provides easy release patch cords with snag-less feature and integral to on each end; strain relief boot to be moulded. Label on patch cord provide identification or performance level, length, quality control number. Each patch cord is a 100% teste to component limits.
  - .3 Plugs meets all applicable ANSI/TIA-1096-A requirements and exceeds IEC 60603-7 specification.
  - .4 of specific colours to identify each system as confirmed with Owner and reviewed with Consultant.
    - .1 Blue for Kidnet Data outlets,

- .2 Yellow for Patient Monitoring Data Outlets,
  - .3 Confirm colors for other systems with Consultant prior to order.
- .2 Provide sufficient quantity of patch cords at patch panels to activate each port. In addition, include required patch cords, jumper assemblies to connect additional ports to active switches / servers. Confirm exact requirements with Owner and review with Consultant.

## 2.7 RACKS & VERTICAL MANAGERS

- .1 Open type, equipment racks to be heavy duty type, standard EIA 19" free standing racks complete with but not limited to following requirements: Panduit part number R4P.
- .2 Independent adjustable front and rear mounting rails
- .3 Support equipment mounting depths from 3" to 41.5" and provide ventilation path for side ventilated switches for greater system flexibility
- .4 Welded steel construction 2500 lb. load capacity provides greater stability
- .5 Numerical rack unit identification. Allows for quick location of rack spaces speeding installation of rack mount items
- .6 Fully bonded structure Two-hole ground lug attachment simplifies grounding to assure proper grounding technique
- .7 Weld nut construction Eliminates the need for a second wrench, increasing speed and ease of assembly
- .8 Multiple options for mounting, accessories. Accessories such as POU, spool brackets, zero RU brackets mount on posts or rails for greater application flexibility
- .9 Universal equipment rails Rack unit identification can be set either "numbers up" or "numbers down" by flipping rail positions; shipped numbers up 7 feet and 8-foot versions Allows maximum utilization of available vertical space.
- .10 Vertical Cable Management – Panduit patch Runner 2 series
- .11 Push to close door design for easy operation
- .12 Curved Fingers, support cables as they transition to vertical pathway eliminating the need for horizontal managers.
- .13 Individual Fingers, aligns with rack spaces to simplify cable routing changes and keeping patch cords organized and neat.
- .14 Integral Bend Radius Control, maintains cable bend radius ensuring network performance and system reliability.
- .15 Each rack to include grounding provisions to meet previously listed standards, which include but are not limited to following provisions:
  - .1 copper ground strip mounted on side rail extending full height of rack;
  - .2 equipment jumper kits, to bond network equipment to rack ground strip;
  - .3 common bonding network to rack jumper kit, to bond rack to room common bonding network;
  - .4 hardware including, copper compression HTAPS, paint piercing washer kits, bonding screws and electrostatic discharge port kits.
- .16 Racks to be of size and quantity to accommodate respective number of patch panel ports to suit number of required drops, quantity of network electronic components as directed by Owner's network integrator, uninterruptible power supply unit and an additional 20% spare capacity for future expansion.



- .17 Within LAN rooms, provide flexible steel type wire basket tray to manage cabling to and from racks. Refer to cable tray section for tray requirements.
- .18 Panduit are acceptable rack manufacturers are listed network cabling system manufacturers.

## **2.8 PUNCHDOWN BLOCK TERMINATIONS**

- .1 Where telephone service cabling is identified on drawings it is to be terminated on BIX or 110 mounts and connectors, provide required punchdown blocks.
- .2 Capacity of connectors to suit number of conductors. Confirm and coordinate exact type of termination means and ratings with the Owner and review with Consultant. Mounts to be suitable for wall mounting.
- .3 BIX or 110 Series, 100 pair and 300 pair wiring blocks consisting of horizontal index strips with insulation displacement for termination of 4 pairs, and of ratings to suit applications as confirmed with owner. Wall mounting block to be with mounting legs to provide wiring space.
- .4 Cross connect jumper wire, patch cords, cable HUB harness or pigtails as required to extend connections from blocks to patchpanels and to Owner's switches/servers.
- .5 Connecting tool, termination kits, designation strips, labels, and wiring distribution rings.

## **2.9 SYSTEM VENDORS**

- .1 Vendor selected for provision of system to have following qualifications:
  - .1 being established communications and electronics contractor that has and currently maintains a locally run and operated business for at least five years and holds applicable provincial and local licenses;
  - .2 be authorized distributor or established franchisee (certified system vendor) for manufacturer of product/system proposed, be experienced in installation and testing of data cabling systems, with full manufacturer's warranty privileges and can provide post warranty service;
  - .3 employ technicians who are BICSI certified and or have attended and successfully completed manufacturer's technical certification classes for proposed system;
  - .4 show satisfactory evidence, upon request, that they maintain a fully equipped service organization capable of furnishing adequate inspection and service to system on a 24-hour/7-day basis;
  - .5 maintain at their facility necessary spare parts in proper proportion as recommended by manufacturer to maintain and service equipment being supplied.
- .2 Vendors not meeting any of above qualifications may be disqualified at Owner's discretion and be replaced with qualified vendor.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION - GENERAL**

- .1 Prior to start of work, notify Owner's Network Integrator/Project Manager and submit in writing the following information:
  - .1 name of installation contractor;
  - .2 name of supervisor on site;
  - .3 description of scope of work;
  - .4 duration of work;
  - .5 location of telecommunication closet / room number;



- .6 name of project and location.
- .2 Obtain permission of Owner's Network Integrator / Project Manager before commencing any work or accessing any telecom closet.
- .3 Properly handle and install structured network cabling in accordance with manufacturer's specifications. Avoid undue pulling tension, abrasion, or rough handling to ensure that cables will permit transmission up to required category rating design speed for cables. Install cables without splices or cuts to ensure elimination of reflections, discontinuities, impedance mismatches, etc. maximum horizontal length of copper cabling from workstation to network switch is not to exceed 90 m (295') or less if recommended by system manufacturer to meet required category grade rating performance standards. Maximum length of patch cables (either cross connects or interconnecting with electronic equipment to connect devices at work area outlet), to be a total of 10 m (30'). Maintain system manufacturer's minimum channel lengths as confirmed with system manufacturer. Provide cable loops in accordance with manufacturer's instructions.
- .4 Run horizontal, UTP cables continuous from end to end with no splices. Install horizontal cables in Star topology, emanating from rack mounted patch panel(s) and terminating on data outlet faceplates in rooms or other workstation locations.
- .5 Terminations to involve as little outer jacket removal as possible and cable pairs "untwisting" is to not exceed 6 mm (1/4").
- .6 Unless otherwise noted or where cable tray is shown for such use, run cabling in conduit. Install pull cords for future use, in conduits extending between floors.
- .7 Provide slack cable to allow for minor workstation relocations. Provide a coil of slack cable of an approximate 2 m (6') length for each workstation outlet run.
- .8 Generally, no more than two (2) 90-degree changes in direction are recommended for cable installed in conduit without pull boxes and not more than 40% fill ratio. Confirm exact conduit bending radii restrictions and fill ratios with system manufacturer and comply with those standards.
- .9 With consideration in minimizing alien crosstalk to levels as per BICSI standards and manufacturer's standards, dress cables in a neat and orderly fashion from entrance of communications closet to relay racks using vertical and horizontal cable management trays and paths. Do not exceed manufacturer's distance limitations to maintain required category rating performance standards.
- .10 Care to be taken to ensure that during installation, nicks, abrasions, burning and scuffing of cable is prevented. Replace cables found to be damaged regardless of whether cable passes category grade rating or fibre performance testing standards.
- .11 Secure bundled cables transitioning between floors via ladder cable tray, to vertical ladder sections with Velcro wraps. Use waterfall (rounded transition) fittings for cable changing from a horizontal path to a vertical one. This is to maintain minimum bend radius for cabling system. Support cables running through risers between floors such that they are properly supported for their weight, especially in situations with high pair count cables and large bundles.
- .12 Electrical Contractor and telecommunication system vendor to provide coordination of structured cabling system with other systems as required. Review data drop interconnections with various trades and provide data drop to equipment as required.
- .13 Required necessary drilling and anchoring components to be installed before any horizontal cable is installed.
- .14 Route horizontal cable into equipment racks/enclosures and neatly bundle with Velcro cable ties. Maximum number of cables per bundle to be 25.
- .15 Securely mount fire retardant plywood on wall in each telecommunications room or closet.
- .16 Review installation of conduits and boxes and advise Electrical Contractor where products do not comply with specified category rating standards. Ensure that products are replaced as required to meet standards.

- .17 Where conduits and/or cable tray is not being provided, conductors within accessible ceiling spaces to be properly bundled using "Velcro" type wraps and supported with "J" hooks. Secure "J" hooks to ceiling slab structure. Install conductors following building lines. Do not fastened conductors to suspended ceiling support systems. Obtain Consultant's approval in use of "J" hooks. Unless otherwise noted, drops down from ceiling spaces to consist of cabling installed in vertical conduits running down within walls to outlet boxes and terminating onto jacks.
- .18 For horizontal copper backbone cabling, multi- pair conductor cabling is preferred. If available only in limited number of pair cabling, provide multiple runs to provide quantity as identified on drawings, and increase conduit diameters to suit exact number requirements, in accordance with of standards and codes.
- .19 Cables wraps are to be Velcro type and are not to be over tightened.
- .20 Provide grounding and bonding requirements as specified in Section entitled Grounding and Bonding.

### **3.2 PENETRATION THROUGH FIREWALLS**

- .1 Provide a conduit sleeve where horizontal cables penetrate firewalls. Size conduit sleeve at 40% fill ratio with a plastic bushing at both ends.
- .2 After conduit sleeve is installed, fill opening around conduit with firestop and smoke seal materials.

### **3.3 INSTALLATION OF PATCH-PANELS AND ACCESSORIES**

- .1 Review existing patch panels for spare ports. Confirm with Owner that spare ports may be used for this project and use if Owner approves. If spare ports are not available, provide patch-panels onto existing space of racks in locations as confirmed with Owner. Where space is not available in existing racks, provide wall mounted rack.
- .2 Provide terminating hardware and connectors to suit incoming and outgoing cabling. Clearly identify each port. Provide patch cords as required. Install devices in accordance with system manufacturer's requirements.
- .3 Terminate both data and voice horizontal cabling onto patch-panel punch downs using manufacturer's recommended tools. Bundle cabling in neat configuration and secure to patch-panels and rack assemblies. Typically dedicated separate patch panels are required for data and voice.
- .4 Install rack enclosures on walls. Neatly bundle wiring within wiring management channels. Do not over tighten Velco straps. Ground racks as required.

### **3.4 INSTALLATION OF TERMINATION HARDWARE**

- .1 For telephone service conductors as detailed, provide BIX/110 required punch down connectors and mounts on hardwood backboards on walls. Refer to drawing details. Design system layout to best suit incoming and outgoing cables. Properly punch down cabling with manufacturer's required tool and label each connector as required.
- .2 Run interconnect cables neatly secured and bundled across connectors and between banks of mounts. Use D-rings to their full advantage. Neatly bundle pigtails and secure to IDC connectors.
- .3 Where wall mounted, align mounts in straight formations to provide a neat installation and to minimize interconnect wiring lengths.
- .4 Where horizontal cables are terminated to patch panels, provide appropriate patch cords/ jumper cables to interconnect patch panel ports to respective wall mounted punch down blocks.
- .5 Clearly and properly identify each cable and block terminations.
- .6 Co-ordinate with Owner's network integrator to determine exact requirements for telephone service interconnections.

### 3.5 INSTALLATION OF OUTLETS

- .1 Connect each data/voice outlet with a 4 pair, UTP cable. Test and identify each outlet and faceplate. Wire and connect data/voice jacks back to respective dedicated racks in LAN/TEL rooms. As detailed, extend voice cabling from voice patch panels to wall mounted BIX/110 connectors, providing patch cords, cross connects/jumpers, etc. as required.
- .2 Provide outlet jack/faceplate configuration as detailed on drawings.
- .3 Drawings identify data jacks for wireless access point receivers (antennae). These locations are approximate. Confirm exact locations during onsite radio frequency studies. Allow for jacks to be repositioned up to 4m (15') to suit results of studies. Perform studies after completion of construction of interior structures. If studies are not performed at discretion of Owner, obtain direction from Consultant to leave slack coiled length of cable on each run, allowing for repositioning.

### 3.6 SEPARATION OF DATA COMMUNICATION CABLES FROM SOURCES OF ELECTROMAGNETIC INTERFERENCE

- .1 Separate data communication cables from sources of electromagnetic radiation in accordance with standard ANSI/TIA/EIA-569, Owner's Standards and following:
- .2 FT-6 rated data cabling raceway and power conductors (2 KVA power circuits) raceway require 125 mm (5") clearance;
  - .1 for fluorescent luminaires, required clearance is 300 mm (12");
  - .2 clearance increases up to 600 mm (24") for power circuits over 5 KVA.
  - .3 for large motor, transformers, power panels, etc., required clearance is 1m (39");
  - .4 route cables to avoid direct contact with steam piping, hot water piping or other heat sources to avoid thermal degradation.

### 3.7 INSTALLATION OF RACKS

- .1 Provide racks and secure to floor with bolts and concrete anchors.
- .2 In locations where more than one rack is required, butt multiple racks together. Provide wiring channel interconnection such that wiring from rack to another is not exposed.
- .3 For open racks, provide metal raceway chimney channel for conductors extending down from ceiling, such that wiring is not exposed. Secure channel to rack and ceiling.
- .4 Run wiring neatly bundled within wiring management channels. Do not over tighten Velcro tie wraps such that they deform cable jacket. Velcro straps to easily slide along length of cable. Velcro tie wraps used in plenum spaces to be CMP/FT-6 rated.
- .5 Protect cable from any obstructions using appropriate grommeting in roof of rack.
- .6 Properly ground and bond rack and equipment to room ground bus as per specifications and to standards of TIA/EIA 607.

### 3.8 IDENTIFICATION

- .1 A complete identification system to Owner's standards shall be provided that clearly designates the following:
  - .1 the horizontal cable;
  - .2 the workstation (or faceplate);
  - .3 the horizontal/passive patch panel port;
  - .4 the network switches active patch panel port;
  - .5 the patch cords;
  - .6 the network switches rack.
- .2 Obtain Owner's approval of identification formats, prior to start of work. Submit proposed identification system and nomenclature with shop drawing submission.

- .3 All cable and workstation identification shall be recorded in a hard copy "CABLE IDENTIFICATION LOG" which is to be handed over to the Owner after cable testing and certification is complete. A duplicate copy shall also be forwarded to the Consultant.

### 3.9 TESTING AND VERIFICATION

- .1 Structured cabling system certification to include 100% cable testing and verification for an EIA/TIA required category 6 grade rating solution.
- .2 Perform verification of each cable and document on a cable testing sheet forming part of hard and soft copy documentation supplied at end of installation. Testing sheets to list detailed performance test measurements as requested and as required to prove compliance with referenced standards. Also include summary sheet of passes, failures and rectified failures. Submit sample of test sheet with shop drawings. Include in report:
  - .1 test results for each cable installed;
  - .2 spreadsheet that contains cable identification number and room number where cable is installed;
  - .3 summary sheet of passes, failures and rectified failures;
  - .4 identification of installation date and contractor name.
- .3 Comply with system manufacturer's testing and certification procedures.
- .4 Perform testing using Category 6A testers such as Fluke Networks Versiv family, or equivalent. All twisted-pair copper cable links shall be tested for compliance to the requirements in ANSI/TIA for the appropriate Category of cabling installed using a test unit meeting a minimum IEC IIIe level of accuracy. Submit with shop drawings copy of calibration certificate issued by tester manufacturer's authorized technician identifying calibration within one year of use for testing on this project. Testing to include, but not be limited to following:
  - .1 wire map
  - .2 cable length;
  - .3 attenuation;
  - .4 near end crosstalk (next);
  - .5 power sum near end crosstalk (PSNEXT);
  - .6 equal level far end crosstalk (ELFEXT);
  - .7 power sum equal level far end crosstalk (PSELFEXT);
  - .8 return loss;
  - .9 ACR;
  - .10 power sum ACR;
  - .11 end to end continuity;
  - .12 opens or shorts;
  - .13 pair polarity.
- .5 Tester to include required modules for certification testing of fibre optic cabling. Perform fibre testing on each fibre in completed end-to-end system. Do not splice cables except where approved by Consultant. Testing to consist of an end-to-end power meter test performed per TIA/EIA-455-53A and. Provide system loss measurements at 850 and/or 1300 nanometers for multi-mode fibres and 1310 and/or 1550 nanometers for single mode fibres. These tests also include continuity checking of each fibre.
- .6 For horizontal cabling system using multi-mode optical fibre, measure attenuation in one direction at either 850 nanometer (nm) or 1300 nm.
- .7 Test backbone multi-mode fibre cabling at both 850 nm and 1300 nm (or 1310 and 1550 nm for single mode) in at least one direction.
- .8 Conduct test set-up and performance in accordance with ANSI/TIA/EIA-526-7 and/or ANSI/TIA/EIA-526-14 Standards, and to manufacturer's application guides.
- .9 Perform attenuation testing with a stable launch condition using two-meter jumpers to attach test equipment to cable plant. Light source to be left in place after calibration and power meter moved to far end to take measurements.

- .10 Acceptable loss measurements for 50-micron laser optimized solution at 850 nm wavelength is not to exceed 2.5 db.
- .11 Since optical signal attenuation at one wavelength is independent of attenuation at a second wavelength, measure attenuation of channel at both standard wavelengths (850nm and 1300nm) for backbone links.
- .12 Replace cable not passing testing procedure, in its entirety. No splicing is permitted
- .13 Reports:
  - .1 Submit test results to system manufacturer and obtain manufacturer's certificate of approval of system. Submit detailed indexed test report in a 3 - ring binder with manufacturer's certificate of approval of installation and testing of system and covering letter from company responsible for installation and testing of system stating accuracy of report. Letter to be signed by company's authorized testing technician. Document testing and reports with date and time of testing, testing technician's name and signature and specification Section number that test fulfilled. Submit minimum 2 hard copies and electronic copy to Consultant for review.
  - .2 Submit minimum 2 hard copy of report including test reports in digital format (pdf) loaded on USB type memory flash drive.
  - .3 Confirm format and number of hard copies with Owner.

### END OF SECTION

### PRODUCT LIST:

Line	Part Number	Description	Qty	UOM	More Information
1	R4P	30" Deep 4 Post Rack	1	Piece	<a href="#">Panduit.com product page</a>
2	CJ6X88TGBU	Mini-Com Module, Cat 6A, UTP, 8 pos 8 wire, Universal, Blue, TG Style	1	Piece	<a href="#">Panduit.com product page</a>
3	PUP6AV04BU-G	Copper Cable, Cat 6A, Vari-MaTriX, 4-Pair, 23 AWG, UTP, CMP, Blue, 1000ft/305m	36000	Foot	<a href="#">Panduit.com product page</a>
4	FSDP912Y	9um OS2 12 Fiber Indoor Distribution Cable, Plenum (OFNP), 900um Buffered Fibers	150	Foot	<a href="#">Panduit.com product page</a>
5	FSDP948Y	9um OS2 48 Fiber Indoor Distribution Cable, Plenum (OFNP), 900um Buffered Fibers	1000	Foot	<a href="#">Panduit.com product page</a>
6	CFFPL4BL	Furniture Faceplate, 4 Port, Black	1	Piece	<a href="#">Panduit.com product page</a>
7	CFG2WH	GFCI Frame, 2 Port, White	1	Piece	<a href="#">Panduit.com product page</a>

8	UTP28X8INBU	Cat 6A 28AWG UTP Patch Cord, CM/LSZH, Blue, 8 inch	1	Piece	<a href="#">Panduit.com product page</a>
9	CFG4WH	GFCI Frame, 4 Port, White	1	Piece	<a href="#">Panduit.com product page</a>
10	UTP28X10BU	Cat 6A 28AWG UTP Patch Cord, CM/LSZH, Blue, 10 feet	1	Piece	<a href="#">Panduit.com product page</a>
11	UTP28X7BU	Cat 6A 28AWG UTP Patch Cord, CM/LSZH, Blue, 7 feet	1	Piece	<a href="#">Panduit.com product page</a>
12	CPPA48FMWBLY	Patch Panel, 48 Port, Modular Angled Flush Mount, Black	1	Piece	<a href="#">Panduit.com product page</a>
13	CPPA24FMWBLY	Patch Panel, 24 Port, Modular Flush Mount, Black	1	Piece	<a href="#">Panduit.com product page</a>
14	FCE1U	Rack Mount Fiber Enclosure 1RU	1	Piece	<a href="#">Panduit.com product page</a>
15	FCE4U	Rack Mount Fiber Enclosure 4 RU	1	Piece	<a href="#">Panduit.com product page</a>
16	FLCS2/9SOCU9BU	Fiber LC-UPC Splice-On Connector for 250/900um Fiber, 9um Singlemode	10	Piece	<a href="#">Panduit.com product page</a>
17	FAP12WBUDLCZ	FAP w/12 LC Dupl Adapters (BU) Zirconia	1	Piece	<a href="#">Panduit.com product page</a>
18	F92ERLNLNSNM002	OS2 2 Fiber 1.6mm Jacket Patchcord Riser LC Duplex to LC Duplex Std IL - 2 Meters	1	Piece	<a href="#">Panduit.com product page</a>
19	PR2VFD08	PATCHRUNNER2 VERTICAL MANAGER AND DOOR, 8in WIDE, 7ft TALL, FRONT ONLY	1	Piece	<a href="#">Panduit.com product page</a>
20	PR2VFD12	PATCHRUNNER2 VERTICAL MANAGER AND DOORS, 12in WIDE, 7ft TALL, FRONT ONLY	1	Piece	<a href="#">Panduit.com product page</a>
21	PZRFE4U	Zone Cabling Raised Floor Enclosure, 4" High (102mm)	1	Piece	<a href="#">Panduit.com product page</a>
22	PZRFC	Panzone Raised Floor Cover For PZRFE	1	Piece	<a href="#">Panduit.com product page</a>
23	PZICEA	Zone Cabling Active In-Ceiling Enclosure	1	Piece	<a href="#">Panduit.com product page</a>
24	CPP48FMWBLY	Patch Panel, 48 Port, Modular Flush Mount, Black	1	Piece	<a href="#">Panduit.com product page</a>
25	CPP24FMWBLY	Patch Panel, 24 Port, Modular Flush Mount, Black	1	Piece	<a href="#">Panduit.com product page</a>

## **PART 1 - GENERAL**

### **1.1 SECTION INCLUDES**

- .1 The specifications for the visual nurse call system are a description of the various components with the minimum operational sequence requirements. System shall comply with all applicable codes.
- .2 When all systems are completely installed and ready to be used, the successful supplier shall thoroughly instruct those appointed by the Owners in the complete operation of all systems provided by him for a minimum time of 4 hours (Two 2 hour sessions at times as directed by Owner to suit staff's requirements) unless in the opinion of the Consultant a longer instruction period is necessary.

### **1.2 ACTION SUBMITTALS**

- .1 Submit shop drawings and product data in accordance with Section 01.
- .2 Product Data: Provide manufacturer's catalogue information showing dimensions, colours, and configurations.

### **1.3 INFORMATIONAL SUBMITTALS**

- .1 Submit manufacturer's installation instructions.

### **1.4 REGULATORY REQUIREMENTS**

- .1 Provide products listed and classified by CSA (Canadian Standards Association).

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- .1 The systems shall be as manufactured by:
  - .1 Aatel (Contact: Laura Graham, T: 905 526 2378)

### **2.2 EXISTING NURSE CALL SYSTEM**

- .1 The existing Aatel
- .2 nurse call system presently serves the existing hospital and is to be retained to accommodate the additional nurse call devices in the renovated areas.
- .3 Nurse Call scope of work will include for provision of:
  - .1 co-ordination of system work to clearly identify responsibilities of system vendor and Electrical Contractor;
  - .2 all required conduits and boxes, power feeders, to suit system requirements and as per requirements of Section 26 05 33.13 and as per system manufacturer's requirements;
  - .3 installing all nurse call system components, wiring, wiring accessories, identification and labelling of each wiring run;
  - .4 all required nurse call system programming;
  - .5 all nurse call system testing, inspection and verification work upon completion;
  - .6 testing and verification reports signed by manufacturer's authorized representative and by Electrical Contractor;
  - .7 nurse call vendor's provision of technical assistance and supervision of Electrical Contractor with regards to conduit, wiring and component installation requirements.



- .8 Additional stations and other products to be 100% compatible to existing system.
- .9 All required modifications to existing area control units and floor control stations (master and submasters);
- .10 All required additional control units;
- .11 All required software programming; Coordinate with owner where the alarms are to be displayed when the Code Blue is activated.
- .12 bed stations;
- .13 washroom stations;
- .14 staff stations and duty stations;
- .15 emergency stations;
- .16 centralized code blue (cardiac arrest) stations;
- .17 code white stations;
- .18 code blue (cardiac arrest) stations;
- .19 corridor dome lights;
- .20 paging speakers;
- .21 wiring as per system manufacturer's requirements, run in conduit and provision of required ancillary devices;
- .22 ring tones to match existing;
- .23 nurse call devices to ring at consoles designated by Owner.
- .4 The specifications for this system are a description of the various components with the minimum requirements of the operations sequence, facilities and features required.
- .5 Dome lights shall be complete with transparent dome, stainless steel trim, backbox and lamps, white, red, blue and yellow.
- .6 Wiring shall be minimum 16 gauge copper in twisted pairs with overall PVC jacket and in accordance with manufacturer's requirements. All wiring shall be installed with minimum ¾" (19mm) conduit unless otherwise noted.
- .7 The system to be UL 1069 listed as a Nurse Communications Network. The system to be capable of interconnecting with the hospital's LAN (Local Area Network). This connection to be minimal and utilize only one Ethernet 100 Mbps (or optionally 1 Gb) connection to accomplish all information exchange. The HL-7 standard shall be to match existing system.
- .8 Components and the system as a whole to meet or exceed the minimal standards issued by CSA, EEMAC and ULC. Work in conjunction with this installation to meet the provisions of the local governing electrical code, edition of CSA Z32 enforced by local governing authority and any applicable local codes.
- .9 Each major component to bear the manufacturer's name, catalogue number, place of manufacture and CSA/ULC label.
- .10 Devices located within areas where abuse can occur such as the Mental Health Unit areas, to be constructed with vandal-proof and shatter resistant features and tamperproof access/mounting screws.
- .11 The system to be compatible and include provisions to integrate fully to systems such as code white systems, infant abduction, asset tracking, and patient wandering systems such that the central station display annunciates and displays alarm information available from each integrated system, such as the unique address of alarm transmitter, exact location of alarm, patient's bed number, etc. In addition the system performs required responses to alarms, system alarm resets, and basic controlling features of the integrated systems. Features and functions to be programmable to suit



- Owner's specific requirement. Include selectively programmable system features as confirmed with Owner's Project Manager in writing prior to system programming.
- .12 Priority level names to be displayed as alpha characters, and the room numbers to be user-programmable.
  - .13 The room numbers to be numeric with alpha characters for descriptions.
  - .14 Visible annunciation to be by corridor and zone lights associated with each call.
  - .15 System to permit the nurse at the communications station to hear the slightest whisper or movement of patients in rooms.
  - .16 Failure of the voice intercom portion of the system to not interfere with the visual signal system.
  - .17 System to use multiplex technology, requiring no unique wiring on a per station basis.
  - .18 System to have automatic supervision of associated bedside patient stations, emergency stations, staff stations, code blue/white stations, zone lights, dome lights and consoles, with an indication at the console of which station or stations failed.
  - .19 System to provide for transfer of one or more individual or groups of stations from one console to another without mechanical switches or additional predetermined wiring of the stations.
  - .20 System to be configurable by call priority level to allow the attendant to set any levels of staff reminder on a manual basis or be automatically set on answering the call from the console.
  - .21 System user features and programmable access to make system changes to be password protected to ensure that only authorized personnel can make changes.
  - .22 The system to contain built-in diagnostics to monitor and diagnose system operation.
  - .23 The system to have the capability to program/create a list of staff, for the purpose of individual assignment to each patient/bed as a primary or alternate caregiver. Once assigned by shift, calls placed by the patient may be automatically directed to the assigned staff currently on duty, alerting them of the pending call and subsequent care givers if necessary.
  - .24 Ability to program individual staff to patient assignments easily from work station terminal at the beginning of each shift by selecting the staff's name and changing their personal assignment screen. The staff-to-patient assignments are established directly using the patient's room and bed. Additionally the staff may receive all call priorities or only a selected subset of call priorities.
  - .25 Capabilities for the nurse follow feature to be included. The basic nurse follow function, when activated from the master station, to allow a staff member to leave the master station and be notified of a call at a designated room and bed.
  - .26 The system to provide audio paging to individual stations or groups of stations using an auxiliary amplifier located within the central equipment cabinet.
  - .27 Code blue calls placed from any room to be annunciated on a centralized digital code blue display panel(s) and on the PC terminals.
  - .28 The system to be provided with the activity reporting and management system interface software program to record all patient calls and related time-based activities and to provide for recall, summary reporting and printing of statistical information from a computer station provided with system. System software to perform automatically daylight saving time adjustments to the Eastern Time Zone.
  - .29 The system to be of modular construction. Components used in signal control to be plug-in for easy replacement and maintenance. A solid-state plug-in flasher to be incorporated to provide the steady and interrupted alerting tones and indicating lights.
  - .30 The normal and emergency call tones generated at the console and duty stations to be preprogrammed at different rates for easy identification. The alerting tones to be electronically generated. Tone level to be adjustable or turned off as required during night hours.

- .31 Patient stations, emergency stations, and staff/duty stations to be installed into standard electrical backboxes.
- .32 The system to be capable of side-rail communications capability including visual and audible annunciation of a disconnected bed.
- .33 The system sequence of operation to be confirmed with Owner. This sequence is generally for pricing purposes and exact sequence of operation to be programmable to suit Owner's exact requirements. Confirm exact sequence with Owner and Consultant, in writing prior to start of work.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- .1 Coordinate work of each trade for scheduling, demolition, rough-in, power and conduit requirements, installation and testing.
- .2 Provide complete visual nurse call systems as shown on Drawings and as specified.
- .3 Provide specified various nurse call systems components in areas as shown and as required. Programme system on servers/terminals. Obtain Owner's approval of room nomenclature prior to start of programming. Customize software to suit Owner's specific applications. Program sequence of operation and user information as required. Include for system manufacturers authorized representative to program systems. Programme exact programming requirements as confirmed with Consultant and/or Owner in writing prior to start of Work. Utilize manufacturer's recommended configuration chart during installation and record respective device names, serial number, room name and number and comments, as outlined on sheets.
- .4 Provide control units and stations and install into locations. Install components at the mounting heights as noted on drawings and as required and confirmed with Consultant. Generally, wall mounted devices onto recessed boxes. Provide suitable conduits and backboxes to accommodate device installations. Confirm back box requirements with system vendor prior to roughing-in.
- .5 Generally, install dome lights located between doorframe and underside of suspended ceiling. Interconnect patient room smoke detectors to dome lights and remote communicators. Coordinate work with fire alarm system technicians of fire alarm system vendor. Install zone lights to ceilings on recessed boxes in locations confirmed with Consultant and coordinated with other systems and equipment. Confirm colours for dome lights with Consultant prior to ordering.
- .6 Provide minimum ¾" (19mm) conduit from each device to the ceiling and provide deep back boxes as specified.
- .7 Provide system wiring. Wiring to be copper conductor, colour coded, and in accordance with the system manufacturer's recommendations and instructions. Connect equipment in accordance with the system manufacturer's certified wiring diagrams and instructions and under direct supervision of the manufacturer. Provide and arrange for authorized system manufacturer's representative to make all final equipment connections. Run conductors in conduit or in cable tray, as identified on drawings. Use of cable hangers system such as J hooks are not acceptable unless approved in writing from Consultant and/or unless such use is specifically noted on drawings.
- .8 Obtain required training from manufacturer's representative on any special installation procedures. Install devices and perform work in accordance with the manufacturer's instructions and requirements and in accordance to applicable codes of the governing authorities having jurisdiction.
- .9 Confirm locations of devices with Consultant prior to roughing-in.
- .10 Perform system integration connections to various systems as required. Include costs for systems service vendors to perform required integration and programming requirements.
- .11 Ground and bond system as required by local governing electrical code and authority and system manufacturer.

- .12 Provide a lamaroid identification nameplate for each enclosure. Confirm wording of identification nameplates and colour finishes of devices with Owner prior to ordering.
- .13 When work is complete, arrange for attendance at the site of the system manufacturer's authorized representative to make final equipment connections and provide inspection, testing, adjusting and verification requirements.
- .14 Turn over to Consultant/Owner, specified loose accessories.

### **3.2 SYSTEM TRAINING**

- .1 Provide to Owner's designated staff, onsite training sessions to Owner's designated personnel on the operation and maintenance procedures with regards to the system. Each session may be held on different days and locations, at Owner's discretion. Exact times and dates to be coordinated with and approved by Owner.
- .2 The following are required from Nurse Call System supplier, one week before each training session:
  - .1 an easy to read manual describing the features, providing trouble-shooting guidelines;
- .3 Schedule
  - .1 Training on the operation of the Nurse Call System for Maintenance staff:
    - .1 Two sessions, 1 hour duration for up to ten (10) people each session.
    - .2 There should be enough copies of printout regarding repair of parts, for each participant.
  - .2 Training on the operation and managing software for Nurse Managers, Program Service Managers, Program Director, Operations Directors, VP Programs, Director of Organizational effectiveness and Risk Management and designate, Program Assistant:
    - .1 Two sessions, 1 hour duration for up to ten (10) people each session.
    - .2 There should be enough copies of handouts on summary of training, for each participant.
  - .3 Training for Nurses will be for the operation only. Allow for four (4) training days. At each training day, the training schedule to include:
    - .1 minimum four (4) 1 hour sessions spread out over the day at times directed by Owner;
    - .2 the number of nurses to be accommodated to be as later directed.
  - .4 Provide training/coordination on access and networking issues for Owner's computer network for one session, one hour duration for up to 8 people. There should be enough copies of handouts for technical information for networking and edit access.
- .4 Include for professional recording of and copying onto CD/ DVD digital video disk of operation and maintenance procedures.

**END OF SECTION**

## **PART 1 - GENERAL**

### **1.1 SECTION INCLUDES**

- .1 Modifications to existing fire alarm system, relocating and new fire alarm devices as indicated on the drawings, and system verification to the appropriate codes and standards. Complete systems shall be left ready for continuous and efficient satisfactory operation.
- .2 New devices connected directly to the existing fire alarm system shall of the manufacturer's current product selection, and to match the existing system.
- .3 Verify system upon completion of installation and submit verification report to the Consultant with close-out documents and as-built drawings.

### **1.2 RELATED REQUIREMENTS**

- .1 Section 26 05 33.13 – Conduit for Electrical Systems.
- .2 Section 26 05 33.16 – Boxes for Electrical Systems.
- .3 Latest fire alarm verification report.

### **1.3 REFERENCES**

- .1 The publications listed below form a part of this specification. The publications are referenced in text by the basic designation only. Comply with latest edition / amendment referenced Code/Publication.
  - .1 Ontario Building Code.
  - .2 Ontario Fire Code.
  - .3 ULC-S524 Installation of Fire Alarm Systems.
  - .4 ULC-S537 Verification of Fire Alarm Systems.
  - .5 Ontario Electrical Safety Code.
  - .6 All requirements of the Authority Having Jurisdiction (AHJ).

### **1.4 SUBMITTALS**

- .1 Provide submittals to the Consultant for review in accordance with Section 01.
- .2 All references to manufacturer's model numbers and other pertinent information herein is intended to establish minimum standards of performance, function and quality.
- .3 Shop Drawings
  - .1 Include sufficient information, clearly presented, to determine compliance with drawings and specifications.
  - .2 Include manufacturer's name(s), model numbers, ratings, power requirements, equipment layout, and device arrangement.
  - .3 Show annunciator layout and main control panel module layout, configurations and terminations.
  - .4 Show device layout, complete riser diagram, and auxiliary functions.
  - .5 Show revised system programming.
  - .6 The supplier of the system shall prepare a complete zoning schedule and artwork layout for active graphic to be included with submittal package.
- .4 Manuals

- .1 Submit complete operating and maintenance manuals listing the manufacturer's name(s) including technical data sheets (with model numbers to be used indicated).
- .2 Wiring diagrams indicating terminals and the interconnections between the items of equipment.
- .3 Provide a clear and concise description of operation which gives, in detail, the information required to properly operate the equipment.

## **1.5 QUALITY ASSURANCE**

- .1 Approvals
  - .1 The system shall have proper listing and/or approval from the following nationally recognized agencies:
    - .1 FM Factory Mutual.
    - .2 UL Underwriters Laboratories Inc.
    - .3 ULC Underwriters Laboratories Canada.
  - .2 The fire alarm control, panel shall meet the modular listing requirements of ULC. Each subassembly of the FACP, including all printed circuit boards, shall include the appropriate ULC modular label.
- .2 Fire alarm shall conform to the Building Code, Ontario Regulations 925/75 and as amended subsequently.
- .3 Fire alarm system installation shall conform to ULC Standard S524-M, latest edition.
- .4 All devices/components shall be suitable for the locations, environment, temperatures in which they are to be installed.
- .5 The fire alarm system shall be manufactured by an ISO 9001 certified company and meet the requirements of BS EN9001: ANSI/ASQC Q9001-1994.
- .6 The FACP and peripheral devices shall be manufactured 100% by a single manufacturer (or division thereof).

## **1.6 WARRANTY**

- .1 All work performed and all material and equipment furnished under this contract shall be free from defects and shall remain so for a period of at least one (1) year from the date of acceptance.

## **PART 2 - PRODUCTS**

### **2.1 EXISTING SYSTEMS**

- .1 The existing Simplex fire alarm system serving the building to be retrofitted to serve renovated areas. Additional devices to be 100% compatible with and of same manufacture as per existing system. Work shall include provision of all necessary control panel and annunciator work of existing system to accommodate integration of additional system.
- .2 Include for and engage Owner's existing Simplex fire alarm system vendors authorized technicians to provide and perform required system products and work. Vendor must be Symplex authorized vendor as approved by Owner. Obtain confirmation of vendor and contact information from Owner prior to pricing. Use of vendor cannot invalidate any existing manufacturer's warranties.
- .3 Verify with existing fire alarm system manufacturer during Bid period, the exact requirements needed to provide renovation work. If necessary, visit site with manufacturer to review existing conditions. Confirm and coordinate exact work responsibilities with system vendor. Items of

clarification or proposed revisions to Bid Documents must be reviewed with Consultant during Bid Period.

- .4 In areas of high abuse such as mental health areas, devices to include vandal resistant, anti-ligature, tamperproof features such as guards, fasteners requiring use of special tools and fasteners not exposed.

## **2.2 EQUIPMENT AND MATERIAL, GENERAL**

- .1 Review latest verification report, and review existing system during tender walkthrough and note all required modifications.
- .2 All equipment and components shall be new, and the manufacturer's current model.
- .3 All equipment and components shall be installed in strict compliance with manufacturers' recommendations.
- .4 Modify control panels and annunciators to supervise and annunciate additional and relocated devices. Additional devices shall be devices that are 100% compatible with existing controls and be ULC listed and labelled for connecting to respective control units. Include for manufacturer's authorized representative to perform control panel/transponder work, provision of required additional devices and to reprogram system software to accommodate renovation work.
- .5 Additional devices to be ULC listed and labelled devices suitable for fire alarm applications. Power supplies and other components to be CSA approved where required by local governing authorities and codes. Refer to drawings for additional device requirements.
- .6 Exact type of device to be used in each area of installation to be as recommended by system manufacturer to suit specific applications and to be approved for such use as per ULC standards. Devices in non-climatic controlled areas to be weatherproof, corrosion resistant and ULC listed for use in below freezing temperatures. System manufacturer to be responsible for ensuring compliance with these requirements.

## **2.3 CONDUIT AND WIRE**

- .1 New conduit and wire for new zones and new devices to Section 27 15 01.19.
- .2 Conduit
  - .1 Conduit shall be in accordance with the Electrical Safety Authority (ESA), local and provincial requirements.
  - .2 All wiring shall be installed in conduit or raceway to Section 26 05 33.13 and Section 26 05 33.23.
- .3 Wire
  - .1 All fire alarm system wiring to suit new devices shall be new.
  - .2 CSA approved and ULC listed wire and cable, approved for fire alarm circuits; with colour coded, insulated solid copper conductors; wiring shall be in accordance with local, provincial and national codes and as recommended by the manufacturer of the fire alarm system. Number and size of conductors shall be as outlined in the Ontario Electrical Safety Code and as recommended by the fire alarm system manufacturer.
  - .3 All wire and cable shall be listed and/or approved by a recognized testing agency for use with a protective signalling system, as outlined in the Ontario Electrical Safety Code.
  - .4 To be mechanically protected to satisfaction of local fire authority.
- .4 Terminal Boxes, Junction Boxes and Cabinets:
  - .1 All boxes and cabinets shall be listed for their purpose and use.]



## **PART 3 - EXECUTION**

### **3.1 VERIFICATION OF CONDITIONS**

- .1 Conduct an impedance test of initiation and signal circuits, and submit report to the Consultant. Report any discrepancies in circuit loading.

### **3.2 MONITORING OF SYSTEMS**

- .1 In area that remain occupied and used by Owner during Work, monitoring and supervision of existing fire alarm system serving renovated areas, to be daily monitored to ensure that system is left in proper operating condition at end of each working day. Include for but not be limited to performing following:
  - .1 under presence of Owner's representative, check each morning and evening (start and end of work) of each day, system to ensure that it is in proper working condition;
  - .2 if portions of system are not in proper working order, provide temporary bypass wiring (if fire alarm system, must be subject to approval of local fire authority), and/or provide supervisory personnel to monitor systems for area affected;
  - .3 document and sign off with Owner's representative signing off also, each respective daily check condition;
  - .4 ensure that work to system does not affect portion of system serving areas outside of renovation/working areas.

### **3.3 INSTALLATION**

- .1 Provide additional components and retrofit work as required. Locate existing head end equipment and annunciators.
- .2 Confirm exact sequence of operation of system with Owner and review with Consultant prior to start of Work. Obtain approvals from local fire authority. Program approved sequence of operation to satisfaction of Owner and review with Consultant.
- .3 Work in conjunction with this installation to meet requirements of latest editions of local governing building code, local governing electrical code, ULC Standards including Installation Standard CAN/ULC-S524, and any applicable local governing codes. If any requirements of these specifications are different, omitted or contrary to ULC-S524 Standard, then ULC Standard governs and overrides these specifications, but in no instance will standards established by drawings and specifications be reduced by any of Codes referred to previously. Control units and annunciators to be in accordance to latest requirements of ULC Standard CAN/ULC-S527 "Control Units for Fire Alarm Systems.
- .4 In addition, work to meet Owner's standards, and recommendations and instructions from system manufacturer.
- .5 During work to the existing fire alarm system, the time and duration of interruption shall be approved by Owner and reviewed with Consultant. At any time due to emergency situations, Owner may request by-passed zone(s) to be re-instated immediately. In all areas where the renovation work requires shutdown of any part of the fire alarm protection system, provide manual fire alarm protection (Fire Warden) by means of supervising the area as approved by Governing Authorities. At no time shall the fire alarm system or any one (1) zone be left inoperative overnight. Provide all required bypass wiring and temporary wiring as may be required to maintain all parts of the fire alarm system operative during construction and alterations.
- .6 Verify with existing fire alarm system manufacturer during Bid period, the exact requirements needed to provide renovation work. If necessary, visit site with manufacturer to review existing conditions. Items of clarification or proposed revisions to Bid Documents must be reviewed with Consultant during Bid Period.

- .7 Provide for the existing building fire alarm system manufacturers to perform control panel/annunciator work required for work of this phase. Provide additional modules as required for connection of additional devices and zones.
- .8 Relocate devices to accommodate ceiling and wall demolitions and installation of new ceilings and walls. Maintain fire alarm protection in areas of Work to satisfaction of Owner and local fire authority. Provide required temporary supporting structures to support temporary located devices in order to maintain proper operation and fire protection. Obtain required inspections and approvals from local fire authority and Owner. Relocate devices to suit local fire authority directions.
- .9 When ceiling and/or wall work has been completed, disconnect temporary devices and existing devices in temporary locations. Locate devices in permanent locations to suit renovations work as per issued drawings and Consultant's directions. Connect, adjust, test and verify.
- .10 Provide required additional devices and install existing devices as required. Circuit device's to existing standards and in compliance with local governing codes and authorities. Unless otherwise noted in Contract Documents, do not load device circuits more than 80% capacity. Determine exact quantities of circuits based on requirements of governing codes and standards, and recommendations of system manufacturer.
- .11 Install the mounting plate of detectors to ceiling mounted boxes as required. Secure the detectors to the plates.
- .12 Where applicable, provide wiring in conduit and connections from smoke detector auxiliary relays to interconnected devices. Coordinate work of respective trades.
- .13 Mount each duct mounted products of combustion detector on the duct in question and connect with smoke sampling tubes which extend into the duct air stream. Install a remote alarm lamp assembly for each duct mounted detector. Wall mount each lamp assembly on a standard 100 mm (4") outlet box as close as possible or practicable to the detector. Do not locate duct detectors within 1 m (3') of duct size increaser or decreaser fittings or any duct elbow. Provide wiring in conduit and extend to connect back to system control unit.
- .14 Provide required audible/visual devices. Tap/set devices to existing standards. Ensure that ceiling mounted speakers are flush ceiling mounted within back box, each complete with a painted steel grille. Provide strobes in locations as shown and as required to comply with OBC.
- .15 Generally, audible device locations are indicated on drawings, however, exact audible device quantities and locations shall be in accordance with results of audibility device coverage site tests. Provide suitable sound detection metering and personnel to make necessary tests. Relocate audible devices and/or provide additional audible devices as required. Refer to system testing specified later in this Section.
- .16 Note: Where applicable, flush ceiling mounted audible device back boxes must be supported from the structure and not the suspended ceiling grid or tiles. Devices shall be connected to the specified taps and ensure that the sound levels are in accordance with the local authority and sound level requirements. Adjust as required and certify that levels are in compliance with the Code level requirements.
- .17 In application with hold open devices on doors, ensure compliance with NFPA regarding smoke detectors tied to hold open devices such that a signal received directly from the smoke detector must cause the release of door. Where electromagnetic locks are used on doors of egress, provide required automatic release of locks upon activation of fire alarm. Provide required connections to fire alarm system and to electromagnetic locks, and provide required contactors and/or relays for connection to control panel. Refer to drawings for other interconnection requirements.
- .18 Perform required fire alarm system wiring connections to mechanical equipment to perform functions specified herein and shown and/or specified on the drawings. Provide required fire alarm system wiring between the fire alarm system and the various equipment to achieve the automatic or manual control of these units to perform functions required. Provision of fire alarm supervisory wiring connections to include but not be limited to the following (where applicable):
  - .1 Supervised valves and flow switches;



- .2 Fan equipment starters;
- .3 Door holders.
- .19 Provide end of line resistors to electrically supervise all wiring. Identify and locate to existing standards.
- .20 Refer to the drawing riser diagram which is diagrammatic only. Quantities of components shall be as per the floor plans and not the riser diagram.
- .21 Review exact location of components with Consultant prior to roughing in.
- .22 Install all wiring in conduit (except for MI). All wiring connections associated with the fire alarm system shall be performed on terminal strips in junction boxes. When pulling wires into conduit, use lubricant and ensure that wires are kept straight and are not twisted or abraded. Neatly secure exposed wires in apparatus enclosures with approved supports or ties. All wires must be clearly identified at all termination points. In addition they shall be numbered with Brady Ltd. or Electrovert Ltd. Z type markers. Colour conductors for each part of the system in accordance with the system equipment manufacturer's recommendations.
- .23 Alarm signalling circuits (horns/speakers/strobes/bells) and alarm receiving circuits (pullstations, detectors) must be run in separate conduits from each other. All wiring connections shall be performed on terminal strips in junction boxes. Conduit couplings for fire alarm system wiring shall be painted red.
- .24 Provide engraved Lamacoid identification nameplates for each equipment or wiring housing and secure to the front of the housing. Exact wording designations and sizes to be reviewed with Consultant prior to manufacture.
- .25 Review nomenclature of the annunciator identification with Consultant and obtain necessary governing authority approvals prior to ordering.
- .26 Ground and bond system as required by local governing electrical code and authority and system manufacturer.

### 3.4 FIELD QUALITY CONTROL

- .1 Testing and Verification
  - .1 Provide the service of a competent, factory trained engineer or technician authorized by the manufacturer of the fire alarm equipment to technically supervise and participate during all of the adjustments and tests for the system. All testing shall be in accordance with CAN/ULC S537.
  - .2 Check for correct connections and test for short circuits, ground faults, continuity, and insulation.
  - .3 Perform audibility test of space and provide annunciation devices to suit ambient sound levels. Ensure coverage for fire alarm signalling devices on base building fire alarm system. Provide audible test of signaling devices after other systems have been commissioned to verify operation at room ambient sound level.
  - .4 Verify activation of all relocated devices, including flow switches, trouble, and supervisory signals from the relocated pre-action assembly.
  - .5 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.
  - .6 All initial testing shall be in accordance with CAN/ULC-S537. A representative of the electrical contractor shall be present to participate and assist the manufacturer representative during the course of the verification. The electrical contractor shall make good any deficiencies discovered during the verification. All devices, new and existing, shall be verified. The electrical contractor shall provide one person for assistance with the verification.
  - .7 Include associated costs in Tender Price.

- .8 Carry out a complete audibility test and submit report.
- .9 On completion of the verification the manufacturer shall supply a certificate, together with detailed inspection record sheets showing location of each device and certifying the test results per unit, confirming that the system is installed, supervised and operational.
- .10 In addition to the 3<sup>rd</sup> party testing by the manufacturer required by the ULC-S537, Contractor to perform a 3<sup>rd</sup> party verification of the fire alarm system with a separate vendor. Contractor to coordinate with the Owner for selection of the approved 3<sup>rd</sup> party vendor.
- .2 Manufacturer Services
  - .1 The manufacturer(s) of the fire alarm shall make a complete inspection of all existing and new components installed for system(s), such as manual stations, horns, and annunciators and sprinkler and standpipe valves and smoke detectors to ensure the following:
    - .1 That the system is complete in accordance with Specifications.
    - .2 That the system is connected according to ULC requirements.
    - .3 That the system is connected in accordance with the Manufacturer's recommendations.
    - .4 That the regulations concerning the supervision of components have been adhered to (e.g. stations, detectors, supervised valves, bells), and are properly wired and supervised.
    - .5 That all valves are properly connected and displayed correctly on each annunciator.
    - .6 That any subsequent changes necessary to conform to the above will be carried out with technical advice supplied by the Manufacturer.
    - .7 That all thermal detectors, smoke detectors and manual pull stations have been operated and are in good working order.
    - .8 That all sprinkler system and standpipe system valves have been operated and are in good working order.
    - .9 That all annunciators correctly pin-point the origin of any fire alarm.
    - .10 That actual smoke concentration of sufficient density, have been applied to each smoke detector to cause the detector to be set off and that the sensitivity of each smoke detector has been set.
    - .11 That all existing devices are in good working order. Include for replacement of any defective/damaged devices at no extra cost to Owner.
    - .12 That signal audibility is acceptable in all areas. Submit audibility readings for every room.
    - .13 If existing audible signal devices have been discontinued by the manufacturer (for example mechanical horns), allow for replacement of all audible devices so that all devices generate similar sounds and sound patterns when activated.
    - .14 Also be responsible for but not be limited to following additional work to existing systems:
      - .1 coordinate with local fire authority inspector and Electrical Division Contractor, required testing and verification work in order to obtain certification and meet local fire code and local fire authority requirements;
      - .2 test system battery power supplies and demonstrate compliance with local governing building code and local fire authority requirements that battery supplies are capable of providing required 24 hours of supervisory power followed by local governing building code required time (or time directed by local fire authority) of full load power; exact method of testing to be approved by local fire authority, Consultant and Owner; confirm exact procedures with previously named parties prior to testing; include for sufficient sound measurement devices and personnel in order to successfully comply with this requirement;

- .3 full review, testing, and verification of operation of building ventilation and smoke exhaust system and its integrated operation with fire alarm system and various pieces of air handling equipment;
  - .4 full review, testing and verification of operation of integrated systems such as elevators and their emergency sequence of operation, supervisory annunciation of sprinkler/standpipe monitor switches, pressure switches and flow switches, security alarms, BAS alarms, release of door holders and electromagnetic locks, and any other integrated components; coordinate requirements with trades responsible for integrated components and systems who will be present at time of testing and verification work;
  - .5 test that system audible devices provide alarm sound levels in areas as per local governing building code and local fire authority requirements; site adjust tap settings of audible devices as required to achieve required audibility levels; also test that emergency voice communication system meets or exceeds intelligibility requirements of local governing building code and is approved by local fire authority;
  - .6 assist in Testing and Verification of electromagnetic door locks to meet requirements of authorities having jurisdiction and to obtain overall approval of installation;
  - .7 coordination with Electrical Divisions and local fire authority to provide requirements needed to obtain certificates of approvals from local fire authority;
  - .8 provide full detailed test sheets of tested components and provide certification that system work has been fully tested, that devices have passed testing and that system is in proper work order in compliance to code requirements and project documents; test documents to be additionally provided in electronic format as confirmed with Owner and Consultant.
- .15 Where project work is phased and Owner requires occupancy at various stages, include for providing system testing, verification and certification after completion of each phase of work, to approval of local governing authorities. Upon Substantial Performance of the Project Work, include for providing system testing, verification and certification of the entire system work.
- .16 Contact local fire authority inspector and coordinate and arrange for Fire Inspector to perform required inspections. Integrate local fire authority inspection requirements with testing and verification work to extent as per Fire Inspector's directions. Obtain full approval and certification by local fire authority.
- .17 Local fire authority inspector, Consultant and Commissioning Agent to at their discretion test system or parts of system in their review of test reports. Correct/repair any failures or deficiencies found in system, whether or not identified in test reports of manufacturer. Re-test and re-verify until successfully passed, at no extra cost to Owner.
- .18 Obtain from local fire authority required certificate of approval of system and forward to Consultant.
- .19 Arrange for manufacturers to supply reasonable amounts of technical assistance with respect to any changes required to conform to paragraphs above. During period of inspection, testing and verification, make Electricians available to do any required correction work and to assist during this Work. Include for trades responsible for integrated components (i.e. exhaust fans, sprinklers, elevators, gensets, etc.) and systems to be present at time of testing and verification work.
- .20 On completion of verification, inspection and testing of system, obtain from manufacturer and testing company and forward to Consultant, a verification certificate together with detailed inspection reports listing each and every system component, its location in building and its acceptability. Verification certificate and inspection reports to be prepared and signed by certified testing technicians. Signed test reports to confirm that systems

are installed and perform in accordance with requirements specified above. Submit minimum 2 hard copies and electronic copy.

- .21 Obtain from system manufacturer and testing agency and forward to Consultant a certificate of liability insurance of minimum amount of Two Million Dollars (\$2,000,000.00) each that is to be registered for this project to show satisfactory proof of manufacturer's and testing agency's liability coverage for both their product and personnel.
- .22 Unless approved in writing by Owner and reviewed with Consultant, does not use open flame and/or smoke for testing.
- .23 Testing technicians to be registered technicians in good standing with Canadian Fire Alarm Association (CFAA) or be a Certified Fire Alarm Electrician (CFAE) with Electrical Contractors Association of Ontario (ECAO) as deemed acceptable to Ontario Fire Marshall.

### **3.5 DEMONSTRATION**

- .1 At the final inspection a factory trained representative of the manufacturer of the major equipment shall demonstrate that the systems function properly in every respect.

### **3.6 TRAINING**

- .1 Provide instruction as required to the building personnel and fire and safety personnel. "Hands-on" demonstrations of the operation of the system shall be provided.

**END OF SECTION**

## PART 1 - GENERAL

### 1.1 SECTION INCLUDES

- .1 The specifications for the access control system are a description of the various components with the minimum operational sequence requirements. System shall comply with all applicable codes.
- .2 When all systems are completely installed and ready to be used, the successful supplier shall thoroughly instruct those appointed by the Owners in the complete operation of all systems provided by him for a minimum time of 2 hours (Two 1 hour sessions at times as directed by Owner to suit staff's requirements) unless in the opinion of the Consultant a longer instruction period is necessary.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- .1 The systems shall be as manufactured by:
  - .1 CHUBB (Contact: Mike Petryniak, E:[mike.petryniak@chubbfs.com](mailto:mike.petryniak@chubbfs.com))

### 2.2 EXISTING ACCESS CONTROL SYSTEM

- .1 The existing CHUBB Security System presently serves the existing hospital and is to be retained to accommodate the access control devices in the renovated areas.
- .2 Access Control scope of work will include for provision of:
  - .1 co-ordination of system work to clearly identify responsibilities of system vendor and Electrical Contractor;
  - .2 all required conduits and boxes, power feeders, to suit system requirements and as per requirements of Section 26 05 33.13 and as per system manufacturer's requirements;
  - .3 installing all access control system components, wiring, wiring accessories, identification and labelling of each wiring run;
  - .4 all required access control system programming;
  - .5 all access control system testing, inspection and verification work upon completion;
  - .6 testing and verification reports signed by manufacturer's authorized representative and by Electrical Contractor;
  - .7 access control vendor's provision of technical assistance and supervision of Electrical Contractor with regards to conduit, wiring and component installation requirements.
  - .8 Additional access control devices and other products to be 100% compatible to existing system.
  - .9 All required modifications to existing access controller(s) – (CK721);
  - .10 All required additional access controller(s);
  - .11 All required software programming;
  - .12 wiring as per system manufacturer's requirements, run in conduit and provision of required ancillary devices;
- .3 Card readers:
  - .1 HID iCLASS Readers Model no. #RP40, for all devices provide tamperproof screws and anti-pick sealant.
  - .2 Type: dual technology and iclass proximity.
  - .3 Quantity of card readers required: see plans.

- .4 Dual technology and iclass proximity.
- .5 Fitted with LED indicator light.
- .6 Reading distance 50 - 200 mm.
- .7 Compatible with Owner's existing access cards.
- .4 System Accessories:
  - .1 Door strike: surface mounted, latch UL approved complete with mounting hardware.
  - .2 Door Contact: recessed mounted, complete with mounting hardware.
  - .3 Request to exit motion sensor device:
    - .1 Heavy duty assembly.
    - .2 Size: square, 50 x 50 mm.
    - .3 Sturdy and attractive finishing plate with security screws.
  - .4 Power supplies:
    - .1 Continuous low-voltage operation output.
    - .2 Equipped with secondary protection for each output.
    - .3 Individual outputs for connection of devices.
    - .4 AC power failure output.
    - .5 DC power failure output and low battery output.
    - .6 Fitted with tamper contact.
    - .7 Wall mounted cabinet with locked door complete with 2 keys.
  - .5 Voltage: requires Belden #8444.
  - .6 Access Control Systems: to UL-1023.
- .5 The specifications for this system are a description of the various components with the minimum requirements of the operations sequence, facilities and features required.
- .6 Fully complement and function and match door manufacturer's controls and hardware.
- .7 Fully function with OEM supplied door controls and hardware to activate system in routine and emergency conditions.
- .8 Fully function within supplied electrical supervision circuits as specified.
- .9 Wiring shall be as follows:
  - .1 Card Reader: Beldon #9554
  - .2 Electric Strike or Maglock: Beldon # 8471
  - .3 All other devices, Door contact, Sonalert, exit button, auto exit power, auto exit contact, key switches, door operator, keypad power, keypad contact and fire alarm release are Beldon #8444.
  - .4 All wiring shall be installed with minimum ¾" (19mm) conduit unless otherwise noted.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- .1 Provide complete access control system as shown on Drawings and as specified.

- .2 Install Access Control System units and components in accordance with CAN/ULC-S310 UL 1641.
- .3 Conduits and back boxes for devices in walls and doors will be provided by Electrical Trade as noted in Section 26 05 33.13 and as per system manufacturer's requirements. Provide all control boxes/equipment and conduit work to tie in to rough-ins.
- .4 Install wiring in conduit in accordance with the recommendations of the manufacturer.
- .5 Provide tamperproof attachments for each activation unit cover plate to back box.
- .6 For all access control surface mounted devices provide tamperproof screws and anti-pick sealant.
- .7 Enclose in conduit or flexible protective armor external cables for associated junction box to remaining system locations, from junction box to above ceiling mounted cable ducts or master conduit routes.
- .8 Securely fasten all components to wall, ceiling, or other substrate or structure.
- .9 Provide minimum 3/4" (19mm) conduit from each device to the ceiling and provide 4"x4" deep junction boxes as specified in ceiling space for each door.
- .10 Mount card reader at 36" above floor to center of device, unless noted otherwise, using single deep back box and plaster ring. Coordinate exact location with owner prior to rough-in.
- .11 Protect installed products and components from damage during construction.
- .12 Repair damage to adjacent materials caused by access controls and equipment installation.
- .13 Field Quality Control
  - .1 Manufacturer Services:
    - .1 Manufacturer of products, supplied under this Section, to review Work involved in the handling, installation/application, protection and cleaning, of its products and submit written reports, in acceptable format, to verify compliance of Work with Contract.
  - .2 Manufacturer's Field Services:
    - .1 Obtain written reports from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product.
    - .2 Submit manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
    - .3 Ensure manufacturer's representative is present before and during critical periods of installation and testing.

**END OF SECTION**